A NATURALISTIC INQUIRY INTO THE ATTITUDES TOWARD MATHEMATICS AND MATHEMATICS SELF-EFFICACY BELIEFS OF MIDDLE SCHOOL STUDENTS

by

JANET K. STRAMEL

B.S., University of Central Oklahoma, 1985

M.S., Kansas State University, 2004

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Curriculum and Instruction

College of Education

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2010

Abstract

While there has been much quantitative research done in the area of attitudes and self-efficacy beliefs, this study sought hear the voices of the middle school child. Therefore, this qualitative study investigated the attitudes toward mathematics and mathematics self-efficacy beliefs of middle school students in one middle school in western Kansas. The conceptual framework for this study is supported by the research of Albert Bandura on Social Cognitive Theory.

This study used a naturalistic inquiry approach and data were collected from multiple sources, including short-answer questionnaires, classroom observations, and one-on-one interviews. Coded data were examined for patterns, themes, and relationships.

Middle school students in this study exhibited positive, negative, and variable attitudes toward mathematics, and both positive and negative mathematics self-efficacy beliefs. Students attribute their high mathematics self-efficacy beliefs to the teacher or the high grades they receive on daily assignments, as well as the scores they receive on state and local assessments. Conversely, middle school students have low mathematics self-efficacy beliefs when they feel unsuccessful or distressed, and they attribute those beliefs to the low grades they receive on daily assignments and assessments, as well as the distress of not understanding the mathematics. Middle school students told their mathematical stories of the change in attitudes toward mathematics and mathematics self-efficacy beliefs, and attributed positive changes to the mathematics teacher. Negative changes in attitudes toward mathematics and mathematics self-efficacy beliefs were attributed to the amount of homework expected at the middle school level, as well as the lack of hands-on activities. The influence of the teacher, grades, and hands-on

activities impact middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs.

There is a relationship between attitudes toward mathematics and mathematics self-efficacy beliefs. Low mathematics self-efficacy beliefs and poor attitudes toward mathematics are related since low mathematics self-efficacy beliefs and poor attitudes toward mathematics are highly connected. Conversely, high mathematics self-efficacy beliefs and good attitudes toward mathematics are highly related. Middle school students' experiences impact both mathematics self-efficacy beliefs and attitudes toward mathematics. Students' mathematics self-efficacy beliefs impact their attitudes toward mathematics.

A NATURALISTIC INQUIRY INTO THE ATTITUDES TOWARD MATHEMATICS AND MATHEMATICS SELF-EFFICACY BELIEFS OF MIDDLE SCHOOL STUDENTS

by

JANET K. STRAMEL

B.S., University of Central Oklahoma, 1985

M.S., Kansas State University, 2004

A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Curriculum and Instruction

College of Education

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2010

Approved by:

Major Professor

Dr. Gail Shroyer

Abstract

While there has been much quantitative research done in the area of attitudes and self-efficacy beliefs, this study sought hear the voices of the middle school child. Therefore, this qualitative study investigated the attitudes toward mathematics and mathematics self-efficacy beliefs of middle school students in one middle school in western Kansas. The conceptual framework for this study is supported by the research of Albert Bandura on Social Cognitive Theory.

This study used a naturalistic inquiry approach and data were collected from multiple sources, including short-answer questionnaires, classroom observations, and one-on-one interviews. Coded data were examined for patterns, themes, and relationships.

Middle school students in this study exhibited positive, negative, and variable attitudes toward mathematics, and both positive and negative mathematics self-efficacy beliefs. Students attribute their high mathematics self-efficacy beliefs to the teacher or the high grades they receive on daily assignments, as well as the scores they receive on state and local assessments. Conversely, middle school students have low mathematics self-efficacy beliefs when they feel unsuccessful or distressed, and they attribute those beliefs to the low grades they receive on daily assignments and assessments, as well as the distress of not understanding the mathematics. Middle school students told their mathematical stories of the change in attitudes toward mathematics and mathematics self-efficacy beliefs, and attributed positive changes to the mathematics teacher. Negative changes in attitudes toward mathematics and mathematics self-efficacy beliefs were attributed to the amount of homework expected at the middle school level, as well as the lack of hands-on activities. The influence of the teacher, grades, and hands-on

activities impact middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs.

There is a relationship between attitudes toward mathematics and mathematics self-efficacy beliefs. Low mathematics self-efficacy beliefs and poor attitudes toward mathematics are related since low mathematics self-efficacy beliefs and poor attitudes toward mathematics are highly connected. Conversely, high mathematics self-efficacy beliefs and good attitudes toward mathematics are highly related. Middle school students' experiences impact both mathematics self-efficacy beliefs and attitudes toward mathematics. Students' mathematics self-efficacy beliefs impact their attitudes toward mathematics.

Table of Contents

List of Figures

List of Tables

Acknowledgements

A huge thank you to my advisor, Dr. Gail Shroyer, whose help and guidance was invaluable. Thank you for your time and patience, your suggestions, input, and listening ear. Also to my committee, Dr. David Allen, Dr. Jeong-Hee Kim, and Dr. Kay Ann Taylor, who have supported me and answered all my questions. I believe that I have the best committee! I also want to thank Dr. Trudy Salsberry for opening my eyes to qualitative research.

I would like to thank my colleagues and friends at Fort Hays State University. Your support, encouragement, and friendship were exactly what I needed during my first year. Thank you to Sara, Lorie, Natalie, Beth, Carol, Blaine, Robert, Dorothy, Regi, Beverly, Sherry, and Rachel. And a very special thank you goes to Dr. Germaine Taggart who gave me time to work and support and encouragement to finish this project.

Thank you to the faculty, staff, and students at the selected middle school, especially to the teachers who so graciously allowed me to spend time in their classrooms.

This is for my children Tracy and Joshua, and step-children Luke and Anna. You gave up a lot of time for your teacher-mother. Thank you to my daughter, Tracy, for your patience and understanding this last year. And thank you to my son Joshua and daughter-in-law Daneé, for understanding my time commitments this summer. For my parents, Bob and Norma Smith, your love, encouragement, and pride in a teacher-daughter will always be overwhelming.

For my sister-in-law and friend, Nancy Stramel, thank you. Our talks and walks helped to keep me going, and your support, encouragement, and friendship helped me through some long and lonely weeks. And to Glen, thank you, for letting me tag along with you and Nancy many times. Thank you to the most wonderful in-laws a person could ever hope to have, Jim and Alice Stramel. I love you both.

This has been a life-long journey. As a five-year-old, I knew wanted to be a teacher. Thank you to my sister Kathy for being my "willing student" as I "taught" my classroom. My seventh and eighth grade mathematics teacher, Mabel Sparkman, gave me the first real opportunity to teach by asking me to tutor a student after school. That opened in me a greater love of mathematics and teaching. Encouragement from Dr. Donna Powell to go back to school, and from Cheryl Marcoux Callahan and Dr. Sherri Martinie to begin not only a master's program, but National Board Certification, gave me the confidence to complete this journey to doctorate.

Most importantly, I want thank my wonderful husband, Dean. How can I ever thank you? Your encouragement and support has been invaluable to me in this endeavor. Your strength sustained me through many difficult times and stressful situations. Thank you for understanding when I needed to read and write instead of spending time with you. Thank you for listening to my rambles, reading my papers, and giving me advice, even when I didn't want it. I will love you always.

Dedication

This is for my beautiful granddaughter, Addison Reece Carlton.

May you always love mathematics!

CHAPTER 1 - Introduction

"I hate math!" This is a typical comment from many middle school students. Most children enter school mathematically healthy. Many times elementary children say that their favorite subject is mathematics. They report a love of numbers, counting, sorting, looking for patterns, solving problems in ways that make sense to them, using manipulatives, and enthusiasm and curiosity that causes mathematical questions (Battista, 1999; National Research Council, 1989; 2001; Sutton & Krueger, 2002). What happens when students begin taking mathematics in the middle school? Why do middle school students "hate math?"

According to the National Research Council (1989), as children grow, they begin to view mathematics as a rigid system governed by rules and procedures, speed, and memory. Their view shifts from one of curiosity and excitement to that of apprehension and fear (National Research Council, 1989). Is it the mathematics curriculum that emphasizes computation and rules and procedures that impacts attitudes? Is it the emphasis on the mechanics of mathematics, not the process that causes students to dislike mathematics? Is it the perception that there is only 'one right answer' that inhibits mathematical learning? Is it the focus on "yesterday's arithmetic" and not on "tomorrow's problem solving" that alienates students from mathematics? Why do middle school students hate mathematics?

As a middle school mathematics teacher, I have heard negative comments toward mathematics over and over again. Good students and poor students alike state that they don't like mathematics, and report that mathematics is definitely not their favorite subject in middle school. Middle school students also seem to have low mathematics self-efficacy beliefs and the perception that they cannot "do math."

Attitudes have been defined in many ways. According to Allport (1935), "attitudes determine for each individual what he will see and hear, what he will think and what he will do" (Allport, 1935, p. 806). Neale (1969) refers to characteristics including "a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless" (Neale, 1969, p. 632). According to Sutton and Krueger (2002), attitudes toward mathematics are "stable dispositions, affective responses, or beliefs individuals have that develop largely through experience" (Sutton & Krueger, 2002, p. 86). Doob (1947) defined attitude as a learned, implicit anticipatory response. According to these definitions, many ideas emerge: attitude is learned; it is a result of prior experience; and it influences a person to take a position toward something.

Self-efficacy is at the center of Bandura's (1995) Social Cognitive Theory which states that self-efficacy is "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" (Bandura, 1995, p. 2). Bandura believed that not only does environment cause behavior; behavior causes environment. This is the basis of his theory of reciprocal determinism (Bandura, 1995). Research conducted by social cognitive theorists (Bandura, 1994; Schunk, 1991; Zimmerman, 1989) has demonstrated self-efficacy beliefs affect a person's choice of activities, and the effort and persistence they put forth, especially when obstacles are encountered, and affects their learning and achievement. Self-efficacy beliefs are not always apparent, but assessing students' self-efficacy beliefs can help all educators with insights about "academic motivation, behavior, and future choices" (Pajares, 2006, p. 354).

Adolescents avoid many opportunities because they lack self-efficacy, and those self-efficacy beliefs ultimately become habits of thinking (Pajares, 2006).

The relationship between self-efficacy beliefs and attitudes is evident in the research, but there is limited research to indicate the relationship of attitudes toward mathematics and mathematics self-efficacy beliefs, especially in the area of the middle school child. Absent is the voice of the middle school child. This qualitative study sought to understand the nature of middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs. More specifically, this study focused on middle school students from a public middle school in western Kansas. Discussion in this chapter is organized in the following sections: (1) overview of the issues, (2) statement of the problem, (3) purpose of the study, (4) research questions, (5) research design, (6) significance of the study, (7) limitations of the study, (8) delimitations of the study, and (9) definition of terms.

Overview of the Issues

Studies show that attitudes toward mathematics decline as a student progresses from elementary school to secondary school (Eccles & Midgley, 1989; Wilkins & Ma, 2003). During middle school, students' attitudes toward mathematics change, and most result in a substantial negative change (McCoy, 2005; McLeod, 1994; Wilkins & Ma, 2003). According to Gilroy (2002), middle school students who have negative attitudes about mathematics are discouraged and apprehensive about mathematics learning. Gilroy states that "students' attitudes toward math continue to confound both researchers and educators" (Gilroy, 2002, p. 22).

Middle school students' perceptions of their parents, teachers, peers, and the media regarding mathematical attitudes may relate to their own attitudes toward mathematics (Bouchey

& Harter, 2005). People proudly say "'I was never good at math,' as if displaying a badge of courage for enduring what for them was a painful and useless experience" (Battista, 1999, p. 426). Students' attitudes toward mathematics are affected by their parents' and society's views of mathematics (Martinie, 2006; Picker & Berry, 2001). Too many Americans continue to believe that mathematics is not important to learn, and many adults "openly proclaim their ignorance of mathematics ("I was never very good at math") as if it were some sort of merit badge" (National Research Council, 1989, p. 76).

Mathematics educators generally believe that students will achieve in mathematics if they like mathematics. Attitudes of students have been studied by many, and include or have included topics such as gender differences, confidence in learning mathematics, mathematics usefulness, mathematics anxiety, confidence, self-concept, self-efficacy, and motivation (Bandalos, Yates, & Thorndike-Christ, 1995; Fennema & Sherman, 1976; Higgins, 1970; McLeod, 1994). "The research community is still struggling to build a suitable framework for the study of beliefs and attitudes related to mathematics learning" (McLeod, 1994, p. 643).

Much research has been conducted on self-efficacy beliefs (Bandura, 1994). Bandura believed that self-efficacy beliefs are developed through four main sources of influence – experience, models, social persuasion, and mood (Bandura, 1994). Bandura showed that people with a high sense of self-efficacy have the "staying power to endure the obstacles and setbacks that characterize difficult undertakings" (Bandura, 1994, para. 33). According to Friedel, Cortina, Turner, and Midgley (2007), self-efficacy beliefs are different from perceived ability or competence. A student who says, "I am good at math" is confident in his or her abilities. A student who has high self-efficacy beliefs anticipates success given their current capabilities.

They may say “I can master the skills in math this year if I try” (Friedel, Cortina, Turner, & Midgley, 2007).

Many researchers have focused on the self-efficacy beliefs of students and included topics such as self-concept, high school students’ performance in mathematics, elementary school children’s arithmetic achievement, and children’s perception of the goals of their teachers and parents in regard to mathematics achievement (Bong & Clark, 1999; Friedel et al., 2007; Pietsch, Walker, & Chapman, 2003; Schunk, 1981). Most recently, Usher (2009) conducted a study of eighth-grade students focusing on factors related to mathematics self-efficacy and student self-regulation.

Although attitudes and self-efficacy beliefs have been studied previously, most of these studies are quantitative and involve older students. This qualitative study focuses on the attitudes toward mathematics and mathematics self-efficacy beliefs of middle school children in one public middle school in western Kansas in order to provide a voice for the middle school child. This research provides a deeper and more complete understanding of the complex relationship between the attitudes toward mathematics and mathematics self-efficacy beliefs of middle school children. The insights gained may lead to greater awareness, improvements in teacher practice, and ultimately enhanced attitudes, efficacy, and student achievement in mathematics.

Statement of the Problem

Middle school students have long indicated a hatred of mathematics, although elementary school students typically say they love mathematics (Battista, 1999). The researcher’s personal experience teaching middle school mathematics led to this research. The insights related to students' mathematics self-efficacy beliefs and attitudes toward mathematics emerged from listening to the students' voices. Quantitative surveys have focused on self-efficacy beliefs and attitudes (Bouchey & Harter, 2005; Hackett & Betz, 1989; House, 2006; Kloosterman & Stage, 1992; Ma & Kishor, 1997; Ma & Xu, 2004; Pajares & Miller, 1995; Pietsch et al., 2003; Reynolds & Walberg, 1992; Schommer-Aikins, Duell, & Hutter, 2005; Tapia & Marsh, 2004) but there has been no in-depth understanding of the middle school child's attitudes toward mathematics and mathematics self-efficacy beliefs from the students' personal perspective.

Middle school is an important period in human development. According to Hamburg (1974), the time represents the "most abrupt and demanding transition" for any individual (Hamburg, 1974, p. 113). During this time, adolescents seek and identify their own interests and abilities, and experience physical, emotional, and intellectual changes (National Council of Teachers of Mathematics [NCTM], 2000). Middle school has long been thought as the bridge between preadolescent and adolescent development, and the success in middle school can influence students' attitude and their academic performance (Reynolds, 1991). Attitudes toward mathematics have a major impact on the learning of mathematics. According to Tapia and Marsh (2004), the success or failure in mathematics is determined by personal attitudes and beliefs. "Attitudes affect everything that you attempt. They affect your relations with other people and your openness to new experiences" (Yenilmez, Girginer, & Uzun, 2007, p. 2002).

Research shows that students' attitudes toward mathematics influence their self-efficacy beliefs (Usher, 2009); but, there has been limited research to show the relationship between attitudes toward mathematics and middle school students' mathematics self-efficacy beliefs. Additionally, this existing body of research has had a limited impact on changing those negative attitudes toward mathematics and helping students raise their self-efficacy beliefs toward mathematics. Middle school students from western Kansas remain uninvestigated. This is the basis for this study.

Purpose of the Study

The purpose of this qualitative study was to explore the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs in one public middle school in western Kansas. In this research, the attitudes toward mathematics and mathematics self-efficacy beliefs for middle school students will be generally defined as beliefs, perceptions, and reactions to mathematics for children in grades six through eight. This qualitative study provided an opportunity for middle school students to tell their mathematical stories. Students were encouraged to express their attitudes toward mathematics, to reflect on their earlier attitudes, to ponder changes in these attitudes and what they perceived may have impacted any changes in attitudes. Students also were encouraged to express their beliefs in their abilities in mathematics (their mathematics self-efficacy beliefs), and to reflect on their earlier beliefs, to ponder any changes in beliefs and what they perceived may have impacted change in beliefs. Patterns in the data were examined to understand the relationship between experiences, attitudes, and self-efficacy.

More specifically, using Bandura's (1995) Social Cognitive Theory as a conceptual framework, this study explored the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs. Many quantitative studies have been conducted, but this study sought to hear the voices of the middle school child in one public middle school in western Kansas.

There was potential for researcher bias throughout this study. The researcher is a former middle school mathematics teacher who has frequently heard negative comments toward mathematics.

Research Questions

In order to fill in the gaps in the current research, this study examined middle school students who attended one public middle school in western Kansas. All middle school students were given the short-answer questionnaire, all students in three classrooms were observed, and all observed students were invited to be interviewed. However, many decisions regarding participation were not in the hands of the researcher. Administrators selected the final school and teachers to be involved, while the parents/guardians and students determined student participation in interviews. Therefore, no claims are made regarding the representativeness of the schools, teachers, or students involved.

This study was guided by the following overarching question:

What is the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs?

This overarching question was explored through the follow sub-questions:

1. What are middle school students' attitudes toward mathematics?
2. What are middle school students' mathematics self-efficacy beliefs?
3. How have students' attitudes toward mathematics and mathematics self-efficacy beliefs changed across time?
4. What experiences have impacted attitudes toward mathematics and mathematics self-efficacy beliefs?

5. In what ways are attitudes toward mathematics related to mathematics self-efficacy beliefs?

Research Design

This research is based on a naturalistic inquiry design. Willems and Raush (1969) define naturalistic inquiry as "the investigation of phenomena within and in relation to their naturally occurring contexts" (Willems & Raush, 1969, p. 3). Doing research in a natural setting is crucial for the most comprehensive understanding of the phenomenon (Lincoln & Guba, 1985).

In order to ensure that the information obtained enabled the researcher to answer the initial research question, she collected data that described the middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs. This was accomplished through short-answer questionnaires, classroom observations, and student interviews. A short-answer questionnaire was given to all sixth, seventh, and eighth grade students in one middle school in order to ascertain their attitudes toward mathematics and their mathematics self-efficacy beliefs. Two-hundred seventy-three students completed the questionnaire. Fill in the blank sentences included items such as "When I think of mathematics, I feel…" and "I believe I will be … in mathematics this year." The guidelines for the teacher and the short-answer questionnaire can be found in appendices E and F, respectively. Classroom observations were conducted in three middle school mathematics classrooms in one public middle school in western Kansas in order to explore student attitudes toward mathematics and mathematics self-efficacy beliefs, and the experiences that impact these attitudes and self-efficacy beliefs. The researcher gathered field notes over a five-week period in sixth, seventh, and eighth grade classrooms as an observer in order to gather evidence of attitudes toward mathematics and mathematics self-efficacy beliefs, and to explore what is impacting those attitudes and beliefs. Evidence included indicators of attitudes toward mathematics, such as engagement in class, body language, verbal frustrations, or statements such as “I don’t want to do this” as well as indicators of mathematics self-efficacy through statements such as “I can’t do this.” Observations also focused on experiences that may be impacting attitudes and self-efficacy such as student success or failure, teacher praise and encouragement, peer encouragement, the curriculum being used, instructional events, activities, and assignments and how students react to these experiences. Field notes included both descriptive and reflective notes such as descriptions of each classroom setting, and researcher reactions.

Interviews were conducted with 18 middle school students. Students in the observed classrooms were selected for participation in the one-on-one interviews. Interviews were semi-structured and approximately 30 minutes in length. Interviews were audio taped, and then transcribed. Each interview was conducted in the conference room in the middle school, quiet and free from distractions. The interview protocol began with a conversation about favorite subjects and why, what the student is currently studying in mathematics, what they like to do in mathematics, and what they do not like to do in mathematics. The interview then continued with open-ended questions such as “Do you like mathematics?” and “Why or why not?” Students were asked if they have always liked or disliked mathematics or if they could remember a time when they liked or disliked mathematics. Through prompts, they were encouraged to reflect on if and when their attitudes changed and what impacted any changes. If student responses indicated a change in attitudes, they were encouraged to reflect on what they were doing or how their experiences were different when they held different attitudes toward mathematics. A second line of similar questions related to mathematics self-efficacy. Students were asked “Do you feel successful in mathematics?" If students expressed a low mathematics self-efficacy, they were asked if they could remember a time when they felt they could be successful in mathematics. Through prompts they were encouraged to reflect on if and when their mathematics self-efficacy changed and what impacted any changes. If their responses indicated a change in mathematics self-efficacy, they were encouraged to reflect on what they were doing or how their experiences were different when they felt successful in mathematics. The researcher refined the interview questions by conducting a pilot study with family, friends, and friends' middle school students. The pilot study also helped to refine the data collection plans and develop relevant questions (Yin, 2003).

Significance of the Study

The middle school years are critical in the life of a child. This is the time that prepares students to strive for mastery in future coursework (Chen & Zimmerman, 2007). According to Reynolds (1991), the middle school years are the most significant in human development. It is during this time that adolescents are seeking their own identity, interests, and abilities.

Bong and Clark (1999) suggested that self-efficacy positively influences students' academic choices, academic performance, effort, and persistence. Research in self-efficacy beliefs has mainly focused on academic motivation and self-regulation. The relationship between self-efficacy beliefs and college major and career choices and self-efficacy beliefs correlated with motivation constructs including attributions, goal setting, modeling, problem solving, test anxiety, reward contingencies, self-regulation, social comparisons, and strategy training have been explored. Self-efficacy has been popular in motivation research. According to Pajares (2000), the connection from theory to practice has been slow. Teachers are interested in "useful educational implications, sensible intervention strategies, and practical ways to alter self-efficacy beliefs" (Pajares, 2000, para. 96).

Researchers continue to be confounded by the attitudes of middle school students (Gilroy, 2002, p. 22). Middle school teachers of mathematics continue to search for ways that will improve their students' attitudes toward mathematics. While evidence of the relationship between self-efficacy beliefs and attitudes has been established, the complex relationship between the two has not been explored and the relationship between attitudes and self-efficacy beliefs has not been investigated in the middle school children of western Kansas.

According to Yenilmez et al. (2007), the greatest factor in developing positive attitudes toward mathematics is the classroom teacher. Creswell (2003) states that qualitative research can be used as a justification for reform or change (Creswell, 2003). This study explored attitudes and self-efficacy beliefs and the complex relationship between the two constructs through the eyes of middle level students in western Kansas. Understanding what impacts attitudes and self-efficacy beliefs, when, why, and how attitudes toward mathematics and mathematics self-efficacy change, and the relationship between attitudes and self-efficacy beliefs, teachers can know when and where to intervene. Therefore, this study could lead to insight about how we prepare future teachers to teach mathematics to middle school children.

Limitations of the Study

This study was based on short-answer questionnaires, classroom observations, and face-to-face interviews. Observations were based on the researcher's perceptions of the observed behaviors. Assumptions the researcher made include the honesty of the students who completed the questionnaire and those who were interviewed.

Bandura developed a theoretical construct many researchers have tried to operationalize. Many have explored the construct of self-efficacy beliefs through quantitative means, and instruments have been developed that are both valid and reliable. The researcher studied those instruments (to be discussed more thoroughly in chapter 2), but wanted to hear the voices of the middle school child. Therefore, the researcher chose to not use the quantitative instruments, but did examine those instruments in order to come up with questions and prompts to be used in a qualitative, naturalistic way.

This study was limited by the following characteristics:

1. Participation was a limitation. The researcher chose the district, but the middle school and the teachers were chosen for the researcher. Therefore, it is not known how representative the district, teachers, and students are of other populations.
2. All students in three classrooms were observed, but the parent/guardians made the decision whether their child was interviewed. Therefore, this study may not necessarily be representative of middle school students.
3. The only source of data for the change across time that have impacted students' attitudes toward mathematics and mathematics self-efficacy beliefs was the stories of the students, and is therefore self-reported data.
4. The study was limited by the personal data collection and interpretations of the researcher.
5. All data was analyzed separately to ensure patterns were consistent across grade levels.
6. Attitudes and self-efficacy beliefs are a difficult construct to measure. Therefore, one of the limitations is that the researcher asked students open-ended questions, and

assumed that students were responding to questions of attitudes and self-efficacy beliefs.

Delimitations of the Study

Several factors were considered for this study. First, students participating in this study were middle school students enrolled in one public middle school in western Kansas. Since the intent of this qualitative study was to identify the nature of middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs, the most accurate source of information came from the stories of middle school students.

This study was bounded by the following characteristics:

1. This qualitative study was a bounded system, bounded by time (two months of data collection) and place (situated in a single public middle school in western Kansas) in order to provide an in-depth description of the case.
2. The study was limited to one public middle school in western Kansas, and was limited to students in grades six through eight.
3. The data was limited to short-answer questionnaires, classroom observations, and interviews collected during the spring 2010 semester.

Definition of Terms

For the purpose of this study, the following definitions were used.

Attitude toward mathematics – a person's manner, disposition, or feeling with regard to mathematics

Middle school – a school that contains grades six through eight

Middle school child/student – a student taking classes in a middle school – typically 11-14 years of age

Naturalistic inquiry – "the investigation of phenomena within and in relation to their naturally occurring contexts" (Willems & Raush, 1969, p. 3).

Self-efficacy beliefs – "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" (Bandura, 1995, p. 2)

Chapter Review

Attitudes and self-efficacy beliefs continue to confound researchers. Many quantitative research studies have been conducted. Due to the nature of the study, this research was a naturalistic inquiry in which the voices of middle school students were heard in order to understand their attitudes toward mathematics and mathematics self-efficacy beliefs.

Organization of the Study

This study is divided into five chapters. Chapter One consists of the introduction, overview of the issues, statement of the problem, purpose of the study, research questions, research design, significance of the study, limitations of the study, delimitations of the study, definition of terms, chapter review, and organization of the study. Chapter Two includes the theoretical framework for the study, the review of literature related to attitudes, self-efficacy beliefs, the middle school concept, the middle school child, middle school mathematics curriculum, and the summary. Chapter Three contains the research methodology used in the study, the design of the study, population of the study, the pilot study, the data collecting procedures, data analysis, establishing trustworthiness, and ethical considerations. Chapter Four presents the findings and the analysis of data. Chapter Five includes the summary, conclusions, and recommendations for future research.

CHAPTER 2 - Review of Literature

This chapter reviews the theoretical framework and research-based literature that supports the need for this study. This chapter is organized into four sections. The first section grounds the study in a theoretical framework. The second section addresses the literature on self-efficacy beliefs. The third section discusses attitudes, and more specifically, attitudes toward mathematics of the middle school child. The fourth section provides the history of the middle school and research in relation to the middle school philosophy, the middle school child, and the mathematics curriculum at the middle school level. The purpose of this qualitative study was to understand the nature of the middle school student's attitudes toward mathematics and their mathematics self-efficacy beliefs in one public middle school in western Kansas.

Theoretical Framework

The theoretical framework for this study was Bandura's (1986, 1989) Social Cognitive Theory, which focuses on the social influences of human behavior (Bandura, 1986, 1989; Pintrich & Schunk, 2002). Bandura proposed that human function is based upon an individual's thoughts, goals, beliefs, and values. According to Bandura's Social Cognitive Theory, a person possesses a system in which they control their own thoughts, feelings, motivations, and actions. There are connections between this system and a person's environment, which provides persons with the ability to influence their own cognitive processes and thus change their environment.

"Social learning theory approaches the explanation of human behavior in terms of a continuous reciprocal interaction between cognitive, behavioral, and environmental determinants" (Bandura, 1977, p. vii). How people interpret the results of their performance and change their environment can alter future performance (Bandura, 1986). The basis for Bandura's reciprocal determinism is one element of Social Cognitive Theory in which person, behavior, and environment all influence and function together (Bandura, 1986). The reciprocal determinism model is triadic in which a person's cognitive abilities affect his or her behavior, which affects his or her environment.

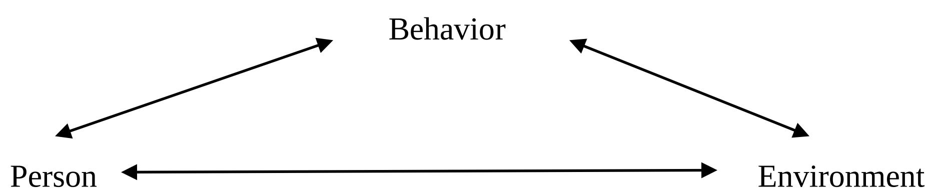

Figure 2-1: Reciprocal Determinism Model

Personal factors include cognitive abilities, physical characteristics, and beliefs and attitudes; behavior comprises motor and verbal responses, as well as social interactions; and environment consists of physical surroundings, family and friends, and other social influences.

Within the model of reciprocal determinism lies a person's ability to influence his or her future (Bandura, 1977). This concept does not lead a person into a powerless object controlled by environmental forces, nor as a free agent to become whatever he or she chooses. But, a person and his or her environment are "reciprocal determinants of each other" (Bandura, 1977, p. vii) and are explained by the continuous reciprocal interaction determined by personal and environmental. Behavior is a function of the person's cognitive ability and his or her environment.

According to Social Cognitive Theory, "the events over which personal influence is exercised vary" (Pajares, 1996, p. 546). Ghee and Khoury (2008) applied reciprocal determinism to learning mathematics and science. If a person's belief is that they like mathematics, then there is a personal connection to learning mathematics. Personal attributes, behavioral experiences, and environmental experiences may be inputs as well as outputs in the reciprocal determinism model (Ghee & Khoury, 2008). According to Pajares (2000), students develop beliefs about their own academic capabilities. Their academic performance is in part a result of what they have come to believe (Pajares, 2000).

Expectancy Theory of Motivation

Expectancy theory of motivation stresses the idea that behavior is a joint function of a person's expectations of a particular outcome and the extent to which they value those outcomes (Schunk, 1991). This theory assumes that people make realistic judgments based on the attainment of certain goals. They are not motivated to do the impossible; therefore, they do not pursue those goals.

In 1971, Bandura theorized that expectations determine motivation. He maintained that people are motivated by the consequences they expect to receive rather than for the actual rewards (Bandura, 1971). "Although expected outcomes had explanatory advantages over actual outcomes, they could not explain easily a students' unwillingness to attempt tasks on which a model could succeed" (Zimmerman, 1989). Therefore, Bandura hypothesized the presence of a second motivational construct, which he named self-efficacy. He defined self-efficacy to be the "perceived ability to implement actions necessary to attain designated performance levels" (Zimmerman, 1989), and began a program of research in order to establish the "predictiveness of motivation, particularly in personally threatening or difficult circumstances" (Zimmerman, 1989).

Attribution Theory

According to attribution theory, a person attributes their behavior to explain their success or failure. Weiner (1986) proposed that students' perceptions of their ability influence their performance. The explanations that people make to explain their success or failure can be determined by three characteristics: locus of control, stability, and controllability. In self-efficacy theory, attributions "constitute one type of cue that students use to appraise efficacy (Schunk, 1991, p. 211).

In attribution theory, a person who tries to understand why another person did something may attribute causes to that behavior. There is a three-stage process that underlies an attribution. The person must perceive or observe the behavior, then believe that the behavior was intentional, and then determine if they believe the other person was forced to perform the behavior or not. Weiner focused on achievement and identified ability, effort, task difficulty, and luck as the most important factors contributing to achievement (Weiner, 1985).

Attribution theory has been used to explain motivation differences in high and low achievers. For example, high achievers will approach a task because they believe their success is due to ability and effort, while low achievers believe failure is a result of bad luck or something that is not his or her fault, such as a poor test. Low achievers tend to avoid tasks because they doubt their ability or assume that success is due to luck or other factors beyond their control (Weiner, 1985).

Goal Theory

Goal theory is an extension of attribution theory in which students pursue goals that are associated with certain behaviors and beliefs. The two dominant goals, mastery and performance, are associated with beliefs and behaviors. Mastery-oriented students want to increase their knowledge and believe that effort is the cause of their success or failure. They want a challenge, and are intrinsically motivated.

Performance-oriented students believe that ability is the cause of their success or failure. They view intelligence as a fixed trait. Students who are performance-oriented tend to make negative statements and attribute their success to uncontrollable factors. Schunk (1989a) found that allowing students to set goals promotes self-efficacy (Schunk, 1989a).

Self-Efficacy Beliefs

Self-efficacy is a relatively new construct which began in 1977 with Bandura's publication "Self-Efficacy: Toward a Unifying Theory of Behavioral Change." "Self-efficacy beliefs affect thought patterns that may be self-aiding or self-hindering" (Bandura, 1989, p. 1175). As a person reflects upon and internalizes their successes or failures, then learning occurs. Students who have a strong sense of efficacy in any academic subject are expected to exhibit strong achievement (Schunk, 1981a).

According to Bandura (1995), self-efficacy is "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" (Bandura, 1995, p. 2). It is a person's "beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave" (Bandura, 1994, p. 71). When a person has a strong sense of self-efficacy, their personal well being is enhanced, and they "approach difficult tasks as challenges to be mastered rather than threats to be avoided" (Bandura, 1994, p.

71). In the academic domain, students with strong self-efficacy beliefs feel that they can complete any assignment, learn any material, or master any concept (Anderman & Midgley, 1992; Friedel et al., 2007). In contrast, people with low self-efficacy beliefs shy away from challenging tasks and tend to view them as personal threats.

High self-efficacy fosters an intrinsic interest in activities, and those with such an efficacious outlook sets challenging goals and maintain a strong commitment to those goals (Bandura, 1994). Those with high self-efficacy beliefs persevere, even when confronted with failure. They have the power to persist even in the face of difficulties and setbacks (Schunk, 1981). In contrast, people with low self-efficacy shy away from tasks that they perceive as difficult. They dwell on their personal deficiencies, and the problems they might encounter. They give up quickly, and are slow to recover when faced with failure (Bandura, 1994).

According to Zimmerman (1995), many academic self-efficacy researchers presume that students arrive at their self-efficacy opinions based on standards of success or failure (Zimmerman, 1995).

> Perceived efficacy plays a key role in human functioning because it affects behavior not only directly, but by its impact on other determinants such as goals and aspiration, outcome expectations, affective proclivities, and perception of impediments and opportunities in the social environment. (Bandura, 2006, p. 309)

Sources of Self-Efficacy

There are four main sources of self-efficacy – performance accomplishments, vicarious experience, verbal persuasion, and physiological states (Bandura, 1977, 1994).

Performance accomplishments are the most effective way to build self-efficacy, and the single greatest contributor to a student's confidence (Bandura, 1977, 1994; Pietsch et al., 2003). Students bring a wide variety of experiences with them, both positive and negative. The ways in which students interpret those experiences will have an impact on their self-efficacy. Success increases one's personal self-efficacy while repeated failures undermine it, especially if the failures happen early in the experience (Bandura, 1977, 1994). After strong self-efficacy is developed through repeated success, the impact of failure is reduced. According to Bandura (1977), the effects of failure on self-efficacy depend partly on the "timing and total pattern of experiences in which the failures occur (Bandura, 1977, p. 195). Once self-efficacy is established, it is generalized to other situations (Bandura, 1977, 1994). Self-efficacy beliefs are more affected by a person's experiences than by any other comparison (Bandura, 1994).

Vicarious experiences, provided by social models, are another way of creating self-efficacy beliefs (Bandura, 1977, 1994; Pietsch et al., 2003). Seeing a peer succeed at a task without adverse consequences raises the belief that they also possess the ability to master that task. By observing others like themselves carry out tasks, students make judgments about their own capabilities. Bandura stresses that relying on vicarious experiences is a less dependable source of self-efficacy than personal accomplishments, therefore self-efficacy beliefs generated by models is likely to be weaker and more vulnerable to change (Bandura, 1977, 1994).

Verbal persuasion is a third way of strengthening self-efficacy beliefs and is widely used. Verbal cues, such as "You can do this," can increase a student's self-efficacy, although higher self-efficacy occurs when verbal cues are by someone that students believe is trustworthy. Teachers can boost self-efficacy with communication and feedback that leads the student through the task or motivates them to do their best. Verbal persuasion is also weaker than those self-efficacy beliefs that come from one's own accomplishments (Bandura, 1977, 1994).

Psychological states, or mood, also influence self-efficacy. A positive mood can increase self-efficacy while fear and worry can erode it. Stressful situations and high anxiety can contribute to low self-efficacy (Bandura, 1977, 1994; Kirk, 2009; Siegle & Ranney, 2003).

Research shows that learning environments can improve self-efficacy. Pedagogies that improve self-efficacy include cooperative learning strategies, establishing specific, short-term goals that challenge students, helping students verbalize a plan for a specific learning strategy, and comparing student performance to their own goals (Kirk, 2009).

Psychological Process and Self-Efficacy Beliefs

There are four major psychological processes through which self-efficacy beliefs affect human performance. Research has been conducted on the cognitive, motivational, affective, and selection processes (Bandura, 1994).

The results of self-efficacy beliefs on *cognitive processes* take many forms. Human behavior is often regulated by valued goals, and personal goals are influenced by the self evaluation of capabilities. The stronger the perceived self-efficacy, the higher the goals that people set for themselves (Bandura, 1994). Those who have high self-efficacy visualize success, while those with low self-efficacy beliefs imagine failure and dwell on what could go wrong. "It is difficult to achieve much while fighting self-doubt" (Bandura, 1994, para. 15).

Self-efficacy is crucial to the *motivational processes*. Motivation is generally cognitive; people motivate themselves and form beliefs about what they can and cannot do. "Self-efficacy beliefs provide the foundation for motivation, well-being, and personal accomplishment in all areas of life" (Pajares, 2006, p. 339).

According to Bandura (1994), there are three different forms of cognitive motivators. These include causal attributions, outcome expectancies, and cognized goals (Bandura, 1994). The corresponding theories, attribution theory, expectancy-value theory and goal theory, have been addressed earlier. Self-efficacy beliefs influence each of these types of cognitive motivators. In causal attributions, people with high self-efficacy beliefs attribute their failures to lack of effort, while those with low self-efficacy beliefs attribute their failures to low ability (Bandura, 1994). In the motivational process, outcome expectancies, motivation is regulated by the expectation that a given behavior will produce a certain result. Specific and challenging goals can enhance and sustain motivation; therefore, cognized goals are based on intrinsic rewards and self-satisfaction (Bandura, 1994). Self-efficacy beliefs determine the goals people set for themselves, how much effort they apply, how long they persevere, and their reaction to failures (Bandura, 1989).

In the *affective domain,* people's beliefs affect how they cope in different situations. Those with high self-efficacy are able to handle stress, while those with low self-efficacy dwell on their deficiencies, as well as possible threats. Perceived self-efficacy is key in regulating stress and depression (Bandura, 1994). People tend to avoid potentially threatening situations and activities because they believe they are unable to cope with situations they believe are risky (Bandura, 1989).

In the *selection processes domain,* people select the environments in which they feel most comfortable. They are likely to avoid situations and activities that they believe exceed their capabilities, although they readily accept challenging activities that they believe they are capable of handling. The power of self-efficacy influences the paths people take through selection processes in regard to coursework and career choices (Bandura, 1989).

Development of Self-Efficacy

Different periods in a person's life present different demands for success. The developmental changes that occur and the perceived self-efficacy over time are addressed in this section.

Sources of self-efficacy begin in the family. Young children develop a sense of self-efficacy in their daily lives through physical capabilities, social competencies, linguistic skills, and cognitive skills for comprehending and managing situations (Bandura, 1994). Although the first self-efficacy experiences begin at the family level, as the child grows and matures, peers become increasingly more important in the development of self-efficacy beliefs. Children tend to choose peers who share similar interests; therefore peer association promotes self-efficacy (Bandura, 1994).

School is the place where children develop and acquire the knowledge and problem-solving skills that are essential for life. "During the critical formative period in children's lives, the school functions as the primary setting for the cultivation and social validation of cognitive competencies (Bandura, 1994, p. 78). Self-efficacy beliefs tend to decline as students advance through school and this is attributed to a variety of factors; greater competition, more norm-referenced grading, less teacher attention to individual progress, and stresses associated with school transitions. A focus on procedures in instruction frustrates some students, and low ability grouping can lower a student's self-efficacy (Schunk & Pajares, 2002).

"As children master cognitive skills, they develop a growing sense of their intellectual efficacy" (Bandura, 1994, p. 78). The task then becomes to create a learning environment that is conducive to the development of those cognitive skills. Teachers who have high self-efficacy beliefs about their teaching abilities can motivate their students to achieve (Bandura, 1994).

> There are a number of school practices that, for the less talented or ill prepared, tend to convert instructional experiences into education inefficacy. These include lock-step sequences of instruction, which lose many children along the way; ability groupings which further diminish the perceived self-efficacy of those cast in the lower ranks; and competitive practices where many are doomed to failure for the success of a relative few. (Bandura, 1994, p. 78)

Classroom structures also affect the development of self-efficacy. Students suffer most when they are placed in whole group activities in which they all study the same material. Under this structure, students begin to rank themselves according to the abilities of others in the group. Once this is established, it is difficult to change. Cooperative learning activities tend to promote positive self-efficacy beliefs (Bandura, 1994).

Transition to middle school also affects self-efficacy. Elementary students are with the same teacher and peers for most of the school day, children receive individual attention, and individual progress is stressed. The focus in the early grades is skill mastery and teachers assign tasks that they expect all students to master. Therefore, children's self-efficacy is generally high. Students persist, not because of high self-efficacy, but because teachers help keep them on task (Schunk & Pajares, 2002). When students transition to the middle school, they typically attend classes with peers they do not know, and there is less teacher attention to individual progress (Eccles & Midgley, 1989; Eccles, Midgley, & Adler, 1984).

During adolescence, "learning how to deal with pubertal changes, emotionally invested partnerships, and sexuality becomes a matter of considerable importance" (Bandura, 1994, p.

79). Young adolescents are becoming more independent, and they expand and strengthen their self-efficacy by learning how to deal with problems. Adolescence is a period of time of psychosocial turmoil. Bandura states that students can negotiate the important transitions in this period of their life without turmoil and stress. However, if a child enters middle school with a "disabling sense of inefficacy," then they are vulnerable to stress and weakness to the new demands that middle school places on them (Bandura, 1994).

According to Pajares (1996), there is a commonality in self-efficacy and other expectancy beliefs; they all are about a person's perceived capabilities. The difference is that "self-efficacy is defined in terms of individuals' perceived capabilities to attain designated types of performances and achieve specific results" (Pajares, 1996, p. 546).

Self-Regulatory Learning

Self-regulated learning, as defined by Schunk (1989b), is "learning that occurs from students' self-generated behaviors systematically oriented toward the attainment of their learning goals (Schunk, 1989b, p. 83). Self-regulated learning processes involve goals that students instigate, modify, and sustain (Schunk, 1989b; Zimmerman, 1989). This fits with the idea that rather than just being passive recipients of information, students contribute actively to their learning goals and have control over their realization of those goals (Schunk, 1989b).

Self-regulated learning, from the social cognitive perspective, is what allows a person to control his or her response or behavior when confronted with externally imposed stimuli. Self-regulation looks at the interaction between a person, his or her behavior, and the environment. Bandura (1986) identified three characteristics of self-regulated learning: self-observation, self-judgment, and self-reaction. These are not mutually exclusive, but interact with each other

(Schunk, 1989b; Zimmerman, 1989). Self-observation causes a person to monitor their activities and self-evaluate, which in turn leads to a variety of personal and behavioral reactions.

Self-judgment refers to the self-evaluation of one's performance, comparing existing performance levels to one's learning goals. According to Zimmerman (1989), "goals that are unimportant, or outcomes that are not attributable to one's own ability or effort, are unlikely to produce self-reactive effects" (Zimmerman, 1989, p. 13).

Self-reactions are responses to one's performance outcomes. According to Schunk (as cited in Zimmerman, 1989), there are two major classes of self-reactions, one personal and one environmental. Personal feelings of satisfaction or dissatisfaction are evaluative motivators; tangible motivators indicate self-administered stimuli or consequences that are made when a task is completed or successful.

"Learning is not something that happens *to* students; it is something that happens *by* students" (Zimmerman, 1989, p. 22). For learning to occur, students must be proactive and engaged.

Mathematics Self-Efficacy of Middle School Students

> "Self-efficacy in mathematics differs from perceived ability or competence ("I am good at math"), in that it is a measure of children's *anticipated* success given their current capabilities ("I can master the skills in math this year if I try"). (Friedel et al., 2007, p. 438)

Schommer-Aikins et al., (2005) conducted a study that examined the relationship between middle school students' general beliefs and their specific mathematical problem-solving beliefs. In this quantitative study, they assessed mathematics problem-solving beliefs using the

Indiana Mathematics Scale in which they identified six beliefs that are critical to a learner's motivation (Schommer-Aikins et al., 2005). The beliefs assessed included questions that mathematical problem-solving is time consuming, requires understanding, involves more than step-by-step procedures, involves word problems (not just calculations), and can be improved with effort (Kloosterman & Stage, 1992). They also used the Fennema and Sherman Mathematics Is Useful Scale (1976) which assessed the degree to which students believe they use mathematics in their everyday lives (as cited by Schommer-Aikins, Duell, & Hutter, 2005). The results of this study suggested that general epistemological beliefs and mathematical beliefs affect students' problem-solving in mathematics.

Self-efficacy instruments also have been used to rate students' confidence to solve specific mathematics problems (Hackett & Betz, 1989), and other instruments have been used to show how well students' expect to do in mathematics, and how good they feel about mathematics (Meece, Wigfield, & Eccles, 1990). Sample mathematics questions include, "How confident are you that you could give the correct answer to the following problem with using a calculator?" [followed by 20 algebra and geometry problems] (Pajares & Miller, 1994), "How much confidence do you have that you could complete this algebra course with a final grade of B or better?" (Betz & Hackett, 1983, as cited in Pajares & Miller, 1994), "Circle the number on the line that matches how sure you are that you could work problems like those shown and get the right answers." [after being shown a division problem for two seconds], (Schunk, 1981), "How well can you learn general mathematics?" (Bandura, 1989), and after being presented with sample mathematics problems, students were asked to provide a confidence judgment to correctly solve the problems (Schunk, 1996).

Self-Efficacy in Other Studies

Since Bandura's 1977 publication, self-efficacy has been the focus of many studies and has included questions regarding the level and strength of students' confidence to perform a certain task or succeed in a certain situation.

Bong and Clark (1999) compared academic self-concept and self-efficacy. They defined self-concept as a "person's perception of himself" (Bong & Clark, 1999, p. 140). Self-efficacy "deals primarily with cognitively perceived capability of the self" (Bong & Clark, 1999, p. 141) and involves the competence given to a particular performance. Results of this study indicated that self-efficacy judgment is the successful accomplishment of goals, whether or not one has the capability to carry out the given task. It is a cognitive judgment that puts emphasis on one's prior performance (Bong & Clark, 1999).

The relationship among self-concept, self-efficacy, and performance in mathematics was the subject of research conducted by Pietsch et al. (2003). This quantitative study was conducted with high school students in Australia in which they were asked questions regarding self-efficacy and self-concept for mathematics and the topic of percentages. Self-efficacy beliefs were identified as most related with performance in mathematics and percentages (Pietsch et al., 2003).

Schunk (1981) tested self-efficacy in elementary school children's arithmetic achievement in a quantitative study. Children who showed low arithmetic achievement were divided into two groups. One group of children received problem-solving strategies through modeling in which adults verbalized the operations used in arithmetic activities. The children then practiced those strategies. Another group of children received the same explanations, but did not receive any modeling. They were also given time to practice the strategies. Results of this quantitative study indicated that problem-solving strategies and corrective feedback "were effective in developing skills and enhancing a sense of efficacy in children who had experience profound failure in mathematics" (Schunk, 1981, p. 102).

Friedel et al., (2007) studied children's perceptions of the goals of their teachers and parents in regard to mathematics achievement. Instruments were developed that assessed children's perceptions of the mathematics goals emphasized for them. The results of this quantitative study indicated that children's opinions predicted their own personal goals in mathematics (Friedel et al., 2007).

Licht and Kistner (as cited in Schunk, 1989a) considered the interaction between self-efficacy and learning disabilities. They determined that many learning disabled students have low self-efficacy. They found that environmental factors, such as other students and teachers, have an impact on a students' self-efficacy, although positive teacher feedback can raise students' self-efficacy beliefs (Schunk, 1989a).

Attitudes

Attitudes affect everything. They affect relationships with others, and a person's openness to new situations. If attitude toward a task is positive, a person will most likely enjoy doing it. If a person's attitude is negative, then a person will avoid doing the task. Attitude toward mathematics is a person's manner, disposition, or feeling with regard to mathematics. "Developing a positive attitude in students toward mathematics is as much a goal of school mathematics instruction as are achievement-related goals" (Swafford & Brown, 1989, p. 106).

Park (as cited in Allport, 1935) suggests four criteria for attitude:

> It must have definite orientation in the world of objects (or values), and in this respect differ from simple and conditioned reflexes; it must not be an altogether

> automatic and routine type of conduct, but must display some tension even when latent; it varies in intensity, sometimes being predominant, sometimes relatively ineffective; it is rooted in experience, and therefore is not simply a social instinct. (p. 803)

Over the years, there have been multiple definitions and characteristics of attitude. Here are just a few:

> The specific mental disposition toward an incoming (or arising) experience. (Warren, 1934, as cited in Allport, 1935, p. 804)

> A more or less permanently enduring state of readiness of mental organization which predisposes an individual to react in a characteristic way to any object or situation with which it is related. (Cantril, 1934, as cited in Allport, 1935, p. 804)

> An attitude is a tendency to act toward or against something in the environment which becomes thereby a positive or negative value. (Bogardus, 1931, as cited in Allport, 1935, p. 804)

> An attitude, roughly, is a residuum of experience, by which further activity is conditioned and controlled… We may think of attitudes as acquired tendencies to act in specific ways toward objects. (Krueger and Reckless, 1931, as cited in Allport, 1935, p. 805)

The common thread throughout these definitions is that each is "a preparation or readiness for response…It is not behavior, but the precondition of behavior" (Allport, 1935, p. 805). "Attitudes determine for each individual what he will see and hear, what he will think and what he will do" (Allport, 1935, p. 806).

Dewey equated attitudes with habits (Dewey, 1917) and Allport (1935) suggested that attitudes are often as rigid as habits, and are set early in life.

According to Eccles et al., (1984), there is a gradual decline in students' general attitudes toward school and academic subjects as they progress in age and grade level. Differences in attitudes toward school are influenced by the school environment, and declines are more extreme when students move into a more traditional junior high school rather than a middle school, or when staying in a K-8 school environment. Transition seems to have the greatest impact on attitudes toward school in general (Eccles et al., 1984).

Nardi and Steward (2002) found that students report negative attitudes toward mathematics (Nardi & Steward, 2002). Eccles et al. (1983) found a marked decline in attitudes toward mathematics, especially at the junior high/middle school level (Eccles, et al., 1983). There is also a general decline in children's self-esteem between grades six and seven (Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991). And, according to Eccles and Midgley (1989), sixth-grade children reported high self-ratings in "looks, sports ability, schoolwork ability, intelligence, and popularity" while those same children in seventh-grade believed these advantages disappeared (Eccles & Midgley, 1989, p. 144). Harter, Whitesell, and Kowalski (1987) found a decline in perceived cognitive competence between sixth and seventh grade for all children (as cited in Eccles & Midgley, 1989). Between grades five and twelve, attitudes toward school in general, attitudes toward mathematics, commitment to schoolwork, and attitudes to teachers continue to decline (Eccles & Midgley, 1989; Epstein & McPartland, 1976; Haladyna & Thomas, 1979). Other research also found a decline in self-concept and interest in mathematics (Wigfield & Meece, 1988).

Self-efficacy beliefs are formed by asking questions such as “Can I do this mathematical problem?” whereas attitudes are formed by asking questions such as “Am I good at mathematics?” (Pietsch et al., 2003).

According to the National Research Council (2001), productive disposition is the “tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics” (National Research Council, 2001, p. 131). A student’s disposition toward mathematics determines their success (National Research Council, 2001).

Previous research has concluded that boys in the United States have more positive attitudes toward mathematics than girls, even though their academic achievements are similar. Girls’ attitudes toward mathematics decline more sharply than boys, although attitude differences are not clearly associated with achievement differences (National Research Council, 2001). International studies have concluded that eighth grade students’ attitude toward mathematics is about average (Mullis, et al., 2000).

In order to understand eighth-grade students’ view of mathematics, TIMSS created an index of positive attitudes toward mathematics (PATH). Students were asked the following questions:

1. I like mathematics.
2. I enjoy learning mathematics.
3. Mathematics is boring.
4. Mathematics is important to everyone’s life.
5. I would like a job that involved using mathematics.

For each statement, students responded on a 4-point Likert scale, with strongly positive, positive, negative, strongly negative. Eighth-grade students generally had positive attitudes mathematics. The TIMSS study concluded that "students' attitudes toward any curriculum area can be related to their achievement in ways that reinforce higher or lower performance" (Mullis et al., 2000, p. 137). In almost every country, there was a high correlation between attitudes and mathematics achievement (Mullis et al., 2000).

The National Assessment of Educational Progress (NAEP) includes items in order to gain information about students' attitudes toward mathematics. The fourth NAEP Mathematics Assessment showed that students in the United States "develop a variety of counterproductive beliefs about mathematics and about themselves as learners of mathematics" (National Research Council, 2001, p. 141). In the 1996 NAEP Mathematics Assessment, 40% of eighth graders thought that mathematics is a set of rules and that learning mathematics means memorizing those rules. Despite this fact, 70% of the eighth-grade students view mathematics as useful (National Research Council, 2001). The 2000 NAEP assessment showed that fewer eighth-grade students reported liking mathematics in the 2000 than in the 1990s (Braswell et al., 2001).

The Middle School

This section provides research related to the philosophy of the middle school, the middle school child, and the mathematics curriculum at the middle school level.

Historical Perspective of the Middle School

In the early 1900s, the major school structure was eight years of elementary school and four years of secondary school. At the turn of the 20th century, there were many pressures to reorganize this model. These pressures included increased immigration and increased industrialization. Increased immigration caused overcrowding in the city elementary schools, increased industrialization was needed to better prepare a workforce for the factories. Another pressure was the demand from college presidents that college preparatory courses begin before the ninth grade. In 1899, the Committee on College Entrance Requirements, commissioned by the National Education Association, published a report, which delineated the need for starting secondary education at the seventh grade instead of ninth grade. According to the report, seventh grade was the natural turning point in a child's life. Therefore, the transition from elementary to secondary school was thought to be easier if there were specialized teachers instead of the one-teacher approach typically found in elementary schools (Anfara, 2001; Juvonen, Le, Kaganoff, Augustine, & Constant, 2004; National Education Association [NEA], 1899). According to Howard and Stoumbis (1970), the junior high school was established out of pressures and concerns for a more rigorous curriculum at grades seven and eight. The thought was that these grades were "repetitious and time-wasting" (Howard & Stoumbis, 1970, p. 1).

From Junior High School to Middle School

According to Bossing and Cramer (1965), the junior high school originated in Europe. In fact, Denmark established a middle school in 1903 in order to provide a more broad educational opportunity for children. The Danish middle school had two distinct purposes: (1) an Examination Middle School, which was strictly academic in nature and whose curriculum was determined by the high school; and (2) a Prevocational Middle School, which was vocational in nature and a curriculum that was managed internally. The early American colonies did not have an educational system, although Massachusetts passed a law in 1642 requiring parents to teach children the basics of learning so that their children would become future citizens who could “read and understand the Bible and the laws of the land” (Howard & Stoumbis, 1970, p. 4). As the United States grew, people wanted an education for their children that was more generally available and useful. After the Civil War, the American high school was striving to provide both a college-preparatory education as well as an education for those students whose plans were vocational. The high school was predominately a four-year program, although states adopted their own models (Howard & Stoumbis, 1970). Comenius, Rousseau, Basedow, Pestalozzi, Herbart, and Herbert Spencer influenced the thinking that America should have a school strictly devoted to the adolescent and their unique needs (Bossing & Cramer, 1965).

In the late nineteenth century, criticisms were growing regarding the 8-4 plan. Debates included shortening the public school years and enriching the program so that students could enter college earlier. These debates resulted in the appointment by the National Education Association of the Committee of Ten on Secondary School Studies. In 1892, the committee was formed, chaired by Charles W. Eliot, president of Harvard. The reorganization of the public school system was underway. The Committee of Ten presented their report in 1893 in which they proposed that algebra, geometry, and foreign languages be taught in the last years of elementary school, or that schools reduce the elementary school to six years which in turn would provide six years of secondary education (Howard & Stoumbis, 1970). Some public school systems met these recommendations by departmentalizing the upper elementary grades and by bringing some of the high school subjects into the seventh and eighth grades, although there were no substantial changes. The debate still continued whether schools should be organized as eight years of elementary school and four years in the secondary school. Dropout rates were at a high-level and many blamed the transition between elementary school and high school (Anfara, 2001).

Public school educators were concerned by the college influence on the Committee of Ten; therefore, in 1895, the National Education Association established the Committee on College Entrance Requirements. Out of this committee came a focus on the student first and the organization second. According to the committee report (NEA, 1899), "the committee recommended a six-year elementary program and a unified six-year high school course of study beginning with grade seven because "the seventh grade, rather than the ninth, is the natural turning point in the pupils' life as the age of adolescence demands new methods and wiser direction" (Howard & Stoumbis, 1970, p. 8). The report recognized the need for a gradual transition from elementary to secondary school, as well as a program best suited for the needs of the adolescence.

Major efforts were made to reform the educational pattern. In 1895, Richmond, Indiana established a 6-2-4 pattern and made curriculum changes that included seventh- and eighth-grade English, mathematics, and social studies; algebra in grade eight, and an exploratory program in the fine and practical arts, as well as a homeroom advisor system (Howard & Stoumbis, 1970). Other schools across the nation were making efforts to reorganize. It was in Columbus, Ohio in 1909 that the term "junior high school" was first used.

In 1918, the National Education Association appointed a committee on the reorganization of secondary education. Its publication "Cardinal Principles of Secondary School Education" advocated for a school system in which the first six years would be dedicated to elementary education and the next six years to secondary education. Secondary education could be divided into two periods, junior and senior high school (National Committee on Mathematical Requirements, 1923). The report further stated that the junior high school should include a gradual introduction into departmental instruction, as well as a choice of subjects, prevocational courses, and a social organization within the school (Howard & Stoumbis, 1970).

The National Committee on Mathematical Requirements adopted the following resolution on April 24, 1920 regarding the junior high school. "The National Committee approves the junior high school form of organization, and urges its general adoption in the conviction that it will secure greater efficiency in the teaching of mathematics" (National Committee on Mathematical Requirements, 1923, p. 15). The junior high school was formed with the intention of providing an "educational program best suited to the needs of that unique age, early adolescence" (Howard & Stoumbis, 1970, p. 3).

There was growing dissatisfaction with the junior high school of the 1940s and 50s. It just became a junior version of the high school (Alexander, Williams, Compton, Hines, & Prescott, 1968; Howard & Stoumbis, 1970; Lipka et al, 1998). The junior high school was not a "distinctive institution with distinctive goals" (Lipka et al., 1998, p. 8). According to Brough, 1995 (as cited in Juvonen et al., 2004, p. 12), the emphasis in the junior high school was on "content rather than exploration, departmentalization rather than integration, and an adherence to a rigid schedule." It was accepted that children between the ages of ten and 13 needed an educational program that was different from the self-contained classroom of the elementary school but not yet the departmentalized program of the high school. Traditionally, American education was classified as elementary and secondary, with junior high included as part of the secondary school. Middle school advocates believe that middle school should be a third division, between elementary and secondary school. The middle school provides an educational program for students 10-14 years of age, and emphasizes flexibility in the acquisition of specific skills, as well as an increase in student responsibility for learning (Howard & Stoumbis, 1970).

In the 1960s, when William Alexander proposed a 5-8 or 6-8 middle school as a way to better meet the needs of adolescents, the idea was met with positive reception. According to the National Education Association (NEA, 1927), the middle school was established as an "educational program designed to meet the needs and interests of the preadolescent and early adolescent" with certain requirements. These requirements included at least three grades in order to provide a transition from elementary to high school. Grades seven and eight were mandatory in the new middle school, with no grade below five and no grades above eight. Departmentalization was in effect, as well as flexible approaches to instruction – team teaching, flexible scheduling, individualized instruction, and independent study in order that all children learn how to learn. Special courses were required of all students, such as industrial arts, home economics, foreign languages, art, and music (National Education Association, 1927). Faculty members were to be trained specifically to work with this level of students. An effort was made to combine the best characteristics of both the elementary and secondary schools (Howard & Stoumbis, 1970).

As Atkins (1968) points out:

> The uniqueness of the middle school is not so much a matter of organization, of grouping, of schedules, or of staffing, as it is a matter of attitude, of expectation, of sensitivity, and of perception. The mission of the school is viewed as neither remedial nor preparatory. (pp. 118-119)

Therefore, a "real middle school" was to be established for students from ages ten to fourteen and designed to meet the needs of preadolescents and early adolescents. Middle schools eliminated the rigid departmentalization and competition that was characteristic of the secondary school. The middle school also was designed for individual instruction (Howard & Stoumbis, 1970).

Students in the middle grades "possess unique educational needs, needs that neither align with the needs of elementary age students nor with high school students" (Williamson & Johnston, 2004). Therefore, the concept of the middle school was viewed as transitional in which children are both recognized and valued. The middle school was to be flexible, sensitive, and individualized to the needs of the preadolescent. There was also an emphasis placed on utilization of knowledge rather than mastery of knowledge (Howard & Stoumbis, 1970). Another common element of the new middle school was home base groups in which students were assigned to teachers who had special training in guidance and counseling and who could help students with both personal and academic problems. The sole purpose of the middle school was not developmental, but should recognize and maximize the learning of early adolescent students (Williamson & Johnston, 2004).

The Grosse Pointe, Michigan, Public School System delineated the differences between middle schools and junior high schools. An information bulletin published in 1969 (as cited in Howard & Stoumbis, 1970) stated "A middle school program is designed to recognize the uniqueness of the growth stage spanning the transition from childhood to adolescence. The junior high school has evolved into exactly what the name implies – *junior* high school" (Howard & Stoumbis, 1970, p. 202). Table 2-1 provides a comparison of the middle school and junior high school.

Table 2-1: Middle School and Junior High School Comparisons

Middle School Emphasizes	Junior High Emphasizes
A program that is child-centered	A program that is subject-centered
Learning how to learn	Acquiring a body of information
Creative exploration	Skill and concept mastery
A belief in oneself	Inter-student competition
Skilled guidance for student self-direction	Conformance to the teacher-made lesson plan
Students assuming responsibility for their own learning	Student learning is the responsibility of the teacher
Student independence	Control by the teacher
A flexible schedule	A six-period day
Scheduling involving student planning	A schedule administratively constructed
Variable group size	Standard classrooms
Use of team teaching	One teacher per class
Students learning at different rates – self-pacing	All students at the same place at the same time; textbook approach

(Stemnock, 1969, p. 17)

By the 1970s, middle schools were appearing in many states. Articles appeared in professional journals asserting the advantages of the middle school structure. Middle schools included all kinds of instructional programs, including personal development, skills for continued learning, and organized knowledge. The middle school model stressed individualized instruction, non-grading, diagnostic services, and individually paced materials. This model emphasized continual learning; grades were not used as a motivation; and a strong exploratory program was introduced, which included such areas as ceramics, photography, drama (Howard & Stoumbis, 1970).

By the 1980s, the middle school movement claimed success as a grass-roots effort of teachers and administrators who were voicing concerns about the 'whole child.' Research during this time period suggested that the transition to the junior high school was especially difficult for youth at the beginning of puberty (Juvonen et al., 2004). Research indicated that seventh graders transitioning to the new junior high school had "lower self-esteem, had more negative attitudes about school, and received lower grades" (Juvonen et al., 2004, p. 13). The transition to junior high or middle school is typically characterized by declines in student motivation, attitudes toward school, and perceptions of their own abilities. Other research confirmed these findings (Anfara, 2004; Eccles & Midgley, 1989; Juvonen et al., 2004).

In 1989 the Carnegie Task Force on Education of Young Adolescents noted that young adolescents face significant turning points (Carnegie Corporation of New York, 1995). This set the stage for continuing discussions on middle level education.

The next section provides an overview of the philosophy of the middle school.

Philosophy of the Middle School

The middle school movement was based on the belief that middle school age children have unique characteristics and needs which cannot be met by the elementary school or high school structure. According to George and Alexander (2003), "an effective middle school must not only build upon the program on earlier childhood and anticipate the program of secondary education to follow, but it must be directly concerned with the here-and-now problems and interests of its students" (George & Alexander, 2003, p. 12).

The Carnegie Council on Adolescent Development, in its 1989 report *Turning Points: Preparing American Youth for the 21st Century*, stated:

> Middle grade schools – junior high, intermediate, or middle schools – are potentially society's most powerful force to recapture millions of youth adrift. Yet too often they exacerbate the problems the youth face. A volatile mismatch exists between the organization and curriculum of middle grades schools, and the intellectual, emotional, and interpersonal needs of young adolescents. (p. 32)

The council presented ways to bridge this gap between young adolescents' needs and learning environments. The report proposed that a student leaving middle school should be reflective, on their way toward a lifetime of meaningful work, a good citizen, an ethical and caring person, and a healthy person.

Beginning in 1982, the National Middle School Association (NMSA, 1995) published a series of position papers called "This We Believe" which identified six prerequisites for developmentally responsive schools: educators committed to young adolescents; a shared vision; high expectations for all; an adult advocate for every student; family-community partnerships; and a positive school climate (National Middle School Association [NMSA], 1995).

Middle schools today typically begin with grade six, and end with grade eight, although there are other configurations dependent upon the school system. Researchers tend to use middle school to mean grades five through eight.

In 2000 the Carnegie Corporation of New York published *Turning Points 2000: Educating Adolescents for the 21st Century*. This report (as cited in Anfara, 2004) affirmed these core values: "the primary purpose of middle grades education to promote young adolescents' intellectual development; adolescents' intellectual, ethical, and social developments requires strong, supportive relationships; and successful middle grade schools are equitable with high outcomes for every student" (Anfara, 2004, p. 5).

Research on the Middle School Concept

Van Hoose (1991) stated "the quality of the relationship between teachers and students is the single most important aspect of middle level education" (as cited in Anfara, 2001, p. 7). Although many reports have been written and much research has been done, schools are slow to change. Few of the recommendations are actually practiced in the schools (Anfara, 2001; Dickinson, 2001). Some of the reform efforts include teaming, flexible-scheduling, exploratory curriculum, and advisory programs (Anfara & Brown, 2001). But in many schools, "the middle school concept" is "mindlessly uttered, but with no understanding of the real meaning or importance of the phrase" (Dickinson, 2001, p. 2).

According to John Dewey, "the school must itself be a community life" (Dewey, 1966, p. 385). Interdisciplinary teaming creates in a middle school that sense of community among teachers and students. Research shows that teaming offers students the most direct path for building a stable relationship with teachers and peers (K. Brown, 2001). Teaming addresses a critical time in an adolescent's life. At this time, students are acquiring "durable self-esteem, flexible and inquiring habits of mind, reliable and relatively close human relationships, a sense of belonging in a valued group, and a sense of usefulness in some way beyond the self" (Carnegie Task Force, 1989, p. 12). The Carnegie Task Force stated that "many adolescents attend massive, impersonal schools, learn from unconnected and seemingly irrelevant curricula, know well and trust few adults in school, and lack access to health care, counseling, and the guidance needed to become healthy, thoughtful, and productive adults" (Carnegie Task Force, 1989, p. 13). Research shows that interdisciplinary teaming can provide middle school students the support they need. Teams are a home within the school that can reduce the stress of isolation. The National Middle School Association takes a strong position on interdisciplinary teaming, stating it as central to the middle school concept. Research indicates that middle schools with a high commitment to teaming have significantly stronger academic programs (K. Brown, 2001). According to Hawkins & Berndt, the interdisciplinary team promotes closer student and teacher relationships, and contributes to a students' feelings of being well know, liked, and supported (as cited in Kramer, 1992).

Flexible scheduling provides an alternative for the middle school that supports developmentally appropriate learning. The structure of the school day schedule is typically divided into several equally divided periods. Longer periods can be arranged so that the curriculum can be integrated and more individualized instruction can be given. The schedule can be altered daily or weekly, depending on the needs of the students. Research indicates that flexible scheduling encourages the development of meaningful relationships between students and teachers, increases student understanding, and provides more time for the demands of the diverse learner (D. Brown, 2001). This ensures meaningful learning, promotes the need for hands-on and minds-on learning experiences, and time to make connections among content areas that could not be accomplished during the traditional school schedule. Flexible scheduling also empowers teachers for curricular design, flexibility and creativity, and collaboration and planning (D. Brown, 2001).

Curriculum at the middle school level continues to be debated. Some researchers believe that the curriculum should consider questions that students ask about the world around them, others argue that middle school students need to receive knowledge protected by the limits of the content (Powell & Van Zandt Allen, 2001). At first, the middle school grades were meant to be scaled-down versions of the secondary school; thus it was called the *junior* high school, which consisted of content-centered departments. According to the National Middle School Association's publication *This We Believe* (NMSA, 1995),

> Curriculum is integrative when it helps students make sense out of their life experiences. This requires curriculum that is itself coherent, that helps students

> connect school experiences to their daily lives outside the schools, and encourages them to reflect on the totality of their experience. (p. 22)

Advisory programs are designed to deal directly with the needs of the adolescent. Activities may include non-formal interactions as well as systems of developed units. These do not seem to be functioning as intended because the advisory program is taking place during the homeroom time schedule (Anfara & Brown, 2001). Relationships are key to a successful advisory program; relationships that not only connect the teacher to the student, but student to student in a warm, caring, and friendly environment. The ideal advisory program is a community in which there is a bond among the teachers and students in the group. According to Noddings (1992),

> Students will do things for people they like and trust. They listen to people who matter to them, and to whom they matter. As we are reminded by Palmer (1983), "But what scholars now say – and what good teachers have always known – is that real learning does not happen until students are brought into relationship with the teacher, with each other, and with the subject. We cannot learn deeply and well until a community of learning is created in the classroom. (p. xvi)

The Middle School Child

The middle school child is typically between the ages of 11 and 14, in grades six through eight. According to Lounsbury (n.d.),

> No other age level is of more importance to the future of individuals, and literally, to that of society; because these are the years when youngsters crystallize their beliefs and themselves and firm up their self-concepts, their philosophies of life,

and their values – the things that are the ultimate determinants of their behavior. (para. 3)

"Middle school students are still open to new ideas, still searching for answers, and undecided about who they are and what they will ultimately be" (Pitton, 2001, p. 22). This creates a wonderful opportunity for us as teachers.

Early adolescents are moving from concrete operations – that is, "reasoning about and understanding" the concrete world – to formal operation – that is, "reasoning about and understanding" the abstract world of abstract ideas, principles, and laws. Young adolescents are also becoming more aware of their own thinking; they also begin to see knowledge not as absolute but rather as constructed by people and thus relative. To the young adolescent, knowledge is "valued only to the degree that it is correct and helpful in specific situations" (Gallagher-Polite, 2001, p. 59). Young adolescents are cognitively capable of reasoning; of thinking about why/how they come to that reasoning, and whether that reasoning is helpful or accurate for a specific situation. Early adolescents are also more reflective about themselves (Gallagher-Polite, 2001).

The Middle School Mathematics Curriculum

The middle school years are critical for students' achievement in mathematics (Reynolds, 1991). Middle school prepares students for high school, college, and future careers. School districts in the United States rely on local control to establish curriculum standards. Each district determines what will be taught at which grade level. Each state develops a curriculum that addresses the *No Child Left Behind* (2001) mandates, and sets the standards that each student must attain (Borst & Rorvig, 2006). The focus has shifted from "all children" to an emphasis on "each child" (Williamson & Johnston, 2004).

There is a history of reform in the middle school mathematics curriculum. "In 1989, NCTM recommended that we teach and assess students in very nontraditional ways" (Germain-McCarthy, 2001, p. 1). According to Germain-McCarthy, middle schools' primary focus is now on standards-based and problem-based teaching and learning. Based on the works of Piaget and Vygotsky, many schools have adopted a constructivist approach to teaching. Constructivism does not prescribe a specific way to teach, but rather focuses on students generating their own understanding. With funding from the National Science Foundation, the following mathematics programs were developed; Connected Mathematics, Mathematics In Context, MathScape, Math Thematics, and Middle School Mathematics Through Applications. These have been adopted by many middle schools in an effort to improve their students' achievement (Germain-McCarthy, 2001).

From the Third International Study of Mathematics and Science (TIMSS), eighth grade students in the United States are not as advanced or focused as those students in Japan and Germany (U.S. National Research Center, 1996). Although TIMSS was not as negative as *A Nation at Risk*, the language used to describe TIMSS once again affirmed that the "public schools were to serve as a cornerstone of America's preeminence on the world stage-and that they weren't doing a very good job of it" (Williamson & Johnston, 2004, p. 38). According to Williamson and Johnston (2004), after the release of the 1995 TIMSS results, the "lens of accountability was focused directly on the middle school" (Williamson & Johnston, 2004, p. 38).

Adding It Up: Helping Children Learn Mathematics (National Research Council, 2001) chose the term "mathematical proficiency" to portray what is necessary for a person to learn mathematics. Mathematical proficiency has five strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive dispositions (National Research Council, 2001). These strands are intertwined and interdependent. Learning with understanding is much more powerful than just the memorization of facts, which leads to retention and fluency, and helps students make connections to other ideas.

Conceptual understanding is more than just knowing facts and algorithms. Students with conceptual understanding comprehend mathematical concepts, and are able to represent mathematical situations in a variety of ways. Procedural fluency is the skill in performing procedures accurately and efficiently, and with flexibility. Strategic competence refers to the ability to solve mathematical problems. Adaptive reasoning is the capacity for logical thought, reflection, and justification. Productive dispositions are defined as "habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy" (National Research Council, 2001, p. 116).

The National Council of Teachers of Mathematics published the *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence (Focal Points)* in 2006. The *Focal Points* include grade-specific topics that will enable students to deepen their understanding of the mathematics concepts being taught at that specific grade level.

Governors and state commissioners of education across the country have joined together to develop a common core of state standards in mathematics for grades K-12. They developed the Common Core Standards Initiative. According to the Council of Chief State School Officers, the standards are research- and evidence-based, internationally benchmarked, aligned with college and work expectations, and include rigorous content and skills. The draft, released in September 2009, sets the K-12 standards for mathematics (and English-language arts) that will align with the college- and career-readiness standards. "A primary goal of developing these standards is to enable students to achieve mathematical proficiency" (College and Career Readiness Standards for Mathematics, 2009). The Common Core Standards were released in June, 2010.

Summary

Studies show that self-efficacy beliefs impact students' academic choices, performance, effort, and persistence, as well as careers in mathematics (Bong & Clark, 1999; O'Brien, Martinez-Pons, & Kopala, 1999). According to Pajares and Miller (1994), mathematics self-efficacy is a better predictor of mathematics performance than other self-concept measures (Pajares & Miller, 1994).

> "Most students enter school confident in their own abilities, and they are curious and eager to learn more about numbers and mathematical objects. They make sense of the world by reasoning and problem solving, and teachers must recognize that young students can think in sophisticated ways. Young students are active, resourceful individuals who construct, modify, and integrate ideas by interacting with the physical world and with peers and adults. They make connections that clarify and extend their knowledge, thus adding new meaning to past experiences." (NCTM, 2000, pp. 75-76)

Using Bandura's Social Cognitive Theory as the theoretical framework, the purpose of this qualitative study was to explore the nature of middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs in one public middle school in western Kansas. The next chapter includes the methodology used to conduct this study.

CHAPTER 3 - Methodology

This chapter includes the methodology to conduct this research. Within the chapter is a brief overview, an introduction to the research design, the theoretical framework of this study, the setting, data collection strategies, data analysis plans, establishing trustworthiness, and a summary.

Introduction

Using Bandura's (1995) Social Cognitive Theory as a conceptual framework, the purpose of this study was to explore the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs. Therefore, this study examined the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs, if, when, and under what conditions these attitudes and self-efficacy beliefs change, and the complex relationship between attitudes and self-efficacy. A public middle school in western Kansas was the setting for the analysis, and the students provided their own perspectives on their attitudes and self-efficacy beliefs, the experiences they believe may have impacted their attitudes and self-efficacy, and the relationship between their attitudes toward mathematics and their mathematics self-efficacy beliefs. These personal perspectives were triangulated with a short-answer questionnaire, classroom observations, and one-on-one interviews.

The study focused on middle school students attending the same school, with varying achievement levels. This research is important because it deals with the experiences of the middle school student and the factors that have contributed to their attitudes toward mathematics and mathematics self-efficacy beliefs.

In this study, the overarching philosophical assumption was social constructivism, using qualitative methods in a school setting. Social constructivism seeks understanding in the world and looks for the complexity of views (Creswell, 2007). The goal of the research under the social constructivism assumption is to “rely as much as possible on the participants’ views of the situation” (Creswell, 2007, p. 20). Therefore, the questions were broad and general so that the participants could construct meaning from the situation. Questionnaires and interviews were open-ended. The researcher’s intent was to make sense of and to interpret the students’ meanings regarding their attitudes toward mathematics and mathematics self-efficacy beliefs.

For the purposes of this study, operational definitions were given in order to clarify the research. Specifically, the following terms defined were: a) middle school, b) middle school student, c) attitude toward mathematics, and d) mathematics self-efficacy beliefs.

The literature provides several definitions for the middle school and the middle school child/student. For the purpose of this study, middle school is a school that contains grades six through eight. The middle school student is a student taking classes in a middle school. The middle school child is typically 11-14 years of age.

Attitude has many definitions and connotations. For this study, attitude toward mathematics includes a person’s manner, disposition, or feeling with regard to mathematics.

Self-efficacy is “the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (Bandura, 1995, p. 2). Self-efficacy involves perceived capability. Therefore, items were phrased in the form of *can do* rather than *will do*. “*Can* is a judgment of capability; *will* is a statement of intention” (Bandura, 2006, p. 308). Bandura (2006) indicates that a distinction be made between self-efficacy and self-esteem. Self-efficacy is perceived capability; self-esteem is a judgment of self-worth (Bandura, 2006).

Research Questions

In order to fill in the gaps in the current research about attitudes toward mathematics and mathematics self-efficacy beliefs, this study examined middle school students who attended one public middle school in western Kansas. All middle school students (430) were given the short-answer questionnaire; 273 completed the questionnaire. Sixty-one students in three classrooms were observed, and all observed students were invited to be interviewed. Eighteen parents/guardians agreed for their child to be interviewed. Since parents/guardians made the decision whether their child was to be interviewed, students' mathematics achievement varied.

The research was guided by the following overarching question:

What is the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs?

This overarching question was explored through the following sub-questions:

1. What are middle school students' attitudes toward mathematics?
2. What are middle school students' mathematics self-efficacy beliefs?
3. Have students' attitudes toward mathematics and mathematics self-efficacy changed across time?
4. What experiences have impacted attitudes and self-efficacy in mathematics?
5. In what ways are attitudes toward mathematics related to mathematics self-efficacy beliefs?

This qualitative study provided an opportunity for middle school students to tell their mathematical stories. Students were encouraged to express their attitudes toward mathematics, to reflect on their earlier attitudes, to ponder changes in these attitudes and what they perceive may have impacted any changes in attitudes. Students also were encouraged to express their beliefs in their abilities in mathematics (their mathematics self-efficacy beliefs), to reflect on their earlier beliefs, to ponder any changes in beliefs and what they perceive may have impacted any change in beliefs. Patterns in the data were interpreted to understand the relationship between experiences, attitudes, and self-efficacy.

Research Design

Self-efficacy beliefs and attitudes continue to confound researchers. Many quantitative research studies have been conducted. This qualitative, naturalistic inquiry explored the middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs. This research fits with a qualitative approach so that the voices of middle school students could be heard in order to understand their attitudes toward mathematics and their mathematics self-efficacy beliefs.

The choice of a qualitative study allowed the researcher to "study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them (Denzin & Lincoln, 2005, p. 3). According to Creswell (2007), qualitative research is used when "we need a complex, detailed understanding of the issue" (Creswell, 2007, p. 40). This was accomplished by talking directly to middle school students, going into their schools, and allowing them to tell their stories (Creswell, 2007). The researcher attempted to gain an understanding of the students' stories; therefore, this qualitative study was in a natural context.

Willems and Raush (1969) define naturalistic inquiry as "the investigation of phenomena within and in relation to their naturally occurring contexts" (Willems & Raush, 1969, p. 3). Doing research in a natural setting is crucial for the most comprehensive understanding of the phenomenon (Lincoln & Guba, 1985). Naturalistic inquiry is always carried out in a natural setting. Guba (1978) states that the purpose of naturalistic inquiry is discovery. Through the use of naturalistic inquiry, this study paralleled actual experiences and provided for the discovery (Stake, 2005) of the middle school child's attitudes toward mathematics, the experiences that impact these attitudes and self-efficacy beliefs, and the complex relationship between attitudes and self-efficacy beliefs. According to Denzin and Lincoln (2005), naturalistic observations involve participation in the world being studied (Denzin & Lincoln, 2005). Observation is "the fundamental base of all research methods" (Adler & Adler, 1994, p. 389).

Using naturalistic inquiry, this study examined middle school students at one public middle school site in western Kansas and analyzed their mathematical experiences in relation to their mathematics self-efficacy beliefs and attitudes toward mathematics. Data were collected from within the school environment, a natural setting where events occur (Creswell, 2007). This naturalistic approach was appropriate in order to examine the connections between attitudes toward mathematics and mathematics self-efficacy beliefs. The choice of naturalistic inquiry was based on the researcher's ability to generate a rich description of the events or an understanding of middle school students' attitudes and self-efficacy beliefs. This research attempted to describe the mathematical stories of middle school students by listening to the voices of the middle school child.

Qualitative methods seek to understand phenomena in a specific setting, such as "real-world settings where the researcher does not attempt to manipulate the phenomenon of interest" (Patton, 2002, p. 39). According to Creswell (2003), qualitative research can be used as a rationale for a specific reform or change (Creswell, 2003). This research provided a deeper and more complete understanding of the complex relationship between attitudes toward mathematics and mathematics self-efficacy beliefs of middle school children. The insights gained may lead to greater awareness, improvements in teacher practice, and ultimately, enhanced attitudes, efficacy, student achievement in mathematics, as well as contributions to the literature regarding attitudes toward mathematics and mathematics self-efficacy. As a result, the findings of this study may be of interest to middle school mathematics teachers, administrators, and teacher educators.

The Setting

This research took place in one public middle school in western Kansas, consisting of grades 6-8. A detailed understanding of the nature of attitudes toward mathematics and mathematics self-efficacy beliefs was developed by asking students to react to questions posed in relation to their natural school environment, by observing students in their mathematics classrooms, and by listening to each student's story related to mathematics attitudes and self-efficacy.

District Demographics

The Unified School District, located in western Kansas, serves a 380 square-mile area. Approximately 4,302 students are enrolled in one high school, two middle schools, five elementary schools, and two alternative schools. Approximately 29% of the district's students receive special education services. The district's students consistently score above state and national norms on standardized tests.

The Middle School Demographics

This middle school operates under the middle school concept which includes a daily 32-minute seminar time (Teacher Advisory) for all students. Interdisciplinary teaming at this middle school provides teachers a "team planning period" in addition to their personal planning time. The school schedule is a modified block schedule in which students attend eight 42-minute classes 3 days a week (Monday, Thursday, and Friday). On Tuesday and Wednesday, students attend four classes, each one hour and 47 minutes.

All mathematics classrooms have Elmo projectors, as well as a classroom set of laptop computers for the students to use. There is a school-wide homework policy, called "Time or Signature." If a student does not have their homework when it is due, then that student must stay after school the following day or bring the finished homework with a parent signature. All observed mathematics teachers adhered strictly to this policy. The middle school is a full-inclusion school in which the special education teacher team teaches with the regular education teacher.

The Building Staff Development Priorities for 2004-2005 included the priorities "improve literacy across the curriculum" and "improve math analytical reasoning skills." The mathematics courses offered at this middle school are general mathematics for grades six, seven, and eight, with an option for identified Gifted and Talented students to take an algebra class in grade eight. The textbook series currently used at this middle school is *Prentice-Hall Mathematics* (Charles, Illingworth, McNemar, Mills, Ramirez, & Reeves, 2010), although the Connected Mathematics Project curriculum was used the previous five years. The curriculum used at the upper elementary level (grades 3-5) was the Macmillan/McGraw-Hill series.

This study was conducted in April and May, just after the students had completed the mathematics state assessments.

Student Demographics

There are approximately 430 students in this middle school. The ethnic makeup of the school is: 2.7% African American, 5.6% Hispanic, 0.02 % Native American, 0.02% Asian/Pacific Islander, 0.6% Multi-ethnic, and 91% White. Migrant students total 1.4% in this middle school. There are 221 males and 209 females at this middle school. Approximately ten percent of the students are on an Individualized Education Plan (IEP), and 30% are on free and reduced lunch.

Of the total school population, there are 144 sixth grade students, 128 seventh grade students, and 158 eighth grade students. The average class size in this middle school is 14.6. The Building Student Mastery of Algebraic Concepts report indicate an increase in mastery of algebraic concepts from 1992 through 2001, but a decline from 2002 to 2004. This middle school achieved the State Standard Excellence in reading, mathematics, and writing on the state assessments given in the spring 2010.

Table 3-1: Students Participating in Study

	Number of Students Enrolled in Middle School Mathematics	Number of Students completing Short-Answer Questionnaire	Number of Students in Observed Classrooms	Number of Students Interviewed
6th grade	144	83 (58%)	10	5
7th grade	128	72 (56%)	22	4
8th grade	158	118 (75%)	29	9
TOTAL	430	273 (63%)	61	18

Piloting the Instruments

The short-answer questionnaire and the interview questions were piloted with the researcher's family, friends, and friend's middle school children in order to refine the questions and "net the most useful information" (Creswell, 2007, p. 132). There were eight middle school children, as well as five adults who participated in piloting the instruments. All participants completed the short-answer questionnaire and participated in interviews. Sampson (2004) states that a piloting is invaluable and recommends its use in order to refine the questions, assess observer bias, frame the questions, and adapt the research procedures (Sampson, 2004). Piloting the instruments also helped to improve the data collection plans and develop relevant questions (Yin, 2003).

Data Collection Strategies

This study was conducted in one public middle school in western Kansas, which was chosen based on the nature of this research. All participants attended the same school, which is required for this method of study to be considered suitable (Creswell, 2007). The researcher first contacted the Assistant Superintendent of the Unified School District, who granted consent for this research to be conducted in one middle school in this western Kansas district. The middle school principal was then contacted, as well as the District Mathematics Coach and three middle school mathematics teachers. Three sources of data were collected in this study: short-answer questionnaires, classroom observations, and interviews.

Short-Answer Questionnaires

A short-answer questionnaire was given to all sixth, seventh, and eighth grade students in the middle school in order to ascertain their attitudes toward mathematics and their mathematics self-efficacy beliefs. Three middle school mathematics classroom teachers granted permission for this researcher to be an observer in their sixth, seventh, and eighth grade classrooms. They were given instructions for giving the questionnaire to their students. Fill in the blank sentences included items such as "When I think of mathematics, I feel…" and "I believe I will be … in mathematics this year." Steps were taken to protect the identity of the participants; therefore this questionnaire was completely anonymous. The short-answer questionnaire was completely voluntary, and there was no penalty for not completing the questionnaire. Each student who chose to continue with the questionnaire was given the freedom to skip any question that made them feel uncomfortable. The guidelines for the teacher and the short-answer questionnaire can be found in Appendices E and F, respectively.

Classroom Observations

Classroom observations were conducted in sixth, seventh, and eighth grade middle school mathematics classrooms in order to gather further evidence of mathematical attitudes and mathematics self-efficacy beliefs of the middle school child and the experiences that impact these attitudes and self-efficacy beliefs. Field notes were gathered over a five-week period in one sixth grade classroom, one seventh grade classroom, and one eighth grade classroom. The researcher was in the middle school classrooms a total of 31 class periods, or 24 hours 18 minutes, which included four block schedule class periods. As an observer, the researcher gathered evidence of attitudes toward mathematics and mathematics self-efficacy beliefs, and explored what was impacting those attitudes and beliefs. Evidence included indicators of attitude toward mathematics such as engagement in class, and indicators of mathematics self-efficacy through statements such as "I can't do this." Observations also focused on experiences that may be impacting attitudes and self-efficacy such as student success or failure, teacher praise and encouragement, peer encouragement, the curriculum being used, instructional events, activities, and assignments and how students react to these experiences. Field notes included both descriptive and reflective notes, such as descriptions of each classroom setting and my own reactions. The field notes form can be found in Appendix G.

Interviews

After the classroom observations, parent request forms were sent out to all students in the classrooms in which the researcher observed. Ten sixth-grade letters, 17 seventh-grade letters, and 29 eighth-grade letters were sent home to parents/guardians. Fifty-six parent request letters were sent out; 18 were returned indicating that their child could be interviewed. Five sixth-grade students (3 girls, 2 boys), four seventh-grade students (2 girls, 2 boys), and nine eighth-grade students (7 girls, 2 boys) were interviewed before school, after school, and during Teacher Advisory.

Interviews with 18 students were then conducted. One-on-one interviews were semi-structured in which the researcher audio taped the interview and then transcribed the interview. Each interview was approximately 30 minutes long. The interview was conducted in a quiet location in the middle school, free from distractions. Interviews were scheduled at a time that was convenient for the students and their parents/guardians. Prior to the interview, students and their parents/guardians were asked to sign a consent form which indicated their desire to be in the study.

Ten students were in the sixth grade observed class, but the larger percentage of those students interviewed (50%). There were 22 students in the seventh grade classroom, while four seventh grade students were interviewed (18%); and nine eighth grade students were interviewed out of the 29 observed (31%). Consequently, the sixth, seventh, and eighth grade data were analyzed separately.

A general interview guide approach was used so that the researcher could ensure that the same general areas of information were collected from each participant. An open-ended, directed conversation that seeks to understand the participant's attitudes toward mathematics and mathematics self-efficacy beliefs focused on their "lived experiences." This approach still allowed the researcher the freedom and adaptability to ask follow-up questions from the participant when needed.

The protocol for the interview began with the following items: an explanation of the purpose of the interview, an indication of how long the interview would take, allowing the participant to ask any questions they had about the interview, and addressing confidentiality as well as the audio tape recording and taking of notes.

The interview questions began with a conversation about favorite subjects and why, what the student was currently studying in mathematics, what they like to do in mathematics, and what they do not like to do in mathematics. The interview then continued with open-ended questions such as "Overall, do you like mathematics?" and "Why or why not?" Students were asked if they had always liked or disliked mathematics or if they remembered a time when they liked or disliked mathematics. Through prompts, they were encouraged to reflect on if and when their attitudes changed and what impacted any changes. If student responses indicated a change in attitudes, they were encouraged to reflect on what they were doing or how their experiences were different when they held different attitudes toward mathematics. A second line of similar questions were related to mathematics self-efficacy. Students were asked “Do you believe you can be successful in mathematics?” If students expressed a low mathematics self-efficacy, they were asked if they could remember a time when they believed they could be successful in mathematics. Through prompts they were encouraged to reflect on if and when their mathematics self-efficacy beliefs changed and what impacted any changes. If their responses indicated a change in mathematics self-efficacy beliefs, they were encouraged to reflect on what they were doing or how their experiences were different when they felt successful in mathematics. The interview questions were refined by conducting a pilot study with family and friends’ middle school children. The pilot study also helped to refine the data collection plans and develop relevant questions (Yin, 2003).

Naturalistic inquiry requires that instruments are flexible and adaptive, and most always qualitative in nature; therefore, the interview questions were open-ended, directed conversation that sought to understand the participant’s attitudes toward mathematics and mathematics self-efficacy beliefs. This approach allowed the researcher the freedom and adaptability to ask follow-up questions from the participant if needed. The interview protocol can be found in Appendix H.

Selection of Participants

In order to determine the attitudes toward mathematics and the mathematics self-efficacy beliefs of middle school students, the researcher first searched for a school district in close proximity in order to participate in frequent classroom observations. The researcher looked at several middle schools in western Kansas, as well as the curriculum that was used by the teachers. The researcher wanted a typical middle level curriculum that would be representative of most middle schools.

The process of participant selection began by contacting the district assistant superintendent. The assistant superintendent visited with the two middle school principals, offering them an opportunity for their school's participation in this research. One middle school principal agreed to allow the research to be conducted at his school. Following the assistant superintendent's approval and principal's consent, the researcher contacted the middle school principal. A formal letter was given to the principal explaining the process. The principal suggested that the researcher visit with the district mathematics coach, who in turn contacted the middle school mathematics teachers. Three mathematics teachers volunteered for the research to be conducted in their classrooms. Each teacher also was given a letter with an explanation of the goals of this study. They were then asked to allow the researcher to observe their mathematics classrooms over a five-week period.

All middle school mathematics teachers were asked to give a 5-minute short-answer questionnaire to their students during class time. All students in three classrooms (sixth, seventh, and eighth grade) were observed. From this observation, all observed students were invited to be interviewed. Sixty-one students were observed in sixth, seventh, and eighth grade mathematics classrooms. A letter was sent to the parents/guardians of the selected participants, explaining the goals of the study, as well as an invitation for their child to participate in an interview lasting approximately 30 minutes. This interview was conducted after school, in a quiet setting, free from distractions. Eighteen parents/guardians made the decision for their child to be interviewed.

The researcher fulfilled all the requirements of the Kansas State University Research Involving Human Subject Institutional Review Board. Written consent was obtained from the students' parents/guardians before the student participated in the study. Steps were taken to protect the identity of the participants. This included the use of pseudonyms. Each student had the freedom to leave the study at any time.

Data Analysis

According to Creswell (2007), "data analysis in qualitative research consists of preparing and organizing the data for analysis, then reducing the data into themes through a process of coding and condensing the codes, and finally representing the data in figures, tables, or a discussion" (Creswell, 2007, p. 148). According to Erlandson, Harris, Skipper, & Allen (1993), the "analysis of the data gathered in a naturalistic inquiry begins the first day the researcher arrives at the setting" (Erlandson, Harris, Skipper & Allen, 1993, p. 111).

Data analysis for naturalistic inquiry should be open-ended and inductive. Inductive analysis is more likely to identify the influences that interact with each other (Lincoln & Guba, 1985). Therefore, the constant comparative method of data analysis was used (Creswell, 2007).

Beginning with open coding, the responses to the short-answer questionnaire, field notes from the observations, and the transcribed interviews were coded into major categories. Each source was coded separately at first, looking for trends in the attitudes toward mathematics and mathematics self-efficacy beliefs. Next, the researcher looked for patterns between experiences and attitudes toward mathematics and mathematics self-efficacy beliefs. Finally, the relationship between attitudes toward mathematics and mathematics self-efficacy beliefs was explored.

Open coding led to axial coding, in which an open coding category was identified and focused on. Then the researcher went back to the data and created categories based on that category (Creswell, 2007) looking for patterns and common themes. The researcher was the only person coding the data, looking for patterns and emerging themes.

According to Stake (2005), triangulation is “generally considered a process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation” (Stake, 2005, p. 454). By using triangulation in this study, the researcher was able to clarify meaning through the different ways the study was being seen. Triangulation of the data allowed for the analysis of the data from short-answer questionnaires, classroom observations, and one-on-one interviews in order to understand the nature of middle school students’ attitudes toward mathematics and mathematics self-efficacy beliefs.

Establishing Trustworthiness of the Data

The basic issue of trustworthiness in naturalistic inquiry is to convince the reader that the findings are “worth paying attention to” (Lincoln & Guba, 1985, p. 290). Establishing trustworthiness of the data will be based on credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). According to Lincoln and Guba (1985), credibility, transferability, dependability, and confirmability are “the naturalist’s equivalents for the conventional terms internal validity, external validity, reliability, and objectivity” (Lincoln & Guba, 1985, p. 300).

Credibility is the naturalistic equivalent to internal validity. Credibility is a confidence in the truth of the findings; an assessment of whether or not the findings represent a credible interpretation of the data (Lincoln & Guba, 1985). In order to establish credibility in this study, activities were implemented that increased the probability that the findings are *credible* through triangulation (Lincoln & Guba, 1985). Triangulation ensures that the descriptions are rich, robust, comprehensive and well-developed (Creswell, 2007). Triangulation in this study was based on the use of three different data collection methods; short-answer questionnaires, observations, and interviews (Lincoln & Guba, 1985).

Lincoln and Guba (1985) describe thick description as a way of achieving transferability, or the naturalistic equivalent to external validity. Thick description is the detailed account of field experiences in which the researcher "makes explicit the detailed patterns of cultural and social relationships and puts them in context" (Holloway, 1997, p. 62). By describing a phenomenon in detail, the researcher can evaluate the extent to which the conclusions are transferable to other settings, situations, and people (Lincoln & Guba, 1985). In order to provide the "widest possible range of information for inclusion in the thick description," researchers are engaged in purposeful sampling (Lincoln & Guba, 1985, p. 316). After the classroom observations, all observed students were selected to be interviewed. The data provided in this study is thick, rich descriptions of the attitudes toward mathematics of the middle school child and their mathematics self-efficacy beliefs. This allowed the researcher to "provide the data base that makes *transferability* judgments possible" (Lincoln & Guba, 1985, p. 316).

According to Lincoln and Guba (1985), there is no credibility without dependability; therefore, "a demonstration of the former is sufficient to establish the latter" (Lincoln & Guba, 1985, p. 316). Dependability, or the naturalistic equivalent to reliability, is ensuring that the findings are consistent and can be repeated. Peer review provided *dependability* to this study. The peer debriefer allowed for an external check of the research process (Creswell, 2007). The peer and the researcher kept written accounts of the debriefing sessions and the peer was the "devil's advocate" who kept the researcher honest and asked questions about the methods and interpretations of the data (Creswell, 2007). In addition, the researcher used member checking, in which the researcher paraphrased comments during the interview, such as "So what I heard you say is…"

Confirmabiliy, the naturalistic equivalent to objectivity, is the extent to which the findings are shaped by the participants and not researcher bias, motivation, or interest. According to Lincoln and Guba (1985), an audit trail is a transparent description of the steps taken from the start of a research project to the reporting of findings. According to Halpern (as cited in Lincoln & Guba, 1985), there are six categories for reporting information when developing an audit trail: raw data, data reduction and analysis products, data reconstruction and synthesis products, process notes, materials relating to intentions and disposition, and instrument development information. In order to establish *confirmability*, the researcher conducted an inquiry audit in which she kept all raw data and field notes, including recorded materials, written field notes, and short-answer questionnaire responses. The researcher has maintained records of all data coding, summaries, categories, themes, and patterns that emerged from the data.

Ethical Considerations

All guidelines from the Kansas State University Research Involving Human Subject Institutional Review Board (IRB) were followed. In order to protect the privacy of the participants, a protocol of informed consent was followed. This included obtaining permission from the IRB before collecting data. Students who were selected to take part in this study were notified orally, and parents/guardians were notified in writing about the goals of the study, as well as the methods used in the study. Prior to the interview, all participants were asked to sign a consent form indicating his or her desire to be included in the study. This consent form is in Appendix D. Each participant was informed of their right to leave the study at any time. According to the IRB, all students were given a pseudonym in order to protect their identity.

Participants and parents/guardians were informed about the process of data collection, security, and storage. The audio recordings from the interviews, transcripts, field notes, and short-answer questionnaires are kept in a locked cabinet in the researcher's home. There was no risk to the students who participated in this study.

Summary

The purpose of this study was to explore the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs for middle school students in one public middle school in western Kansas. The implementation of this qualitative approach was appropriate because it allowed for the voices of the middle school child to be heard, and makes meaning of the experiences of the middle school child. The use of a naturalistic inquiry approach within the qualitative tradition was appropriate for this study because it enabled the researcher to generate a rich description of the understandings of the middle school child's attitudes and self-efficacy beliefs. The researcher acknowledged and responded to ethical considerations in this research process, as well as followed the appropriate methods of data collection and analysis in order to gain a deeper understanding of the experiences of the middle school child, and the relationship between his or her attitude toward mathematics and mathematics self-efficacy beliefs. The next chapter includes the results of this study.

CHAPTER 4 - Results

This chapter includes the results concluded from this research, and the analysis of the data collected. Within this chapter is a brief introduction, a description of the participants in the study, the data collection process, and the analysis of the study.

Introduction

The purpose of this qualitative study was to explore the nature of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs in one public middle school in western Kansas. The attitudes toward mathematics and mathematics self-efficacy beliefs for middle school students are the beliefs, perceptions, and reactions to mathematics for children in grades six through eight.

This naturalistic inquiry provided an opportunity for middle school students to tell their mathematical stories. Students were encouraged to express their attitudes toward mathematics, to reflect on their earlier attitudes, to ponder changes in these attitudes and what they perceive may have impacted any changes in attitudes. Students also were encouraged to express their beliefs in their abilities in mathematics (their mathematics self-efficacy beliefs), and to reflect on their earlier beliefs, to ponder any changes in beliefs and what they perceive may have impacted change in beliefs. Patterns in the data were examined to understand the relationship between experiences, attitudes, and self-efficacy.

Participants in the Study

A total of 273 middle school students completed the short-answer questionnaire; 61 sixth, seventh, and eighth-grade students were observed in their mathematics classrooms; and 18 middle school students participated in one-on-one interviews. Table 4-1 provides the number of students involved in this study.

Table 4-1: Students Participating in Study

	Number of Students Enrolled in Middle School Mathematics	Number of Students completing Short-Answer Questionnaire	Number of Students in Observed Classrooms	Number of Students Interviewed
6th grade	144	83 (58%)	10	5
7th grade	128	72 (56%)	22	4
8th grade	158	118 (75%)	29	9
TOTAL	430	273 (63%)	61	18

It should be noted that all middle school students were given the opportunity to complete the short-answer questionnaire. For the classroom observations, all students were observed. This included one eighth grade Hispanic boy, one eighth grade boy with an Individualized Education Plan (IEP), and one sixth grade boy diagnosed with Asperger's Syndrome.

Data Collection Process

This naturalistic inquiry followed strict protocols for data collection. Clear data collection protocols were established for each source of evidence, including the short-answer questionnaire, individual student interviews, and classroom observations. The researcher was the only person who collected the data.

Data from the short-answer questionnaire were collected first. The short-answer questionnaire was given to all sixth, seventh, and eighth grade students in the middle school in order to ascertain their attitudes toward mathematics and their mathematics self-efficacy beliefs. Steps were taken to protect the identity of the participants; therefore this questionnaire was completely anonymous. Since the short-answer questionnaire was completely voluntary, and there was no penalty for not completing it, there were some middle school students who chose not to complete the questionnaire. Each student who chose to continue with the questionnaire was given the freedom to skip any question that made them feel uncomfortable.

Data from classroom observations were then gathered, using the observation protocol instrument. Field notes were transcribed from one sixth grade classroom, one seventh grade classroom, and one eighth grade classroom for a total of 31 class periods, or 24 hours 18 minutes collected over a five week period. Field notes included both descriptive and reflective notes, such as descriptions of each classroom setting, as well as researcher reactions.

The researcher then collected data from student interviews. Eighteen students, six boys and 12 girls, were interviewed by the researcher. This included five sixth-grade students, four seventh-grade students, and nine eighth-grade students. One-on-one interviews were semi-structured and audio taped, and then transcribed by the researcher. Each interview was approximately 30 minutes long, and was held before school, after school, and during the Teacher Advisory time. Prior to the interview, students and their parents/guardians were asked to sign a consent form which indicated their desire to be in the study. In order to establish validity, the researcher used member-checking during the interview by verbally asking students to clarify their responses, or by restating the student's comment.

Data Organization

After the data were collected and reviewed, the researcher organized the data. The researcher used the five research questions to separate the items on the short-answer questionnaire, the field notes from the classroom observations, and the questions asked during the one-on-one interviews.

For the short-answer questionnaire, the student responses were typed by the researcher into an Excel spreadsheet. Specifically, data were organized according to grade level and responses to each fill-in-the-blank question. The short-answer questionnaire items were then divided into four categories: attitudes toward mathematics, mathematics self-efficacy beliefs, experiences that have impacted attitudes toward mathematics and mathematics self-efficacy beliefs, and the relationship between attitudes toward mathematics and mathematics self-efficacy beliefs.

For the classroom observations, the field notes and researcher reflections were first transcribed and then organized. The observations were organized according to three categories: attitude toward mathematics (non-verbal behaviors and physical behaviors and gestures); mathematics self-efficacy beliefs (verbal frustrations); and experiences that impact attitudes toward mathematics and mathematics self-efficacy beliefs (experiences such as student success/failure, teacher praise/encouragement, and peer encouragement; and technology/ manipulatives, mathematics topic, curriculum, kinds of problems given to students, opportunities for students to work together, nature of questions the teacher poses, support and encouragement from teacher/peers).

Lastly, student interviews were transcribed by the researcher. The interviews were first organized by responses to common questions, and then sorted by research question. More specifically, the responses were put into the following categories: attitudes toward mathematics, mathematics self-efficacy beliefs, attitudes toward mathematics and mathematics self-efficacy beliefs change across time, and the experiences that have impacted attitudes toward mathematics and mathematics self-efficacy beliefs.

The researcher created a coding system for the short-answer questionnaire, the interview responses, and the observational data as part of open coding and data analysis. During this phase, the data was cut apart and coded using colors and key words that assisted the researcher in organizing the data into categories.

Preliminary Analysis of Data

Data from three sources were gathered: short-answer questionnaires, classroom observations, and interviews. The researcher sorted the questions from the short-answer questionnaire, the behaviors observed during the classroom observations, and the questions asked during the one-on-one interviews according to the five research questions. The data were then sorted and analyzed separately at first, and categories were determined.

The researcher then analyzed the categories from the open coding to identify, name, categorize, and describe the themes that were emerging. Lastly, the researcher explored the relationship between attitudes toward mathematics and mathematics self-efficacy beliefs by analyzing the student responses on the short-answer questionnaire. The students who replied no to both questions, “Do you like mathematics?” and “Do you believe you can do mathematics?” were coded separately. In addition, the responses to the “why or why not” questions during the one-on-one interviews were analyzed.

Data were triangulated and analyzed to determine patterns and themes. Each research question was addressed individually using the data collected from short-answer questionnaires, classroom observations, and student interviews. Although sixth, seventh, and eighth grade data were analyzed separately, the same patterns emerged in all three grade levels.

Analysis of Short-Answer Questionnaire

The short-answer questionnaire was given to all middle school students. All mathematics teachers gave the anonymous questionnaire to their students as a "warm-up" activity during one mathematics class period. Out of the 430 students in the school, 273 chose to complete the questionnaire. This included 83 sixth graders, 72 seventh graders, and 118 eighth graders.

The questions on the short-answer questionnaire were first divided into the following categories: attitude toward mathematics, mathematics self-efficacy beliefs, and experiences.

Analysis of Classroom Observations

The researcher observed three mathematics classrooms; one class per grade level at the middle school. The number of students in each classroom ranged from 10 to 29 students. The observations were based on the researcher's direct observation of students in the mathematics classroom. The researcher became a part of the classroom, assisting students when they asked for help, and sitting with groups of students as they worked cooperatively. Occasionally the researcher would ask the students questions in relationship to the topic of study. The researcher looked and listened for evidence of attitudes toward mathematics and influenced mathematics self-efficacy beliefs, and the experiences that have impacted students' attitudes toward mathematics.

The field notes and observations were first divided into the following categories: attitude toward mathematics, mathematics self-efficacy beliefs, and experiences. In the category of attitude toward mathematics, field notes were subdivided into engagement in class, body language, enjoyment, and enthusiasm levels. In the mathematics self-efficacy beliefs category, field notes were subdivided into verbal frustrations, teacher encouragement, student encouragement and support, and negative student-to-student comments. The subdivisions of the experiences category were student success, student failure, teacher praise/encouragement, peer encouragement, as well as the mathematics topic, technology/manipulatives, opportunities for students to work together, and the nature of questions the teacher poses. The three grade levels were color coded, although the data were combined in each subcategory.

Analysis of Student Interviews

The researcher interviewed 18 students; five sixth grade students (3 girls, 2 boys), four seventh-grade students (2 girls, 2 boys), and nine eighth-grade students (7 girls, 2 boys). The data collected from the one-on-one interviews were first analyzed separately according to common questions, and then organized by research question. In order to hear the voices of the middle school child, the category descriptions will include direct quotes from the students.

Major Categories in the Data

The researcher organized the data around the five research questions: attitudes toward mathematics, mathematics self-efficacy beliefs, change across time, experiences, and relationships. Categories then emerged from each of these questions. Each question, categories, and subcategories are described below.

The first research question, "attitudes toward mathematics" set the context for how middle school students feel about mathematics. Analysis of the data revealed that middle school students who participated in this study expressed positive, variable, and negative attitudes toward mathematics.

The following subcategories were identified under the positive category: 1) interested, 2) encouraged, and 3) teacher influence. ‘Interested’ in mathematics was used to classify students who attributed their positive attitudes to hands-on activities and projects, content-related topics such as the Pythagorean Theorem and probability, and to the belief that mathematics is fun and easy. Students were coded as ‘encouraged’ in mathematics when they feel challenged. The subcategory ‘teacher influence’ was used to code the positive influence of the mathematics teacher, his/her ability to make mathematics fun, or the ways in which he/she helps students understand a particular mathematics concept or topic.

Variable attitudes toward mathematics were classified as ‘it depends.’ The subcategories identified under the ‘negative’ and ‘it depends’ categories were: 1) disinterested, 2) discouraged, and 3) distressed. Students, who think mathematics is boring, believe that mathematics is not fun, or view mathematics as not relevant to real-life, were coded as ‘disinterested’ in mathematics. Students were coded as ‘discouraged’ in mathematics when they lack confidence and/or described mathematics as difficult, confusing, and unclear. ‘Distress’ in mathematics was used to classify students who are anxious or “feel sick” when thinking about mathematics.

The second research question, “mathematics self-efficacy beliefs,” included how middle school students expressed beliefs in their abilities in mathematics. Analysis of the data revealed that some middle school students who participated in this study expressed positive mathematics self-efficacy beliefs while others expressed negative mathematics self-efficacy beliefs. The following two subcategories were identified under the positive mathematics self-efficacy beliefs category: 1) teacher, and 2) high grades. The subcategory of ‘teacher’ was used to classify the positive influence of the mathematics teacher, and his/her classroom management strategies. The subcategory ‘high grades’ was used to classify the high scores students receive on homework, daily assignments, tests, or the state and local assessments and the positive impact such performances had on mathematics self-efficacy. The following two subcategories were identified under the negative mathematics self-efficacy beliefs category: 1) distress, and 2) low grades. Middle school students’ mathematics self-efficacy belief statements were coded as ‘distressed’ when they demonstrated anxiety and distress over their lack of success or their inability to understand a particular mathematics concept. The subcategory ‘low grades’ was used to code the low scores students receive on homework, daily assignments, tests, or the state and local assessments and the negative impact such performances have on students’ mathematics self-efficacy beliefs.

Research question three, “change across time,” is based on the recollections of middle school students in previous years. Analysis of the data revealed that middle school students who participated in this study expressed either positive changes, negative changes, or no changes in their attitudes toward mathematics. The major subcategory identified under the positive change in attitudes toward mathematics category was the teacher. ‘Teacher’ was the code used to describe the positive influence of the mathematics teacher on his/her students. Three subcategories were identified under the negative change in attitudes category: 1) homework, 2) lack of hands-on activities, and 3) confusion. ‘Homework’ was used to classify the take-home assignments as well as unfinished in-class assignments negatively impacting students’ beliefs in their mathematical abilities. ‘Lack of hands-on activities’ was the code used to describe the limited use of hands-on activities, games, and projects in the middle school mathematics classroom; while ‘confusion’ was a subcategory used to represent students’ feelings of uncertainty and misunderstanding of mathematics. The category ‘no change in attitudes’ refers to the students who always had either positive or negative attitudes toward mathematics.

Analysis of the data also revealed that middle school students who participated in this study expressed either positive changes or no changes in their mathematics self-efficacy beliefs. The major subcategory identified under the positive change in the mathematics self-efficacy beliefs category was grades. ‘Grades’ was the code used to describe the high scores students receive on homework, daily assignments, tests, or the state and local assessments and the positive impact such performances had on mathematics self-efficacy. Two subcategories were identified under the no changes in mathematics self-efficacy beliefs category: 1) teacher and 2) grades. ‘Teacher’ was the code used to describe the positive influence of the mathematics teacher on his/her students. The subcategory ‘grades’ was used to classify the scores students receive on homework, daily assignments, tests, or the state and local assessments and the positive or negative impact such performances have on students’ mathematics self-efficacy beliefs.

Research question four, “experiences,” includes the experiences that have impacted middle school students’ attitudes toward mathematics and mathematics self-efficacy beliefs. Analysis of the data revealed that middle school students who participated in this study expressed either positive or negative experiences. Three subcategories were identified under the positive category: 1) content, 2) hands-on activities, and 3) high grades. ‘Content’ was the code used to describe specific mathematics topics that students are interested in, such as geometry and the Pythagorean Theorem; ‘hands-on activities’ was the code used to describe the positive impact of hands-on activities and games for conceptual understanding, as well as the use of technology and manipulatives to reinforce a mathematics concept; and ‘high grades’ was used to classify the positive impact of students' successful experiences with high scores on mathematics assignments and state and local assessments. The following subcategories were identified under the negative category: 1) low grades, 2) confusion/distress, 3) lack of hands-on activities, and 4) homework. 'Low grades' was the code used to describe the negative impact of students' unsuccessful experiences with low scores on mathematics assignments and state and local assessments; 'confusion/distress' was the code used to represent the students' feelings of uncertainty and misunderstanding of a particular mathematics concept; 'lack of hands-on activities' refer to the negative impact of the lack of hands-on activities, games, projects, technology, and manipulatives; 'homework' was the code that describes the negative impact of take-home assignments as well as unfinished in-class assignments.

Research question five refers to the "relationship" between attitudes toward mathematics and mathematics self-efficacy beliefs. The researcher first compared the answers on the short-answer questionnaire and the responses from the one-on-one interviews. Those students who replied 'no' to both questions or 'yes' to both questions "Do you like mathematics?" and "Do you believe you can do mathematics?" and their reasons why or why not were coded separately. The students who replied 'no' to the question "Do you like mathematics?" and 'yes' to the question "Do you believe you can do mathematics?" and their reasons why or why not also were coded. The subcategories that emerged from the coding in this category were: 1) teacher praise/encouragement, 2) grades, and 3) hands-on activities. 'Teacher praise/encouragement' was the code used to describe the positive comments and support from the mathematics teacher to the student. 'Grades' was used to classify both the positive and negative impact of students' successful and unsuccessful experiences with scores on mathematics assignments and state and local assessments. 'Hands-on activities' was the code used to refer to the activities, games, and projects that students participate in the mathematics classroom that support high mathematics self-efficacy beliefs. Mathematics self-efficacy beliefs can either support or inhibit attitudes toward mathematics. There is evidence that some students have high mathematics self-efficacy beliefs and some students have low mathematics self-efficacy beliefs. There also is evidence that teachers try to support mathematics self-efficacy beliefs while some student-to-student interactions support mathematics self-efficacy beliefs and others inhibit mathematics self-efficacy beliefs.

The voices of the middle school students are included in the discussion of the categories and themes in the next section, which are divided by research question.

Research Question #1 (attitude toward mathematics)

For this study, attitude toward mathematics was defined as a person's manner, disposition, or feeling with regard to mathematics. Two hundred seventy-three middle school students completed a short-answer questionnaire, 61 sixth, seventh, and eighth grade students were observed in three mathematics classrooms over a five-week period, and 18 students were interviewed. Over half (53%) of the students like mathematics, as reported on the short-answer questionnaire; under half (44%) of the students interviewed said they like mathematics, yet observational data did not always support this high level of enthusiasm for mathematics. The following includes the data from each of the three sources.

Short-Answer Questionnaire Data

Fifty-three percent of the students who completed the short-answer questionnaire answered "yes, I like mathematics." Some students clarified their response by adding, "Yes, Mrs. A. makes it easy to understand" and "Yes, but I stink at it." These responses were combined into the subcategory of "positive."

Twenty-seven percent of the student responses were placed into the subcategory "it depends." Forty-three stated "somewhat," "kind of," or "sort of" and 27 replied "sometimes" and when asked to fill in the blank to the question "Do you like mathematics?" Four students said "it depends," and continued by saying "if I understand it," "it depends on the teacher," and "it depends on the topic." These responses were combined into a subcategory of "it depends."

Twenty percent of the students who completed the short-answer questionnaire answered that they did not like mathematics. Fifty-five middle school students answered an emphatic "no" or "not really" when asked, "Do you like mathematics?" These responses combined into the subcategory of "negative." Table 4-2 gives the number of students and their categorized responses to "Do you like mathematics?"

Table 4-2: Number of students responding to the question "Do you like mathematics?"

Do you like mathematics?	Number of students responding
Positive	144
It depends	74
Negative	55
TOTAL	**273**

Question number four on the short-answer questionnaire, "When I think of mathematics, I feel…" generated two subcategories, 1) negative thoughts and 2) positive thoughts. The two subcategories were evenly split. One hundred thirty-seven student comments were in the negative subcategory, while 136 student comments were positive.

For the 137 students whose comments fell into the negative subcategory, the researcher subdivided those comments into disinterested, discouraged, and distressed. Fifty-six students' responses were placed into the "disinterested" category. The majority said, "When I think of mathematics, I feel bored." A few students responded that they were "worried about more homework." Twenty-five students feel discouraged about mathematics. They feel "frustrated," "confused," "helpless," dumb," "depressed," "sick," "sad," and "not good." Some students are distressed about mathematics. Twenty-six students feel "stressed," "scared," "nervous," "the 'oh no' moment." Twenty-seven students left this question blank, while three students said "I don't know" or filled in the blank with a question mark. The researcher interpreted this lack of response to a negative feeling toward mathematics.

One hundred thirty-six students responded positively to the statement, "When I think of mathematics, I feel…" The most common response (46 students) was "smart," "happy," "excited." Others wrote "challenged," "organized," "like I have room to learn, and I like it," and "it's my favorite subject."

The researcher divided the responses for question number six on the short-answer questionnaire "I feel mathematics is…" into the following: 1) positive feelings and 2) negative feelings. The majority (190 or 70%) of the middle school students reported positive feelings about mathematics. These students feel mathematics is "challenging," "fun," "easy," "important," and "useful." Seventy-three (27%) students reported negative feelings about mathematics, and ten students (3%) left this question blank. The subcategory 'negative feelings' was subdivided into: irrelevant, difficult, and disinterested.

Responses from the students who do not like mathematics were examined separately. Forty-nine (40%) of these middle school students who said they did not like mathematics the earlier question did report positive feelings about mathematics when completing the open-ended statement, "I feel mathematics is…"; but, 73 (60%) did not. Fifteen (12%) students who expressed negative feelings stated that mathematics is irrelevant, 37 (30%) said that mathematics is hard and difficult to learn, and 21 (17%) students expressed disinterest in mathematics. The irrelevant subcategory included comments such as “somewhat useless,” “no point,” and “overdone.” The majority of the comments in the difficult subcategory were “hard,” “complicating,” and “hard for me learn.” Students’ comments placed in the disinterested subcategory included “boring” and “dull.”

In response to question number eight, “My favorite part of mathematics is…” resulted in the following subcategories: 1) content-related, 2) knowledge, 3) hands-on activities, and 4) teacher strategies. The majority of the students (51%) responded that their favorite part of mathematics was coded ‘content-related,’ such as graphs, probability, order of operations, and the Pythagorean Theorem. The ‘knowledge’ subcategory includes 47 student responses (25%) whose favorite part of mathematics is “learning something new” or “figuring out something new.” The students (19%) who responded “math games,” “activities,” and “working together” were coded ‘hands-on activities.’ Ten students (5%) responded “going to the board” and “making bookmarks.” These responses were used to classify the ‘teacher strategies’ subcategory.

The categories given for question number nine, “My least favorite part of mathematics is…” were: 1) homework, 2) content-related topics, 3) not understanding, and 4) the classroom environment. The majority of the students (117 or 55%) said that ‘homework’ was their least favorite part of mathematics. This response was approximately the same across all grade levels (sixth grade, 40%; seventh grade, 46%, and eighth grade, 43%). Certain ‘content-related topics’ (36%) also emerged as one of the students’ least favorite parts of mathematics. Examples of least favorite content-related topics included: fractions, long division, and order of operations. Thirteen students (6%) responded that their least favorite part of mathematics was “when I don’t get it,” “that I don’t understand things quickly,” “feeling confused,” and “when I don’t understand it." These responses were classified as 'not understanding.' Five students (2%) said that their least favorite part of mathematics was the 'classroom environment.' These responses included "when we can't talk," or "taking notes," or "boardwork."

Thirteen students completed the sentence "My favorite part of mathematics is…" with "nothing" or "getting it finished." Nine students said their least favorite part of mathematics is "everything." These responses indicate a very negative attitude toward mathematics. Seventeen students said "nothing" or "I don't know" to the short-answer response "My least favorite part of mathematics is…" This indicates a very positive attitude toward mathematics.

Observational Data

The researcher also observed nonverbal behaviors and physical behavior and gestures in order to determine middle school students' attitude toward mathematics. The researcher first watched for engagement in class, body language, enjoyment, and enthusiasm levels. The majority of students were engaged in class part of the time, although some students were not engaged. In every class period observed, students were unengaged in class when given seat work, and many naked number problems. When students were allowed to work at the chalkboard, play games, or construct angles, they were interested and enthusiastic about mathematics. The researcher watched body language for engagement in class and enthusiasm levels.

The subcategories that emerged from the classroom observations were: 1) engagement in class, 2) enjoyment, and 3) enthusiasm levels. 'Engagement in class' was defined as participation, such as those students who were involved in the mathematics assignment, activity, or game. 'Enjoyment in class' was recognized when students smiled, laughed, and exhibited an overall attitude of satisfaction. 'Enthusiasm levels' were related to excitement and interest in class. The results of the classroom observations related to attitudes toward mathematics were positive attitudes, negative attitudes, and mixed attitudes.

A characteristic noted in all subcategories was body language, characterized by body posture, gestures, facial expressions, and eye movements. Body language in all observed classes was difficult to discern. The researcher wondered if the students' body language related to mathematics, or to being a middle school child.

The majority of seventh and eighth grade students appeared to be engaged in class most of the time, although some students were not engaged. During the seventh grade tessellations activity, all students were engaged in drawing and coloring their tessellation; and all seventh grade students were engaged in the assignment that included plotting points on a coordinate graph. Although a few students were frequently off task, they were asking each other questions and offering help to partners. One day, Sean, an eighth grade boy, was practically lying on his desk during work time, punching random numbers into his calculator. Many students gave the impression of engagement, although the researcher noticed that they would frequently stare into space, marking on the assignment sheet to divide up the 30 linear equations before solving.

Most of the sixth grade students appeared to be the least engaged, although some students in all three grade levels showed signed of disengagement. Tanner, a sixth-grade boy, did whatever he could to avoid the order of operations assignment. He did not have paper, so the teacher gave him paper; he needed a pencil, so the teacher gave him a pencil. Tanner would repeat the expression to the teacher as part of his question. He would stare into space, giving others the impression that he was thinking. The researcher also observed the sixth-grade class on a day they were taking a short quiz. Tanner seemed as if he was not listening while the teacher was doing a short review of order of operations and exponents. Five minutes into the quiz, he still had not started. After ten minutes, he asked the teacher a question. His cheeks were very red; he appeared to be lost and not know what to do. Tanner gave the impression that he knows what to do, but the researcher was questioning his skills.

‘Lack of engagement’ was often observed. The following examples represent many students in all three observed classrooms. Tanner (6^{th} grade boy) typically sat slumped in his chair, playing with his pen. It was evident that he was not listening to instruction. Juan, an eighth grade boy, continually compared himself to the girls that sat around him. One day, he was slapping his face when he noticed that Sarah was on question number 11 when he was on number four. Juan then continued to work on the assignment, but was constantly looking at Sarah’s work, still comparing himself to Sarah.

The enjoyment subcategory included smiles, laughs, and positive comments from the students. The researcher noted that when students were playing games, doing a hands-on activity such as constructions with a compass and straightedge, all students were actively engaged and demonstrating signs of enjoyment. For example, when the sixth grade students were engaged in a probability activity, there were smiles and laughter. When the seventh grade students were playing the Battleship game as a follow-up to plotting points on a coordinate plane, all students were engaged and laughing and smiling during class. Emily and Leann were playing Battleship when Emily hit Leann’s ship. Emily said, “I sunk it, already? I am good this!” Leann then hits one of Emily’s battleships and says, “I’m good at this game.” When the eighth grade students were bisecting an angle and constructing parallel lines, all students were engaged and smiling. Lucy commented, “This is so much better than doing math!”

An example of ‘lack of enjoyment’ is Shelton. The seventh grade teacher asked the class for ideas or strategies to solve 1/8 of 640. Shelton told his strategy; “multiply the fractions.”

The teacher said "okay" and then asked for another strategy. Zach said, "Set up a proportion." The teacher wrote Zach's strategy on the board and then solved the problem, but did not mention Shelton's strategy. Shelton looked down at the floor, no expression on his face, but a hurt look in his eyes, which the researcher assumed was a negative reaction to perceived poor performance. Elena, an eighth grade girl, answered incorrectly to a "combining like terms" problem. As the teacher was explaining to Elena how to work the problem, her head was low. It was evident that she was not enjoying this moment. When Alicia, a sixth grade girl, was given the expression 2^3 to solve, she answered 6. She immediately rolled her eyes, and acted embarrassed. The teacher then gave her positive feedback as she helped her see her mistake.

Another example of lack of enjoyment is Jacob. Sixth-grade Jacob never participated in class. The teacher said that Jacob is very shy. During every observed lesson, the researcher noticed that the teacher would call on Jacob, trying to get him to contribute to the discussion or answer a question. He would usually just shrug his shoulders, although occasionally he would speak out.

Enthusiasm levels were high when students were actively engaged in the class discussion or playing a game. The sixth grade class played Jeopardy as a review. Students were clapping for each other, giving each other high-fives. The three teams of students were supporting each other and encouraging each other as the game progressed. When Tanner answered a question correctly, he bopped his head. It was evident that he was proud of himself. Keith commented, "This is the funnest thing we could do in math, ever. I'm serious… it's old school gaming!" This sixth grade class also played The Product Game, the class versus the teacher. They worked together on strategies to block the teacher. There were smiles and laughter this day, and Matthew said, "This is the easiest game ever." The seventh grade class was involved in a Water

Park activity in which they were to plan a trip to a water park. Part of the assignment was to research water parks and the cost for a family of five. Enthusiasm was high when the students were designing their families, using Mii characters from the internet.

Enthusiasm levels were low when students were given naked number problems. Julianna, a sixth grader student, said, “I had no clue how to do number eight.” After the teacher explained to Julianna how to the order of operations expression, Julianna then said, “I don’t care why I got it wrong.” Another sixth grade student, Arthur, asked the teacher about the answer to a problem. She asked him a question in her response, “Do you think it is right?” He then said, “I’m sure it is not. This is stupid.” Another time, when the teacher gave the class the expression $7m$, when $m = 4$, several students responded 74. The teacher then calmly explained that the students were supposed to multiply. Jimmy said, “That’s stupid. They should put a times sign.” In the eighth grade class, while combining like terms, Adam was frequently heard saying, “I hate this” and Trey said, “I might be wrong, but oh well…” Mark and Brad were both heard saying, “This is boring.” Juan solved $-2x > 6$ incorrectly. When Samantha told him he was wrong, he just replied, “Why should I care?”

Lack of engagement, enjoyment and enthusiasm was seen when the kinds of problems given to the students were naked number problems, with no context or real-life connection, students were seen yawning or rolling their eyes. Several students would work quietly, but with what appeared to be bored looks on their faces.

Interview Data

One-on-one interviews also were conducted with 18 middle school students to determine middle school students’ attitude toward mathematics; therefore the researcher asked questions such as “Do you like mathematics?” and “What is your favorite/least favorite subject in school?”

and if they knew anyone who liked or disliked mathematics. The researcher asked other questions related to attitudes toward mathematics such as “Is there something that you have really liked in mathematics this year?” and “Is there something that you have really disliked in mathematics this year?” The researcher placed interview data into the following categories: like mathematics, dislike mathematics, favorite subject mathematics, and least favorite subject mathematics.

Five out of the 18 students interviewed said their least favorite subject in school is mathematics. Student responses in the “dislike mathematics” were placed into the following subcategories: 1) frustration and 2) homework. ‘Frustration’ was a subcategory used to represent students’ confusion and feelings of failure. ‘Homework’ was defined as take-home assignments, as well as unfinished class assignments that students identified as disliking.

Three of the five students who said mathematics was their least favorite subject in school identified the reason as frustration. Alicia said, “I get frustrated with certain problems and don’t want to finish them.” According to Darla, “It’s confusing a lot of the time.” The explanation given by two students was homework. Monica feels that she “is not good at it.” When asked why, Monica replied, “It just takes me a really long time to understand. Like, what Mrs. W says once, everyone else gets it. But she may have to say it to me 20 or 30 times before it registers.”

Two of the five students who said mathematics was their least favorite subject in school identified homework as the reason. Penny’s least favorite subject in school is mathematics, “because of all the homework we get. It’s not hard, but it takes so much time to do… all the steps.” Penny went on to say, “Sometimes I feel that you need to do that stuff, but sometimes, when you are so tired and have to do the homework, it’s like ‘I hate math’ and everything like that." Robert confirmed Penny's sentiments by saying, "In math, you always get a lot of homework. And it's complicated."

Four out of the 18 students interviewed said their favorite subject in school is mathematics. Student responses in the "likes mathematics" category were placed into the following subcategories: 1) teacher 2) high mathematics self-efficacy beliefs. The 'teacher' refers to the positive influence of the mathematics teacher, and 'high mathematics self-efficacy beliefs' were characterized as a student's belief that he/she can do mathematics.

Eighth grade girls, Sophie and Kathryn, commented on the role of the teacher as to why mathematics is their favorite subject in school. Sophie said, "Mrs. W makes math fun and easy." Kathryn echoed these comments by saying, "Because Mrs. W makes it really easy." Mathematics is the favorite class of sixth grade girls Bethany and Suzie. They both attributed this to their high mathematics self-efficacy beliefs. According to Bethany, "I just know how to do a lot of the stuff." Suzie said, "I'm just good at it."

When asked "Is there something that you have really liked in mathematics this year?" the majority of the students gave an example of a game, a project, a hands-on activity, or something they were good at. Monica really liked drawing the squares for the Pythagorean Theorem. She said, "I got that really fast. It was easy." Jerry mentioned "all the projects" in which he expanded a cartoon and the tessellations. Bella also talked about the cartoons. Two eighth grade girls, Elizabeth and Darla really like the probability activities. They both commented on the games with the pigs. Darla said, "We did a lot of fun activities with it" and Elizabeth said they "came up with six different ways the pig could land." Two students identified the teacher as what they really liked in mathematics this year.

Students' responses to the question "Is there something that you really disliked in mathematics this year?" prompted answers that the researcher considered in both the attitude and self-efficacy beliefs categories. Students felt unsuccessful, distressed, and disinterested. Sybil felt unsuccessful at division; "I'm just not good at division." And Bridget replied, "Homework is the worst part. Sometimes, when you go home and totally forget how to do it, you were like, didn't know what to do." The majority of the students expressed distress. Bethany didn't like angles and triangles and continued, "I didn't understand exactly how to do them." Bella "didn't understand the n^{th} term." Ron said, "Sales tax gets confusing at times" and Monica said, "Everything is just really difficult." A few of the students expressed a disinterest in mathematics. Peter, Elizabeth, and Darla said that mathematics was "boring," or "not fun."

When asked how you feel about mathematics, Suzie and Sybil both said they like math. Suzie went on to say, "It comes to me easily." Jerry, David, and Bethany all said they feel good about mathematics "because I like learning something new." One sixth grade girl and two eighth grade girls feel happy about mathematics and related that to the teacher. Bethany attributed her feelings to a small class, "so it is easy to do stuff." Kathryn and Sophie both said that the teacher makes it "fun and easier to learn."

Four students said that mathematics is their favorite subject in school. Sophie and Kelsey said that the teacher makes it fun and easy, while Suzie and Bethany demonstrated high mathematics self-efficacy beliefs because they said, "I know how to do the stuff," and "I'm just good at it." Elizabeth said that her least favorite subject in school is usually mathematics, but "this year it has been easy for me." When asked why, Elizabeth said, "I just like how Mrs. W teaches it. The other years that I did math, it would just kind of go in one ear and out the other and I couldn't understand it. When I got home, I wouldn't know how to do it. But this year, I guess it is just how she teaches it. I understand, like, how to do it."

Three students questioned the use of mathematics. Elizabeth said, "I wonder why we have to learn some things… like we are never going to use it." Darla also had those same feelings. She said, "Some of things we have to learn, it's like we are never going to have to use them in our lifetime." But Kevin felt that mathematics is "needed for everything" as he talked about the usefulness of mathematics to a carpenter. Four students fell into the category of disinterest when asked how they feel about mathematics. Three students, one seventh grader and two eighth graders, said they feel bored. Darla commented, "Most of the time, I am bored." Ron and Peter both said they felt mathematics is "hard, and boring." Bella, a seventh grade girl, said that she "really doesn't like doing it. It's just not fun."

Students also were asked if they knew anyone who loves mathematics or hates mathematics. These two categories generated the following responses. Thirteen students said they know someone who loves mathematics, with three students mentioning the mathematics teachers. Juan said, "Well, they teach it. So they must like it." Four students know family members who love mathematics. According to Bella, "my twin brother loves math. But he is good at it." Five students said they did not know anyone who loves mathematics. Bethany said, "Other than me, no." Suzie said, "Besides me, not really," while Darla stated, "not my friends."

The majority (14 or 78%) of the students interviewed said that they know someone who hates mathematics. Three students have family members who hate mathematics, and seven students said their friends hate mathematics. Darla said, "A lot of my friends don't like math. It's hard and they just don't like it."

Figure 4-1 summarizes the findings in this area.

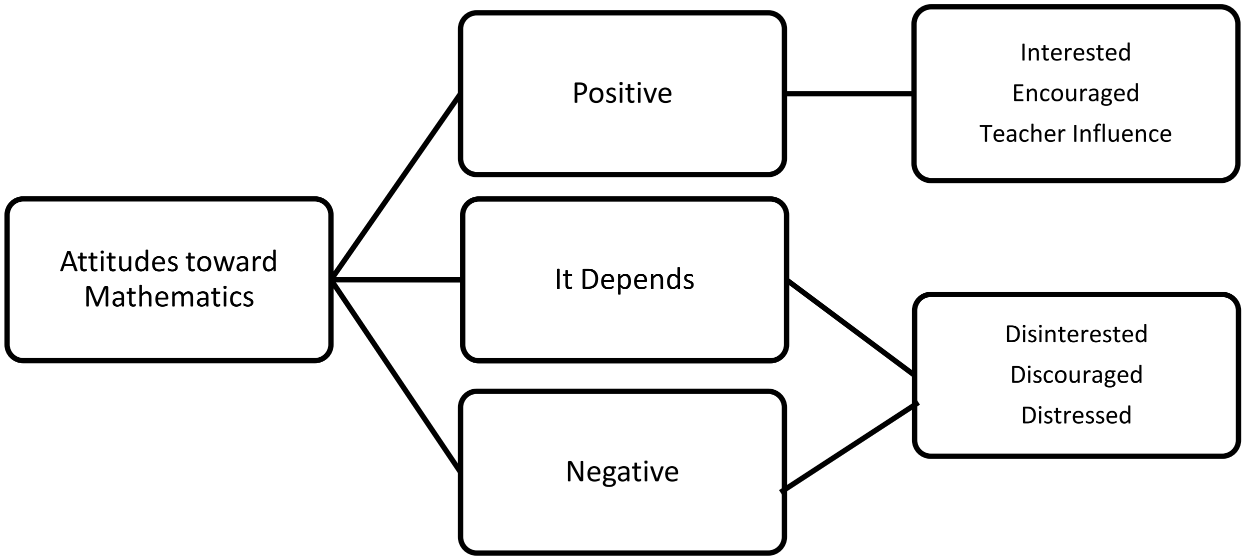

Figure 4-1: Attitudes toward Mathematics Categories and Subcategories

Research Question #2 (mathematics self-efficacy beliefs)

For this study, mathematics self-efficacy beliefs were defined as “the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (Bandura, 1995, p. 2). Data was gathered from 273 middle school students who completed a short-answer questionnaire, 61 sixth, seventh, and eighth grade students observed in three mathematics classrooms over a five-week period, and 18 students interviewed. The majority (84%) of the students in this study have high mathematics self-efficacy beliefs, as reported on the short-answer questionnaire. During the classroom observations, 19 (31%) students verbalized their frustrations with statements such as “I can’t do this” or “I am not good at this” while eight (13%) students’ comments were positive, such as “I am smart!” and “I can do it.” Under half (44%) of the students interviewed said they feel successful mathematics and have high mathematics self-efficacy beliefs. The following includes the data from each of the three sources.

Short-answer Questionnaire Data

"Do you believe you can do mathematics?" was question three on the short-answer questionnaire. This question produced three categories: 1) positive, 2) negative, and 3) it depends. The majority (209 or 84%) of the students believes that they can do mathematics, and replied "yes" or "of course." Forty-five students (16%) said "maybe," "it depends," and "kind of," and "a little bit," "if I tried," "with help," and "if I understand it." Thirteen students (5%) replied "no," "not really," and "probably not" to this question.

Table 4-3: Number of students responding to "Do you believe you can do mathematics?"

Do you believe you can do mathematics?	**Number of students responding**
Positive	219
It depends	45
Negative	13
TOTAL	**277**

The categories for question five, "I believe I … in mathematics this year" generated four categories: 1) successful, 2) unsuccessful, 3) did my best, and 4) improved. The majority of the students (160 or 62%) replied with successful comments, such as "did good," "did really well," "succeeded." Twenty students (8%) believe that were unsuccessful in mathematics this year by filling in the blank with words such as "bad," "failed," "did terrible," "didn't understand some things," and "am struggling." Thirteen (5%) students believe they "did my best," or "tried my best." Responses in the improved category included "improved," "learned," "am getting better," and "did better than last year." These responses came from 67 (26%) of the students who completed the questionnaire.

Students were asked to fill in the blank to "Mathematics homework is…" on item number seven. The responses were categorized into easy/okay, difficult, time-consuming, and disinterested. Ninety-three students (35%) believe that homework is “easy,” “fun to do,” and “okay most of the time,” while 69 (26%) of the students believe that homework is difficult and used the word “hard” when describing homework. Twenty-five percent (67) of the students said that homework is time-consuming and used words such as “too much,” “long,” and “a waste of time.” Student responses (38 or 14%) in the disinterested category included “boring” and “not fun.”

Classroom Observation Data

The researcher also noted student behavior and interactions and verbal frustrations during classroom observations in order to determine middle school students’ mathematics self-efficacy beliefs and to document interactions that might promote or inhibit mathematics self-efficacy beliefs. The researcher identified the following subcategories from observational data related to self-efficacy beliefs: 1) verbal frustrations, 2) positive teacher praise and encouragement, and 3) positive or negative student-to-student comments.

There were many verbal frustrations heard from students in all three grade levels representing low mathematics self-efficacy beliefs. When working with tangrams, Tyler, a sixth grade boy, struggled with putting the pieces back together. He said, “Darn it! I thought I had it figured out. Now I don’t.” Most of the other students in this class made similar comments and also said, “This is going to be hard.” During other activities, such as the Jeopardy review game, Kyler, a sixth grade student, shouted “Whatever” when told his answer to 40^2 was incorrect. After grading an assignment on order of operations, Kyler said, “I stink at these.” The teacher was very calm in her response. But Kyler continued, “I don’t care. I can’t do it.” When the teacher suggested that Kyler show his work, he shouted, “I don’t know how to show my work.”

Other verbal frustrations from seventh grade students also indicated low mathematics self-efficacy beliefs. Comments ranged from “I suck at math,” to “This is confusing,” to “I’m not very good at this,” during a variety of mathematics topics including graphing, adding and subtracting integers and non-linear relationships. For all of these topics, the assignments were naked number problems with no real-life context attached to them. Eighth grade students’ frustrations were “I can’t do this,” “I don’t know how to do this,” and “I can’t.”

Teacher behaviors were observed that the researcher interpreted as supporting students’ mathematics self-efficacy beliefs. All teachers were encouraging to their students, although the eighth grade teacher’s praise was most obvious. She was constantly giving a “thumbs up” to students when they asked for feedback, or shoulder pats to students who were working. Henry was working on his geometric construction and said that he wanted to draw it again because he wanted to remember how to do it. The special education teacher responded, “You are so meticulous. When you were in my room after school, I remember how precise you were.” The regular teacher said, “I see an architect.” She then went to her desk, got her expensive set of compasses (a gift from her parents), and showed them to Henry. She suggested that he invest in a nice set of compasses. The eighth grade teacher also gave individual praise to students, such as “I love watching you guys think!” and “I love how you check your work” and “You have done amazingly well” and “Blake, this is the best so far.” She was also heard saying to students, “This is awesome!” and “I am so proud” when they got correct answers on the homework assignment.

The sixth grade teacher also gave her students a lot of encouragement which the researcher interpreted as supporting students’ mathematics self-efficacy beliefs. She was soft-spoken and calm, and would often say, “I see where you are coming from” or “That is a very common mistake. I’m glad you said that” when a student would give an incorrect answer. As the sixth grade class was cutting apart and then reassembling their tangrams, the teacher gave lots of hints and encouragement. The students seemed very comfortable asking the teacher questions.

The researcher observed students encouraging and supporting each other which she interpreted as supporting mathematics self-efficacy beliefs. Jacob, the very shy and quiet sixth grade boy, answered a question correctly while playing the Jeopardy game. The other students clapped for him, one student said, “Wow” and the teacher said, “Good job.” The entire class would clap and cheer for each other when a question was answered correctly. When a question was answered incorrectly, the students were still supportive by saying, “That’s okay,” and “Maybe next time.” Encouragement and support in the seventh grade observed classroom was mostly heard while students were plotting points on a coordinate plane. Students were most supportive of each other during the lesson on non-linear equations. This appeared to be a difficult topic for this class, but they seemed to be very comfortable asking questions to others in the group. Although some students in the eighth grade classroom did not interact with their group, most groups were supportive of each other, giving comments and help when needed.

Positive student-to-student comments also were heard in the three observed classrooms that the researcher interpreted as supporting mathematics self-efficacy beliefs. When Jacob, a very shy sixth grade boy, answered a question correctly, Levi said, “Wow” and the teacher said, “good job.” Jacob bowed his head, smiling. During the seventh grade Battleship game activity, many students were heard saying, “I sunk it already? I am good at this!” and “I am good at this game.”

Negative student-to-student comments were also heard in the observed classrooms that the researcher interpreted as inhibiting mathematics self-efficacy beliefs. The researcher observed sixth grade students playing The Product Game. When Bethany won, several students said, “she cheated” instead of acknowledging that she knew the strategies to win. A sixth grade lesson on exponents was observed. When Abbie said, “I don’t get this.” Chloe then said, “This is easy.” Abbie did not reply, but appeared to be frustrated and seemed to want more explanation. Seventh grade students were frequently observed comparing grades. Wesley, a seventh grade boy, asked Zoe what her grade point average was. Zoe responded, “It’s a 4.0. I beat you!” Wesley said, “I know. I suck at math.” When Kenneth, an eighth grade boy, answered incorrectly to 9 + 7, Liz said “Stupid! Use your calculator.” and Amelia said “Use your brain.”

Interview Data

During the one-on-one interviews, the researcher asked students questions related to their feelings of success in mathematics, and if they remembered a time when they did feel successful and what they were doing when they did feel successful. Students were also asked how they felt about mathematics, and how they felt when they study/learn mathematics. The researcher first separated the responses into the following subcategories: 1) unsuccessful and 2) successful. Student comments classified as ‘unsuccessful in mathematics’ were subdivided into ‘feelings of distress’ and ‘poor grades.’ Students who feel unsuccessful in mathematics are distressed and attribute their low ability to poor grades. Students comments classified as ‘successful in mathematics’ were subdivided into ‘teacher related’ and ‘grade related.’ Students who feel successful in mathematics attributed that success to the teacher or the good grades they receive.

The majority (11 or 61%) of the students interviewed felt unsuccessful in mathematics and had feelings of distress. These students used words like “confused,” “angry,” “afraid,” and “frustrated.” Sybil, a sixth grade girl, said, “Sometimes I get angry about it because I don’t get that one thing. But sometimes I feel like 'thank you God, because it is my life." Two seventh grade students said they feel confused or frustrated. Alicia said, "Depending on the type of subject in math, it gets really confusing," and went on to say that "story problems, with a lot of information" is what makes mathematics frustrating. Peter's comments were, "That I'm learning it, but I'm not at the same time. I'm taking in some of it, but not getting all of it." Six eighth grade students feel confused, afraid, or frustrated. Sophie feels like she is "scared to mess up" but then went on to say that the teacher makes her feel like "it is fine to mess up, and then she helps you correct it." Monica commented, "It feels like it is the only thing that is keeping me from being a better student." She went on to say, "At the beginning I feel frustrated, and I just feel really really confused." Penny attributed her feelings about mathematics to the confusion about studying for mathematics tests and not knowing what to study. Three eighth grade students commented about homework and feelings of frustration. Juan and Bridget both are frustrated with the amount of homework they are required to do, and Bridget and Ron believe that homework is hard and frustrating.

One student felt unsuccessful in mathematics and related those unsuccessful feelings to grades. Monica feels unsuccessful in mathematics, and when asked why not, she replied, "Because even when I try my hardest, and even when I think I have it, I will take a test and feel confident. And then I get my grade back, and then it's not what I thought it would be." The time that Monica did feel successful in mathematics was when she was "doing the questions faster and it was just coming easier."

Fifty-six percent of the students feel successful in mathematics. Five students attribute their feelings of success in mathematics to the teacher. Kevin said that he feels successful "whenever a teacher tells me I've done a good job in something." Juan said he feels successful in mathematics because his teachers tell him that he is “really good at it.” Sophie, Kathryn, and Elizabeth all made comments about Mrs. W. and the way she teaches. They all said that she “makes sure that you understand” and that “she doesn’t get mad at you.” Sophie commented, “She makes it easier to understand. If you don’t get it, she goes over it more and makes sure that you understand it.”

Seven other students related their success in mathematics to grades, either now or remembering a time when they could be successful in mathematics. Sybil said, “when I get A’s.” Suzie said, “because I have a good grade.” Darla said, “I have an A this year. All other years I’ve had a B-.” Penny said, “I get good grades in math,” and Bethany said she felt successful in mathematics “because I usually get an A in there always.” David also said that he “gets pretty good grades on assignments,” and Bridget said that she is “succeeding because I am getting good grades, and not failing tests and stuff.”

Jerry said that he feels successful when “I do good on a test. But when I don’t do as good, then I don’t feel successful.” When asked if he remembered a time when he did feel successful in mathematics, Jerry said “not really.” Alicia also could not remember a time when she felt successful in mathematics, and said “I get frustrated with some problems.” Bella related her success in mathematics to the state assessments and the Measure of Academic Progress (MAP) testing. She said, “Last year on the MAP test and the assessments, and even this year on the assessments, I did good. So that made me feel good.”

Ron, a special education student, attributes his success in mathematics to moving into a “regular class” although he did not feel successful in previous years. He spoke about his low scores on the state assessment. “Well, last year I did kind of bad in the state assessments and stuff. So that's why they put me in Math Seminar," said Ron. Therefore, Ron did not feel successful "last year" but does feel successful this year.

Peter related his successfulness in mathematics to his attitude toward mathematics. "I feel like I've done good this year, but I could have done better probably." When asked why, Peter replied, "I just kind of got out of it."

Figure 4-2 summarizes the findings in this area.

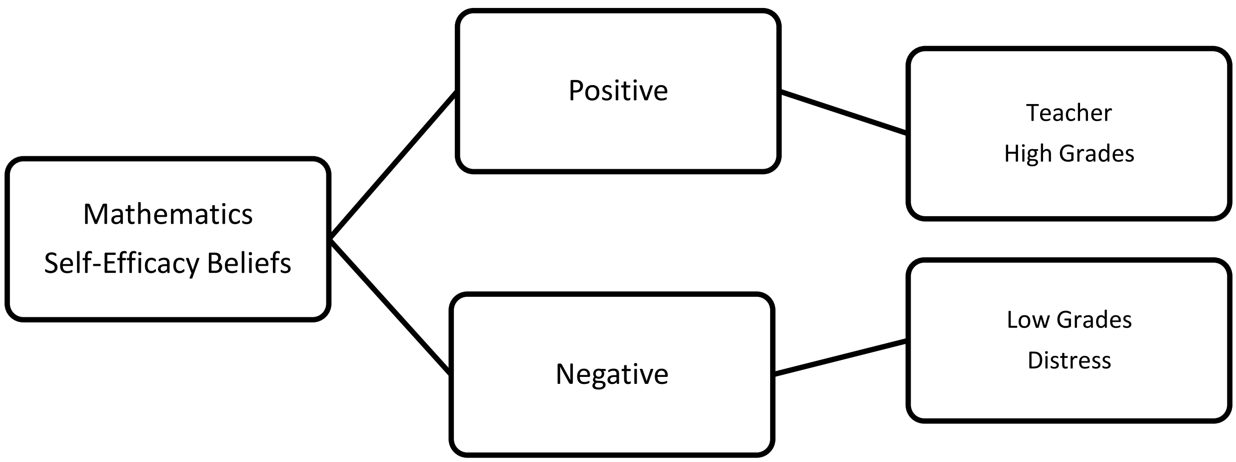

Figure 4-2: Mathematics Self-Efficacy Beliefs Categories and Subcategories

Research Question #3 (change across time)

For this study, change across time is defined as the differences in attitudes toward mathematics and mathematics self-efficacy beliefs students perceive from elementary school to middle school. Eighteen middle school students were interviewed. Sixth, seventh, and eighth grade students were encouraged to reflect on if and when their attitudes toward mathematics changed and what impacted those changes and if and when their self-efficacy beliefs changed and what impacted those changes. Under half (44%) of the students interviewed said there have been positive changes in their attitude toward mathematics, twenty-eight percent said there have been negative changes in their attitude toward mathematics since elementary school, and twenty-eight percent reported no change in their attitudes toward mathematics. Over half (56%) of the students interviewed indicated no change in their mathematics self-efficacy beliefs, while under half (44%) of the students interviewed indicated a positive change in their mathematics self-efficacy beliefs. The following section describes the categories used to represent change in attitudes toward mathematics and mathematics self-efficacy beliefs from the one-on-one interviews.

Interview Data

When students were asked if there was anything different about mathematics last year compared to this year or if they believe their attitude toward mathematics had changed from elementary school, the following subcategories emerged: 1) positive changes, 2) negative changes, and 3) no change. Of the forty-four percent of the students that indicated a positive change in attitudes toward mathematics, the major subcategory that emerged in the positive changes category was the teacher. The majority (75%) of the students attributed their positive changes in attitude toward mathematics to the mathematics teacher. Two other reasons that students mentioned were grades and the use of mathematics.

Eighth grade students Darla, Bridget, Sophie, and Kathryn all said that the teacher made the difference in their attitude toward mathematics. Darla said that mathematics is different this year, because “Mrs. W teaches it differently.” Bridget also said that Mrs. W teaches differently than previous teachers, and believes that her attitude toward mathematics has changed because “Mrs. W actually takes the time to teach it.” Sophie compared other teachers to Mrs. W by saying other teachers “didn’t go over it as much. She went through things and she spent a lot of time on one thing. But this year, Mrs. W makes it fun.” And Kathryn said that mathematics was harder last year because “Mr. Z was a coach, and he yelled everything he said. So it was hard to understand. But this year, Mrs. W makes it fun.” Seventh grade student Jerry said his attitude toward mathematics has experienced a positive change from elementary school because he doesn’t “think the teachers were getting it out as good as our middle school teachers.” David, a sixth grade student, also echoed these comments when he said, “the teachers that teach here just focus on math instead of teaching all the subjects.”

Elizabeth, an eighth grade girl, related her positive change in attitude toward mathematics. “I used to think math was stupid. But now I know that we will use some of the stuff,” said Elizabeth. Sixth grade girl Bethany said her positive change in attitude toward mathematics was associated with the grades she earns. According to Bethany, “in second grade, I got A’s, B’s and C’s. But now I am getting A’s and B’s.”

Of the twenty-eight percent of the students who indicated a negative change in attitudes toward mathematics, three subcategories were identified related to these changes: 1) homework, 2) lack of hands-on activities, and 3) confusion.

Four students believe that homework is the reason their attitudes toward mathematics have changed to negative. Alicia said the reason she liked mathematics in elementary school but not in middle school is “more stress and more homework.” She continued, “You just run out of time with all the activities. And all the other classes have homework too.” Ron said his attitude toward mathematics has changed, “I kind of dislike it more because you get more homework now. And elementary school was easy.” Bridget and Penny both said that homework is the reason they don’t like mathematics now, although they did last year. Bridget said, “We are getting more homework. You like the teacher, and you like the class, but the homework is kind of hard. And it gets harder over the years.” Penny’s response was similar. “I think it is just because it has gotten a lot harder, and taken a lot more time than we're used to. And we are getting more homework than we're used to," said Penny.

Three students attribute the times they liked mathematics to activities, games, and hands-on experiences, which they believe makes mathematics fun. Peter said, "Last year was pretty fun, because we were always involved in a twist with a game. Mr. M always had rhymes and stuff to help you remember." Kathryn also mentioned graphing and "building things" as the key that made mathematics easier in elementary school. Penny focused on the "graphing and stuff that was a lot of fun."

Sixth grade girl Sybil is confused in mathematics. She believes her attitude toward mathematics has changed from positive to negative since elementary school. "Last year, I got almost everything. This year, I am a little bit lost, a little bit not. So I am kind of struggling with that." Although Monica, an eighth grade girl, believes there is no change in her attitude toward mathematics, she did say that this year was different than last year because "we learned a lot more this year than last year. Last year, every block day our teacher would play games with us. And that sort of took up a big chunk of time. And we only had four or five chapters, and this year, we've had like 20." When asked about the game days, Monica said she liked the game days, but was concerned that she needed more practice.

Three students described no change in their attitudes toward mathematics. They have either never liked mathematics or have always liked mathematics. Bella does not like mathematics, and could not remember a time when she did like mathematics. When asked why, she said "I just don't like to work everything out. And it's just hard. And I just don't understand it very well." Monica felt the same as she said, "I would like it a lot. I mean, I like it when I am understanding it. But in the very beginning when I am learning a new thing, and I don't get it at all, it's frustrating." Monica went on to say that she does not remember a time when she did like mathematics, and related, "It's like the one thing that… like I had a math tutor, someone from the college, outside of school who was helping me and I was still not getting good grades. It's just really hard for me." Suzie said has always liked mathematics "since third grade."

In order to determine whether students' mathematics self-efficacy beliefs have changed over time, students were asked if they felt successful in mathematics or if they could remember a time when they believed they could be successful. From this line of questioning, the following subcategories emerged: 1) no change and 2) positive change. The majority (56%) of the students interviewed reported no change in their mathematics self-efficacy beliefs, although most (7/11 or 63%) of these students ascribed the feelings of successfulness or unsuccessfulness to grades. Under half (44%) of the students interviewed reported positive changes in their mathematics self-efficacy beliefs. Students who did indicate a change in their mathematics self-efficacy beliefs attributed those positive changes to the mathematics teacher and the high grades they receive.

Five students have always felt successful in mathematics, and reported no change in their mathematics self-efficacy beliefs. Sixth grade students Bethany and David reported no change in their mathematics self-efficacy beliefs. Bethany said, "I do good because, like, I usually get an A in there always." David has always had high mathematics self-efficacy beliefs and said, "Usually, I get pretty good grades on assignments." Penny, an eighth grade girl, and Suzie, a sixth grade girl, both attributed their high mathematics self-efficacy beliefs and feelings of success to the grades she earns. Juan, the eighth grade Hispanic boy, has always felt successful, and said, "Because my teachers always used to tell me that I'm really good at it."

Four middle school students do not currently feel successful in mathematics and reported no change in their mathematics self-efficacy beliefs. When asked if she felt successful in mathematics, Bella (7th grade girl) first said, “sometimes,” but after some hesitation said, “not normally.” When asked why, Bella answered, “It’s not my best grade,” although she does feel successful when she “does good on the assessments.” Eighth grade student Monica has never felt successful in mathematics and relates those feelings to grades. According to Monica, “When I think in my head, like… I have this and then I take a test and then I don’t.” Alicia, seventh grade girl, does not currently feel successful in mathematics, and described her frustrations. “Some problems, I get frustrated. Other times I can answer the questions,” said Alicia. Jerry, seventh grade boy, reported no change in his feelings of success in mathematics, but did say, “Like when I do good on a test, I feel successful. But when I don’t do as good, then I don’t feel successful.” When asked if there was a time when he thought he could be successful in mathematics, Jerry replied, “not really.”

Five students attribute positive changes in their mathematics self-efficacy beliefs to the mathematics teacher. Three eighth grade girls, Sophie, Kathryn, and Elizabeth attributed their positive changes in mathematics self-efficacy beliefs to the mathematics teacher. When asked if she feels successful in mathematics, Sophie replied, “much more than in other years.” She continued with comments about the mathematics teacher, and said, “Because she makes it, like easier to understand. If you don’t get it, she goes over it more and makes sure that you understand it.” Kathryn was asked if she feels successful in mathematics, she stated, “I do now. Mrs. W makes sure that you understand. She keeps going over it.” Elizabeth “feels successful with certain things.” When asked if she had always felt successful, she talked about the eighth grade mathematics teacher. “The way she teaches makes it, kind of easy and stuff. And she explains it really well. If you mess up on something, she doesn't get all mad at you, like in your face. She acts like she's mad at you, but she's really not. That's nice," said Elizabeth. One sixth grade boy, Kevin, said, "I would only consider myself successful if someone else were to tell me that." He then thought about the times when he did feel successful, and said, "whenever a teacher tells me I've done a good job in something."

Four students attribute the positive changes in their feelings of success in mathematics to the grades they receive. When asked if she felt successful in mathematics, Darla, an eighth grade girl, said, "this year, yes." When asked about previous years, Darla replied, "Umm… I don't know. I've just done really good this year in math. I've done a lot better this year… I have an A this year… all the other years I've had like a B- in it." Sixth grade girl, Sybil, was asked if she feels successful in mathematics, and she replied, "a little bit." When asked why, she said, "because sometimes I get it and sometimes I don't. But when I get it, I am so happy that I do." Sybil feels happy and most successful in mathematics "when I get A's."

Bridget's responses were in both subcategories; the teacher and grades. She attributed the positive changes in her mathematics self-efficacy beliefs to both the mathematics teacher and the grades she earns. Bridget said, "I think I'm succeeding because I am getting good grades, and not failing the tests and stuff. And I am picking up on what she is teaching us pretty fast." Ron, the eighth grade boy who is a special needs student, said, "Well, last year I did kind of bad in the state assessments and stuff. So that's why they put me in Math Seminar. So probably last year" is when he felt unsuccessful in mathematics.

Figure 4-3 summarizes the findings in this area.

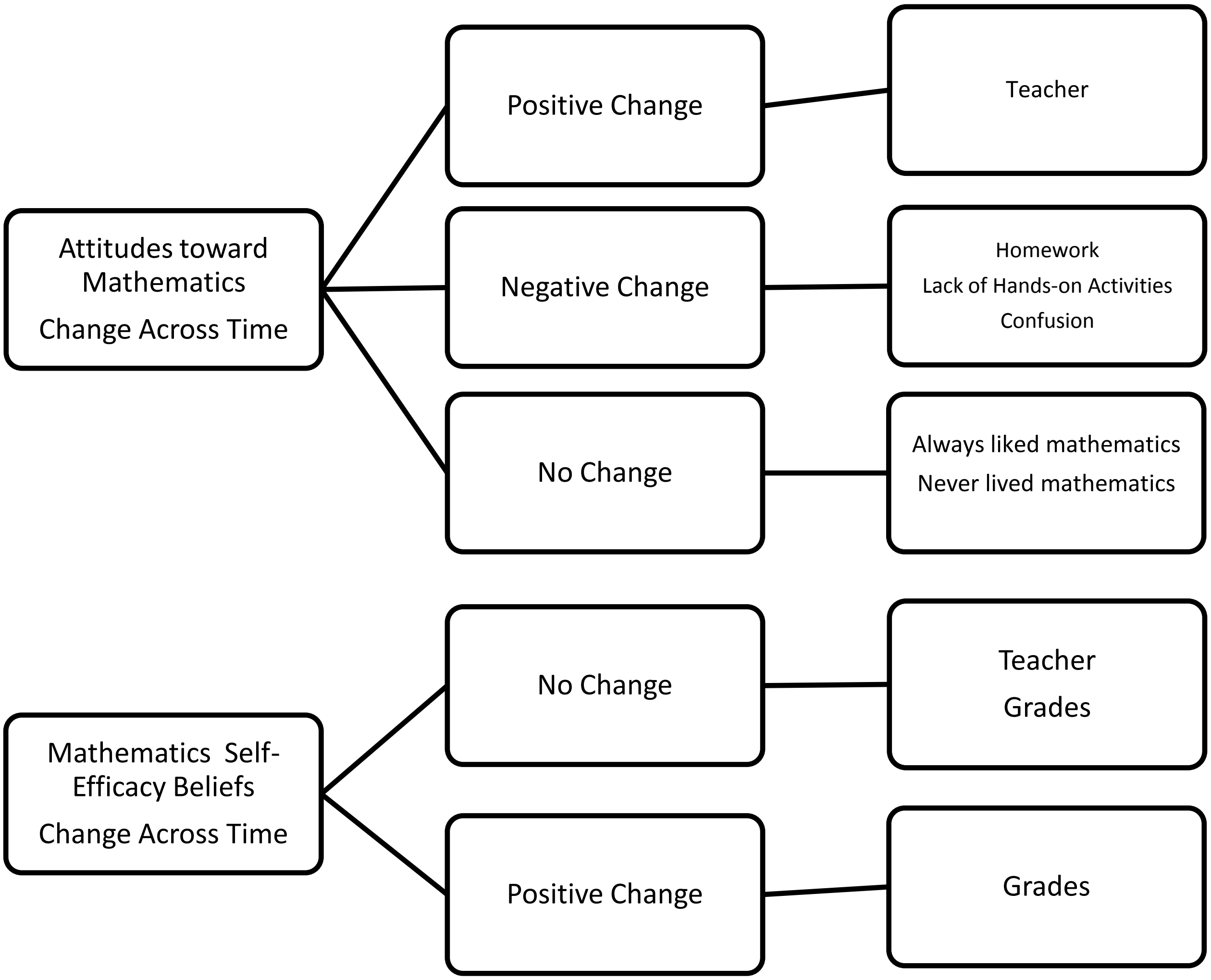

Figure 4-3: Change Across Time Categories and Subcategories

Research Question #4 (experiences)

The experiences that have impacted students' attitudes toward mathematics and mathematics self-efficacy beliefs were the focus for this research question. Sixty-one sixth, seventh, and eighth grade students were observed in three mathematics classrooms over a five-week period, and 18 students were interviewed. Over half (55%) said that homework was their least favorite part of mathematics. Data from classroom observations included the use of technology and manipulatives, the mathematics topic and curriculum, the kinds of problems given to the students, opportunities for students to work together, and the nature of questions the teacher posed.

The following includes the data from two sources: 61 students observed in three mathematics classrooms over a five-week period and 18 one-on-one interviews.

Classroom Observation Data

Sixth, seventh, and eighth grade students were observed over a five-week period. The following narrative describes the typical classroom experiences observed, and then relates these experiences to the observed student behaviors. The subcategory that emerged from the observational data was activities (includes use of technology, manipulatives, and hands-on activities). 'Activities' was the code used to describe the positive impact in the use of technology, manipulatives, and hands-on activities observed in the middle school classrooms, or the negative impact of limited use of hands-on activities, games, and projects. Technology includes electronic and digital media, such as computers and calculators. Manipulatives are the objects students use that aid in the understanding of mathematics concepts. Hands-on activities are activities, games, and projects used in the mathematics classroom.

Both the sixth and seventh grade teachers incorporated online technologies into their instruction, such as the Product Game, Rags to Riches, Jeopardy, and teacher-made Moodle websites. No use of manipulatives to teach or reinforce a mathematics concept was observed in the sixth or seventh grade classrooms. The eighth grade teacher taught students to use a straight edge and compass for a constructions activity, but other observed activities were all naked number problems (problems with no context or connection to real life). All teachers had scientific calculators available for student use, as well as a classroom set of laptop computers for students to use. During the observation period, students used calculators for basic computation. When students were playing an online game, the researcher observed interested students. When no use of manipulatives were observed, the researcher observed disinterested students.

Prentice-Hall Courses 1, 2, 3, is the adopted textbook series for the middle school. The seventh-grade teacher used this textbook almost exclusively to guide all of her lessons, while the sixth grade teacher occasionally used worksheets from this textbook. The eighth grade teacher did not use the textbook at all during the observation period. She used teacher-made worksheets. During this time, the students were disinterested in mathematics.

Mathematics topics were aligned with the Kansas Curricular Standards for Mathematics for each grade level. Sixth grade students explored topics such as exponents, square roots, and factors and products. Seventh grade topics included plotting points on a coordinate plane, and adding and subtracting integers. The eighth grade students focused on geometric constructions, as well as algebraic calculations using the distributive property.

As previously noted, the researcher observed when the kinds of problems given to the students were naked number problems, with no context or real-life connection, students appeared to be disinterested. They were yawning or rolling their eyes. Several students would work quietly, but appeared to have bored looks on their faces. All teachers asked knowledge-based questions in which the students were expected to remember or recall the methods and procedures needed to solve the assigned problems.

The sixth grade teacher told the class stories about the history of the tangram, as well as a story about why we follow an order of operations. The seventh grade teacher frequently gave students choices for graph constructions. She also developed a “Water Park” thematic unit that included costs for a family of five. During this time, the students were interested in mathematics. Other than the geometric constructions, the eighth grade teacher used direct instruction methods and assigned students naked number problems. Almost daily, she would ask students to go to the chalkboard, give them an expression such as $3x + 2(5x - 7)$ and then ask the students to solve. Both the regular teacher and the special education teacher would walk around, checking students' work and offering feedback and help.

Students in all classes were given the opportunity to work with other students. The classroom arrangements were designed for cooperative group work, with either tables or desks placed in groups. The sixth-grade teacher led the students in a discussion about the roles needed in a cooperative group, and the class then discussed group activities and cooperation. When sixth-grade students were playing the Jeopardy game, they were divided into groups of three. Although students took turns buzzing in and answering the question, the group worked together to answer each question. On the Final Jeopardy question, the teacher encouraged the students to work together to solve the problem. The seventh-grade teacher frequently gave her students the choice to work with a partner. Most students chose to work with a partner, but a few students did work alone. The eighth-grade teacher frequently told her students to ask other members in their group if they had a question. Students took advantage of this, often asking each other for help. During this time, the students were interested and encouraged in mathematics.

Interview Data

During the one-on-one interviews, students were asked to tell the researcher about their best and worst experience in mathematics. More students spoke of a worst experience in mathematics than a best experience in mathematics. Five students could not remember a worst experience in mathematics, but the worst experiences for thirteen (72%) students were grouped into the following subcategories: 1) grades, 2) feelings of distress, and 3) content. Ten (56%)

students related their best experience in mathematics to these subcategories: 1) grades, 2) activities, and 3) content. Students also were asked what they would do differently if they were the mathematics teacher. The following subcategories emerged from the interviews: 1) hands-on activities, 2) homework, and 3) teacher strategies.

Kathryn, Peter, Sophie, Bridget, and Monica all said that their worst experience in mathematics is connected to poor grades. According to Kathryn, the worst experience in mathematics is “failing a test” and Peter said, “When I do bad on tests.” Sophie also said that her worst experience in mathematics is “failing a test that you thought you knew.” According to Bridget, a worst experience in mathematics is “when I thought I did perfect on a test. But when I got it back, it was a 0%. There were only four questions, and I missed something on each one. And I was like, ‘Are you kidding?’” Monica also believes that her worst experience in mathematics is related to grades. She said, “when I get my report card and see all A’s and there is one C or D” in mathematics.

Penny, Sybil, and Bella all gave indications of distress in mathematics and associated that distress to a worst experience in mathematics. Penny, an eighth grade student, related her worst experience in mathematics to an experience that happened in sixth grade. She said, “In sixth grade, we were doing this concept that I felt really good about. And then we had a test, and I thought I did good on it, and I didn’t do so good on it.” Sybil’s worst experience in mathematics is when she is “struggling, and I get mad at it.” Bella struggled with giving the details of her worst experience in mathematics but did say, “I think in fifth grade… it just didn’t go well. I didn’t understand.”

Bethany and David both talked about content-related topics such as angles, triangles, and improper fractions as a worst experience in mathematics.

Students were asked what they would do differently if they were the mathematics teacher. The major categories for this question were separated into the following subcategories: 1) activities, 2) homework, and 3) teacher strategies. ‘Activities’ describes the hands-on activities, games, and projects in which the student is actively involved in their own learning. ‘Teacher strategies’ refers to the ways teachers teach, such as asking students to work mathematics problems on the chalkboard, giving students more explanation, and including hands-on activities in the instruction. ‘Homework’ is the take-home assignments, as well as unfinished class assignments.

Six students said that if they were the mathematics teacher, they would make mathematics more fun by including hands-on activities and games. Five of the six, Kathryn, Ron, Sybil, Darla, and Juan, all said if they were the mathematics teacher, they would include more “hands-on activities,” and “make math more fun to learn.” As noted by Juan, “I would make it more fun, and play games sometimes. Math games, because they are fun, but they still help you learn.” Peter said he would “relate it more to kids my age.”

Homework was a common response for six students. Ron said, “Give less homework,” and Bridget said, “One thing that I might change… I know that she gives us a lot of problems because she wants us to learn it. But I might change that. I will have tons of things to do after school, and to fit in all that homework is hard.” Sophie also commented on the “really long assignments” and continued, “So I might make the assignments shorter or something, because it’s a lot to do because it’s so long.” Bella echoed these sentiments by saying, “I probably wouldn’t give as much homework.” Juan comment was to the point when he said, “Not give as much homework.” Darla does believe that the “amount of homework is about right, because she gives us a lot of time in class to do it.”

Alicia and Monica both gave responses that fell into the teacher strategies category. Alicia said, “If I see that a kid is struggling, I would pull them aside and ask if they would like help,” and Monica said, “I would just explain things slower and explain things more, like, elaborate more.” Sybil added to her comments about making mathematics fun, “If kids like drawing on the board, then I would put them at the board and draw a problem that they would actually want to do. Have them do that problem, and after they have done that problem, and they feel nice and secure about it, then I would probably do a problem of my own.” Bethany mentioned that she would “keep the classes small so kids can concentrate.”

Elizabeth included two categories in her response. When asked what she would do differently, Elizabeth replied, “Do more hands-on stuff. And homework, it’s just when they do an overdose. Like sometimes, there’s a little bit too much, with all the kids in sports and everything. Like this one day, since I was gone, I had to do 61 problems. Oh my gosh, it was horrible.”

Four students said they wouldn’t change anything if they were the mathematics teacher. Penny’s commented, “The way that Mrs. W has been teaching math this year has made it pretty easy.” Suzie, Jerry, and David couldn’t “think of anything” but Jerry did add, “Mrs. A is a pretty good teacher.”

Four seventh grade students and four eighth grade students did not have a best experience in mathematics to speak of, but ten students talked about grades, activities, and content.

Four eighth grade students, Bridget, Monica Sophie, and Penny, all associated their best experience in mathematics to the grades they receive. Bridget said, “In fifth grade, we were doing this really hard thing in math. No one would get it, but I thought it was pretty easy. Then, like when the test came, I had no idea what to do. So I just guessed on it. And I was the only that got a 100% on it." Monica also talked about fifth grade and grades. "I did extra credit work, because I had a D in math and an A in everything else. And I did extra credit work, and in two weeks later, I had an A," Monica said. Sophie also said her best experience in mathematics is "probably getting a 100% on a big test." Penny said her best experience in mathematics has been this year "because lately I've been getting all A's on the tests. It's like I am succeeding in math and not failing."

Three students related their best experience in mathematics to games and activities. Kevin's best experience in mathematics was playing the Jeopardy game because it "was fun" and Ron commented, "my best experiences is probably after the state assessments are over and they let you do something fun with math things." Sybil said, "A best experience is hard" but then went on to say "group activities."

Of the students who did have a best experience in mathematics, two talked about content-related topics, such as angles, triangles, and multiplication and division. Sixth grade students Bethany and David both related their best experience in mathematics to their favorite mathematics topic, which were multiplication and division and measuring angles.

Student responses to the kinds of mathematics activities that were most helpful were placed into two subcategories: 1) hands-on activities and 2) teacher strategies. Five students believe that hands-on activities and games are activities that are most helpful. Jerry, Ron, Peter, and Darla all said, "math games," and "hands-on" activities. Bella's comment was, "Mrs. A had this game, like a board game. We had to actually work it out. And I think that really helped me, like with the n^{th} term. She had it (the game) for different subjects in math."

Four eighth grade students like the practice on the chalkboard, a strategy that was observed in the eighth grade classroom. Penny said, "When we do it on the board. She makes sure we are doing it right." According to Bridget, "going to the board" is most helpful. "She moves all around and tells us what we did wrong." Elizabeth noted, "Writing on the board really helps me understand how to do it," while Monica said, "practicing on the board" is most helpful. Sybil did not give a specific activity, but said; "Going up to the teacher and asking for help" is most helpful.

Figure 4-4 summarizes the findings in this area.

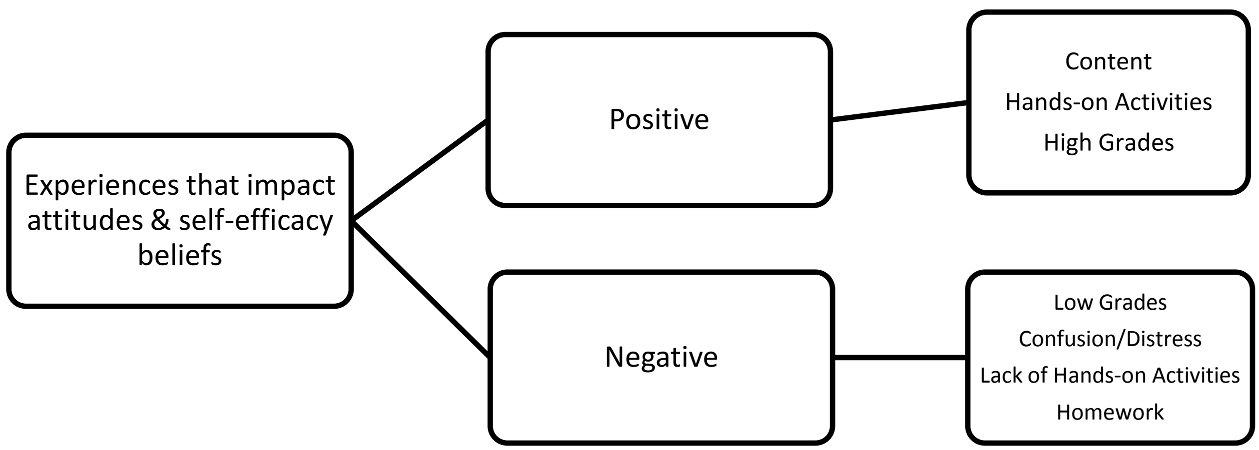

Figure 4-4: Experiences Categories and Subcategories

Research Question #5 (relationship between attitudes and self-efficacy beliefs)

This research question considered the relationship between attitudes toward mathematics and mathematics self-efficacy beliefs. The data from this study support earlier research indicating a relationship between attitudes and self-efficacy beliefs (Pajares & Miller, 1994; Usher, 2009). On both the short-answer questionnaire and in the one-on-one interviews, all middle school students who reported a positive attitude toward mathematics also had high mathematics self-efficacy beliefs. Students credit their positive attitudes and high mathematics self-efficacy beliefs to the teacher and successful performance in mathematics. Thirty-six (13%)

of the students' responses on the short-answer questionnaire replied no to both questions "Do you like mathematics?" and "Do you believe you can do mathematics?" Of these students with negative perspectives, 30 (83%) feel distressed about mathematics. As demonstrated under research question one (attitudes) and research question two (self-efficacy beliefs), student responses indicate that attitudes toward mathematics are highly dependent upon a student's belief in his or her ability to do mathematics (self-efficacy beliefs) which is highly influenced by his or her mathematics teacher and the experiences provided and by their performance and grades. The following includes the data from two sources: 273 short-answer questionnaire responses and 18 one-on-one interviews.

Short-answer Questionnaire Data

Thirty-six students replied no/not really/sometimes/sort of to the question, "Do you like mathematics?" and no/not well/sometimes/maybe to the question "Do you believe you can do mathematics?" This was a fairly even split among the grade levels. Ten sixth grade students, ten seventh grade students, and 16 eighth grade students reported they do not like mathematics and do not believe they can do mathematics.

The majority (30 or 83%) of these students with negative perspectives feel "sick," "dumb," "confused," "sad," "frustrated," "tired," "stupid," "bored," and "scared or nervous" when they think mathematics. Six of the students with negative perspectives finished the sentence, "When I think of mathematics, I feel…" with positive expressions such as "alright," "like I'm smart," "good," "okay," "normal," and "same as usual." "I feel mathematics is …" elicited four positive responses such as "okay," and "fun." Thirty-two students had negative feelings toward mathematics, and said they feel mathematics is "hard to do," "difficult," “somewhat useless,” and “confusing,” while only four students had positive feelings toward mathematics.

Twenty students filled in the sentence, “I believe I … in mathematics this year” with positive comments such as “improved,” “did okay,” “learned things,” and “got smarter.” The other 16 students believe they “did not succeed,” “struggled,” and “failed” in mathematics this year. Thirty-two students completed the sentence, “Mathematics homework is…” with “tiring and difficult,” “hard,” “time consuming,” and “frustrating and confusing.” Four students completed this sentence with positive expressions such as “okay,” “becoming easier,” and “okay.”

The students who said they do not like mathematics and also believe they cannot do mathematics also commented on their favorite and least part of mathematics. Fifteen students said their least favorite part of mathematics is homework and filled in the blank “Mathematics homework is…” with terms such as “boring,” “hard,” “time consuming,” “frustrating,” “confusing,” “stressful,” “not fun to do.” Content-specific topics was the category for 13 students who filled in the blank with “area,” “geometry,” “Pythagorean Theorem,” and “order of operations.” Five eighth grade students said their least favorite part of mathematics is “that I don’t understand things quickly,” “things that confuse me,” and “when I don’t get something and feel frustrated because I might need it in life.”

Three students’ favorite part of mathematics is “playing games,” or “the fun ways we learn,” while one eighth grade student said his least favorite part of mathematics is “no creativity.” Two students (6^{th} and 7^{th} grade) said their favorite part of mathematics was “getting help learning new things,” and “when I understand the work.”

Eighteen students completed the sentence, “My favorite part of mathematics is…” with “nothing,” or “everything easy.” These comments support the strong relationship between poor attitudes toward mathematics and the low self-efficacy beliefs in mathematics.

Interview Data

The majority (14 or 78%) of the students interviewed said they like mathematics and they feel successful in mathematics, although four students said they do not like mathematics and they do not feel successful. When asked, “Overall, do you like mathematics?” Sybil replied, “I don’t know. It’s kind of on and off.” When asked if she always felt that way, or if she remembered a time when she did feel successful, she talked about fifth grade. “My teacher was sweet. So it was easy to go into. And she kind of makes it fun, in a little bit of ways.”

Seventh grade students, Alicia and Bella, both said they do not like mathematics and they do not feel successful in mathematics. Alicia remembered first or second grade as a time when she liked mathematics, but she could not remember specifics. When asked why, Alicia replied that there is “more stress when you are in middle school and more homework.” She continued by saying, “You just run out of time with all the activities. And all the other classes with homework too.” When asked why she did not feel successful in mathematics, Alicia stated, “Some problems, I get frustrated. Other times I can answer the questions.” Alicia could not remember a time when she thought she could be successful. Bella responded, “I just don’t like to work everything out. And it’s just hard. And, like… I just don’t understand it very well” when asked why she did not like mathematics. She went on to say “Like after we grade stuff, and I just don’t do well. It doesn’t really… I don’t know… It’s just… I don’t know… I just…. I’m not… Math is not my best grade. So I just don’t feel that successful.” Bella does feel successful when she completes her homework, and does well on district and state assessments. Bella also mentioned her twin brother. She said, “He loves math. But he is good at it.”

Monica, an eighth grade student, replied to the question “Overall, do you like mathematics?” by saying, “I think I would like it a lot… I mean, I like it when I am understanding it. But in the very beginning when I am learning a new thing, and I don’t get it at all, it’s frustrating.” She could not remember a time when she did like mathematics. When asked if she felt successful in mathematics, Monica related her lack of success to doing poorly on a test or a worksheet.

The students that have positive attitudes toward mathematics attribute their high mathematics self-efficacy beliefs to the teacher and the grades they receive. Many students said that the teacher made the difference in their mathematics self-efficacy beliefs. They related that in previous years they did not believe they could do mathematics, but “this year, Mrs. W makes sure that you understand. She keeps going over it,” according to Kathryn. Sophie echoed these sentiments by saying, “Because she makes it, like easier to understand. If you don’t get it, she goes over it more and makes sure that you understand it.” Elizabeth also commented on the teacher’s role in her success. “The way she teaches makes it, kind of easy and stuff. And she explains it really well. If you mess up on something, she doesn’t get all mad at you like in your face. She acts like she’s mad at you, but she’s really not. That’s nice.” And Juan said, “Because my teachers always used to tell me that I’m really good at it.”

Darla related her success to the grades she is earning this year. “I’ve just done really good this year in math. I’ve done a lot better this year… I have an A this year… all the other years I’ve had like a B- in it.” Penny also attributed her success to grades and that she tutors other students who may be struggling. Penny said, “I get good grades in math. And I think that some of the things we do are easy, but sometimes it is hard sometimes. If someone is struggling in the class, I will help them and stuff." Bethany also credits her success in mathematics to grades. "I do good because I usually get an A in there always." David also said, "Usually, I get pretty good grades on assignments," and Suzie said, "because I have a good grade in it."

Jerry credits his success in mathematics or lack of success in mathematics to test scores. He said, "Like when I do good on a test, I feel successful. But when I don't do as good, then I don't feel successful."

All of these comments relate positive attitudes toward mathematics to high mathematics self-efficacy beliefs. Students' high mathematics self-efficacy beliefs influence their positive attitudes toward mathematics, and they attribute these feelings and beliefs to the teacher and the grades they earn in the class.

There also were comments that relate negative attitudes toward mathematics and low mathematics self-efficacy beliefs. Students' who do not believe they can do mathematics (low mathematics self-efficacy beliefs) also have poorer attitudes and attribute those feelings and beliefs to the teacher, the amount of homework they must do, the grades they receive, and the activities, projects, and hands-on experiences. The majority of the comments most frequently mentioned by students connect mathematics self-efficacy to the teacher and performance.

Figure 4-5 summarizes the findings in this area.

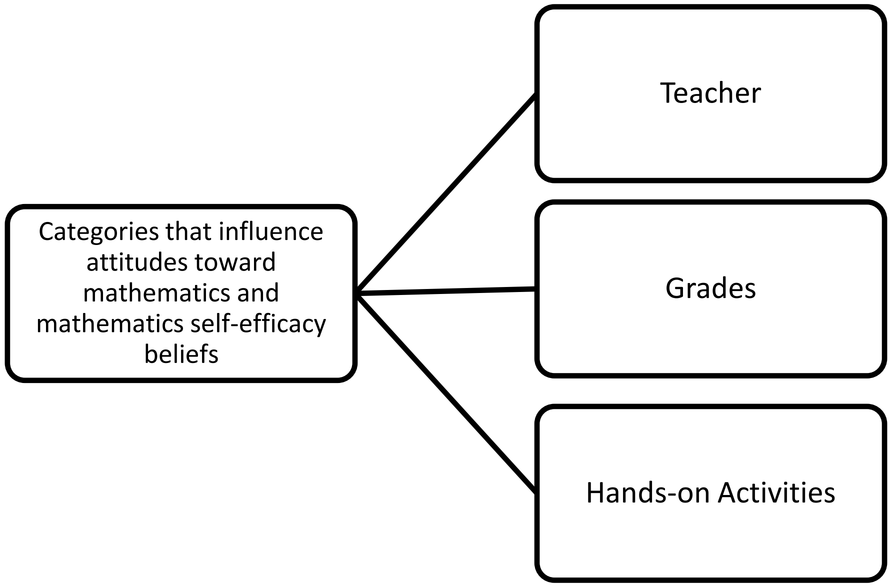

Figure 4-5: Categories that Influence Attitudes and Self-Efficacy Beliefs

Summary

The focus of this study was to explore the nature of middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs. The analysis of the narratives began with the five research questions, with 13 categories and 29 subcategories generated in relation to the questions.

Some middle school students conveyed positive attitudes toward mathematics and high mathematics self-efficacy beliefs; while some students conveyed negative attitudes toward mathematics and negative mathematics self-efficacy beliefs. Many students conveyed mixed attitudes toward mathematics or mathematics self-efficacy beliefs. Middle school students' recollections of previous years revealed positive changes, negative changes, or no changes in their attitudes toward mathematics or their mathematics self-efficacy beliefs. Students also reported certain experiences that they believed were the reason they had either positive or negative mathematics self-efficacy beliefs and positive or negative attitudes toward mathematics.

The teacher, grades, and hands-on activities influence middle school students' mathematics self-efficacy beliefs and their attitudes toward mathematics.

The overall theme that emerged was that mathematics self-efficacy beliefs impact attitudes toward mathematics. Experiences impact both mathematics self-efficacy beliefs and attitudes toward mathematics; while mathematics self-efficacy belief further impact attitudes toward mathematics.

The major constructs that are identified in the analysis of the transcripts, together with the short-answer questionnaire responses and the classroom observations form a example of the nature of middle school students attitudes toward mathematics and their mathematics self-efficacy beliefs.

Each question will be re-examined, patterns, and overall themes that crossed all questions will be discussed in the next chapter.

CHAPTER 5 - Conclusions

This chapter includes the summary of the study, conclusions drawn from the data analysis based on the research questions, implications, limitations of the study, and recommendations for future research. This chapter also presents a discussion of the contributions of the findings in relation to the larger body of literature.

Introduction

This study explored the nature of middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs. Middle school mathematics teachers typically hear their students say "I hate math!" Prior to this study, no research had been done that provided an opportunity for middle school students to tell their mathematical stories; therefore, this research is needed.

This study used naturalistic inquiry methods (Lincoln & Guba, 1985) in order to listen to the voices of the middle school child. The study gathered the mathematical perspectives of sixth, seventh, and eighth grade middle school students. The intent of the study was to provide a description of the nature of middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs.

The data for the study consisted of short-answer questionnaires, observations of sixth, seventh, and eighth grade mathematics classrooms over five weeks (31 class periods, or 24 hours 18 minutes), and 18 one-on-one interviews conducted in person using a semi-structured interview protocol. All middle school students from 20 classes were given the opportunity to complete a short-answer questionnaire; all students in three classrooms were observed; and all students interviewed had the written informed consent to participate from parents/guardians. Data analysis used content analysis to generate categories related to each research question and then the constant comparison method developed by Glaser and Strauss (1967) was used to interpret categories and generate overall patterns and themes. Credibility, confirmability, dependability, and transferability were ensured, according to recommendations provided by Lincoln & Guba (1985).

Summary of the Study

This naturalistic inquiry was conducted in order to explore the nature of middle school students' attitudes toward mathematics and their mathematics self-efficacy beliefs. Since the researcher has experience teaching middle school students mathematics, it was natural that examining questions about attitudes and self-efficacy beliefs be conducted through a naturalistic inquiry format that focused on the middle school student in the school setting.

Two hundred seventy-three students completed the short-answer questionnaire, 61 students in the observed classrooms, and 18 students interviewed. Students who completed the short-answer questionnaire were asked if they liked mathematics, and if they believed they could do mathematics. Other open-ended questions included "When I think of mathematics, I feel…" and "My favorite part of mathematics is…" and "My least favorite part of mathematics is…" The short-answer questionnaire was anonymous and completely voluntary. Students also had the freedom to skip any question that made them feel uncomfortable.

Students in three mathematics classes (sixth, seventh, and eighth grades) were observed. A variety of lessons, types of activities, and student behaviors were observed, as well as student comments noted. Field notes included indicators of attitude toward mathematics such as engagement in class, and indicators of mathematics self-efficacy through statements such as "I can't do this." Observations also focused on experiences that may be impacting attitudes and self-efficacy beliefs such as student success or failure, teacher praise and encouragement, peer encouragement, the curriculum being used, instructional events, activities, and assignments and how students react to these experiences.

One-on-one interviews were conducted at a time that was convenient for the student and his/her parents/guardians. Students told their mathematical stories regarding attitudes toward mathematics and mathematics self-efficacy beliefs. They explained why they like or dislike mathematics, if they had always felt that way or if they remembered a time when they liked or disliked mathematics. Through prompts, students were encouraged to reflect on if and when their attitudes changed and what impacted any changes. If student responses indicated a change in attitudes, they were encouraged to reflect on what they were doing or how their experiences were different when they held different attitudes toward mathematics. A second line of similar questions were related to mathematics self-efficacy. Students were asked "Do you believe you can be successful in mathematics?" If students expressed a low mathematics self-efficacy, they were asked if they could remember a time when they believed they could be successful in mathematics. Through prompts they were encouraged to reflect on if and when their mathematics self-efficacy beliefs changed and what impacted any changes. If their responses indicated a change in mathematics self-efficacy beliefs, they were encouraged to reflect on what they were doing or how their experiences were different when they felt successful in mathematics.

Conclusions Related to the Research Questions

This section provides conclusions related to each research question.

Research Question #1

What are middle school students' attitudes toward mathematics?

The findings of this study revealed that middle school students' attitudes toward mathematics are very mixed. Short-answer questionnaires and one-on-one interviews provided evidence of positive, variable (it depends), and negative attitudes toward mathematics. Approximately half (53%) of the students responded that they like mathematics on the short-answer questionnaire, and credit those positive attitudes toward mathematics to the teacher, the in-class activities or hands-on projects, or a mathematics-related topic. Of those interviewed, less than half (44%) said they like mathematics. Students like mathematics because it is easy, fun, and they like a challenge. These students contradict the research by Nardi and Steward (2002), in which students report negative attitudes toward mathematics.

Nearly half (47%) of the middle school students who completed the short-answer questionnaire had negative or 'it depends' attitudes toward mathematics. Students attribute their negative attitudes toward mathematics to being disinterested, discouraged, and distressed. Students feel disinterested because they are bored or don't see a connection to real-life experiences; discouraged because they are frustrated and confused; and distressed because they feel stressed, scared, and nervous about mathematics. Of the students interviewed, more than half (56%) had negative or variable (it depends) attitudes toward mathematics. Three of these students (2 seventh grade girls and 1 eighth grade girl) do not like mathematics now and have never liked mathematics.

Research Question #2

What are middle school students' mathematics self-efficacy beliefs?

Middle school students exhibit both high mathematics self-efficacy beliefs and low mathematics self-efficacy beliefs, although the majority exhibited high mathematics self-efficacy beliefs. The majority (79%) of the students' completing the short-answer questionnaire believe they can do mathematics and the majority (72%) of the students interviewed feel successful in mathematics. Students with high mathematics self-efficacy beliefs give credit for these beliefs to the teacher or the high grades they earn on daily assignments, as well as the scores they receive on state and local assessments.

Twenty-one percent of middle school students who completed the short-answer questionnaire have low mathematics self-efficacy beliefs. Of the students interviewed, twenty-eight percent have low mathematics self-efficacy beliefs. This included four girls and one boy. Students who have low mathematics self-efficacy beliefs feel unsuccessful or distressed and attribute those feelings to the grades they receive on daily assignments and assessments and the distress of not understanding a particular concept. These findings support the literature related to Bandura's self-efficacy and psychological states, in which stressful situations and high anxiety can contribute to low self-efficacy (Bandura, 1977, 1994).

Grades were a common factor in all middle school students' mathematics self-efficacy beliefs. Middle school students feel successful in mathematics if they have high grades, and unsuccessful if they have low grades. These findings are supportive of Bandura's self-efficacy and performance accomplishments. According to Bandura, success increases one's personal self-efficacy while repeated failures undermine it (Bandura, 1977, 1994).

Research Question #3

Have students' attitudes toward mathematics and mathematics self-efficacy beliefs changed across time?

Interview data indicated middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs change from elementary school. The majority (72%) of those interviewed students reported a change in their attitudes toward mathematics for the better (44%), although five of the students interviewed said that their attitudes toward mathematics had not changed from elementary school. These five students said they had never liked mathematics and do not like mathematics now. Students told their mathematical stories of the change in attitudes toward mathematics and mathematics self-efficacy beliefs and attributed positive changes in attitudes toward mathematics to the teacher. Students also recognize the teacher's role in their feelings of success. These findings provide additional support for Bandura's research on self-efficacy beliefs; teachers can boost self-efficacy with communication and feedback that leads the student through the task or motivates them to do their best (Bandura, 1977, 1994). This also supports research by Van Hoose in which "the quality of the relationship between teachers and students is the single most important aspect of middle level education" (as cited in Anfara, 2001) and in the work by Yenilmez et al. (2007) that the greatest factor in developing positive attitudes toward mathematics is the classroom teacher.

Student stories provided evidence that these middle school students have high mathematics self-efficacy beliefs and feel successful in mathematics when their grades are good and have low mathematics self-efficacy when they have poor grades or fail a test. Students interpret high grades to being successful in mathematics, which impacts their mathematics self-efficacy beliefs. This supports the literature on self-efficacy beliefs in which success increases one's personal self-efficacy while repeated failures undermine it (Bandura, 1977, 1994).

Other themes that emerged in the decline of attitudes toward mathematics and mathematics self-efficacy beliefs were homework and the lack of hands-on activities. The amount of homework given at the middle school level is daunting for most students. The amount of time required to complete the mathematics homework, in the midst of all of the other activities students are involved in and the homework given in other classes, causes students to feel distressed. Middle school students also expressed a need and/or desire for activities, games, and hands-on mathematical experiences. Middle school students' responses demonstrated a relationship between attitudes toward mathematics with positive mathematics self-efficacy beliefs, and they like mathematics when they play a mathematics game, or are engaged in hands-on learning activities.

Research Question #4

What experiences have impacted attitudes toward mathematics and mathematics self-efficacy?

Classroom observations and one-on-one interviews all provided examples of experiences that have impacted these middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs. Experiences that have impacted attitudes toward mathematics and students' mathematics self-efficacy beliefs include the following: homework and the lack of connections to real-life experiences, hands-on activities, teacher and peer encouragement and support, and grades. In addition, some students feel distressed in mathematics and associate that distress to a negative experience described as their "worst experience" in mathematics.

Middle school students viewed homework as strict procedures and steps to follow to get "the answer." While students said that homework is boring and not fun, they also believe that homework is not connected to real-life experiences. This was evident not only in the responses to the short-answer questionnaire and the one-on-one interviews, but also in the classroom observations. Students are disinterested when given naked number problems with no context or real-world connection. When students view homework as a focus only on procedures and rules, attitudes toward mathematics are lessened. This is supportive of the literature which suggests a focus on procedures in instruction frustrates some students, and can lower a student's self-efficacy (Schunk & Pajares, 2002).

Middle school students' written and verbal responses indicated a desire for hands-on activities, and observations demonstrated students were more engaged when they were involved in their own learning. Teacher and peer encouragement and support appear to be experiences that promote middle school students' positive attitudes toward mathematics and high mathematics self-efficacy beliefs. When students heard genuine praise and encouragement from the mathematics teacher as well as from other students, they indicated higher mathematics self-efficacy beliefs. This is supportive of the literature in which Bandura (1977, 1994) suggests that verbal persuasion strengthens self-efficacy beliefs, especially when verbal cues are by someone that students believe are trustworthy.

Another theme that emerged in the experiences that impact middle school students attitudes toward mathematics and their mathematics self-efficacy beliefs was grades. Students related their "best experience" in mathematics to the high grades they receive and their "worst experience" to low grades. If they receive a 100% on a test, or an "A" on a report card, they said they felt successful and described positive attitudes toward mathematics. When students mentioned failing a test, or receiving poor grades on homework assignments, they described feelings of distress and low mathematics self-efficacy beliefs. This is supportive of the literature on self-efficacy beliefs because the ways in which people interpret the results of their performance can alter future performances (Bandura, 1986).

Research Question #5

In what ways are attitudes toward mathematics related to mathematics self-efficacy beliefs?

Evidence from responses on the short-answer questionnaire and one-on-one interviews demonstrated that there is a relationship between attitudes toward mathematics and mathematics self-efficacy beliefs. If students have positive mathematics self-efficacy beliefs, they generally have positive attitudes toward mathematics. On both the short-answer questionnaire and in the one-on-one interviews, all middle school students who reported a positive attitude toward mathematics also had positive mathematics self-efficacy beliefs. Students credit their positive attitudes toward mathematics and positive mathematics self-efficacy beliefs to the teacher and successful performance in mathematics. This affirms the literature by Yenilmez, Girginer and Uzun (2007) in which the greatest factor in developing positive attitudes toward mathematics is the classroom teacher.

On the short-answer questionnaire, the majority of middle school students who said they do not like mathematics also believe they cannot do mathematics and all interviewed students who reported a dislike of mathematics also had low mathematics self-efficacy beliefs. Therefore, students who have negative attitudes toward mathematics also have low mathematics self-efficacy beliefs. This was evident in student comments and the behaviors observed. Middle school students point to poor grades and test scores as reasons for these attitudes and beliefs.

Middle school students associate hands-on activities and projects in the mathematics classroom to positive attitudes toward mathematics, as well as high mathematics self-efficacy beliefs. The lack of hands-on activities relates to student distress and confusion and low mathematics self-efficacy beliefs. Students relate teacher praise and encouragement to a positive attitude toward mathematics and high mathematics self-efficacy beliefs. Students with high grades in mathematics have high mathematics self-efficacy beliefs, and have positive attitudes toward mathematics. This is supportive of the literature by Zimmerman (1989). "Learning is not something that happens *to* students; it is something that happens *by* students" (Zimmerman, 1989, p. 22). For learning to occur, students must be proactive and engaged.

Overall Themes

Several themes ran across all questions. The importance of experiences in the mathematics classroom influences attitudes toward mathematics and mathematics self-efficacy beliefs. 'Experiences' includes the mathematics teacher, performance, engagement in class, and understanding the mathematics. See Figure 5-1.

The influence of the mathematics teacher was the major theme throughout all questions. The middle school mathematics teacher, the classroom experiences that he/she provides, and his/her praise and encouragement provides a foundation for positive attitudes toward mathematics, and positive mathematics self-efficacy beliefs.

Another common theme was performance. Middle school students relate high grades on daily assignments, homework, and state and local assessments with positive mathematics self-efficacy beliefs and also positive attitudes toward mathematics, even if those grades are manufactured (i.e., extra credit). Mathematics self-efficacy beliefs and attitudes toward mathematics are connected with performance.

Hands-on activities was another common theme throughout the research. Hands-on activities engages students in their own learning. In the middle school mathematics classroom, whether the activities/games are for conceptual understanding or for a review of previously learned concepts, students have positive attitudes toward mathematics, which therefore impacts their mathematics self-efficacy beliefs.

A fourth common theme in the research is that middle school students want to understand. This mathematical understanding seems to be very important to the students. The need for understanding could help explain why mathematics self-efficacy beliefs impacts attitudes toward mathematics. When students understand, they feel like they can do mathematics. This is a good experience, and therefore they like mathematics. When students don't understand, it is distressful and frustrating, and therefore they dislike mathematics. See Figure 5-1.

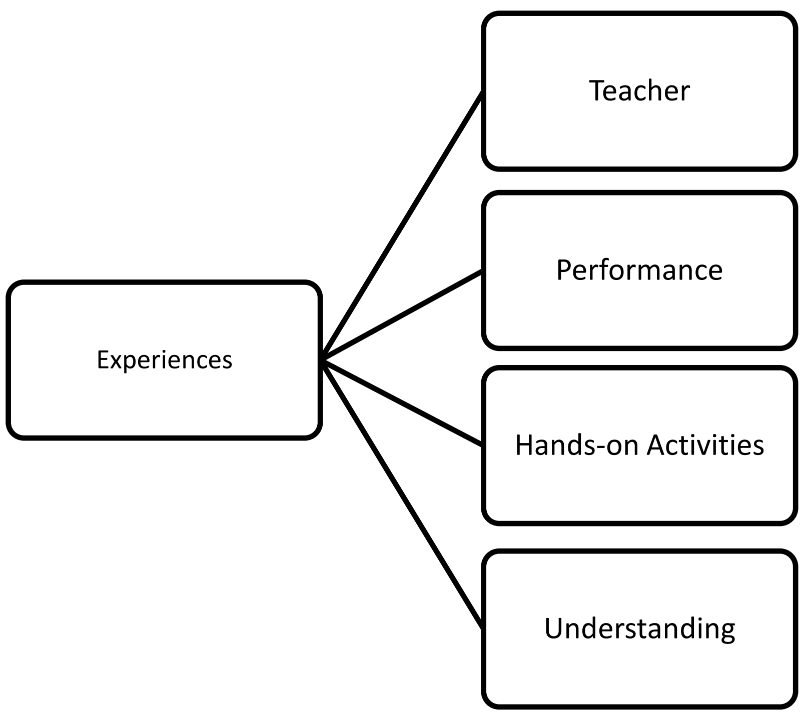

Figure 5-1: Overall Themes in the Research

Therefore, the experiences in the middle school classroom impact both students' mathematics self-efficacy beliefs and their attitudes toward mathematics. Students' mathematics self-efficacy beliefs then further impact their attitudes toward mathematics. See Figure 5-2.

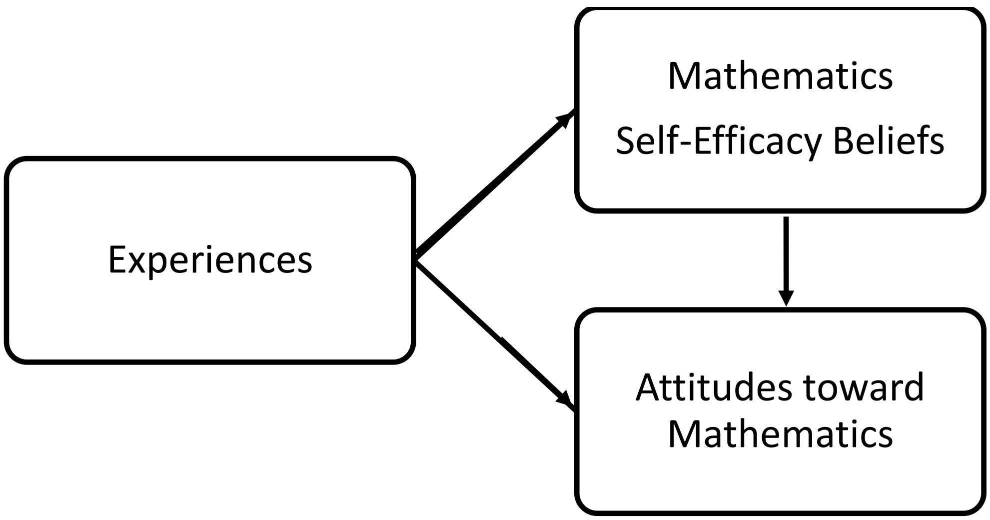

Figure 5-2: Experiences Impact Self-Efficacy Beliefs and Attitudes

Implications

In summary, the findings revealed that middle school students who participated in this study believe that the mathematics teacher, the grades they receive on daily assignments and state and local assessments, and hands-on classroom activities (engagement, relevancy, hands-on experiences) impacted attitudes toward mathematics and mathematics self-efficacy beliefs. Middle school students who have negative attitudes toward mathematics and low mathematics self-efficacy beliefs are distressed and credit that to grades, homework, lack of hands-on activities, and the teacher.

In both positive and negative attitudes toward mathematics, and high and low mathematics self-efficacy beliefs, middle school students who participated in this study expressed the critical role of the teacher in their mathematics attitudes and beliefs. Therefore, the mathematics teacher must give sincere praise and encouragement to all students. Middle school mathematics teachers must "help students understand." Mathematics instruction should include real-world activities and hands-on experiences, which students interpret as "fun."

Teacher and peer encouragement and support are critical experiences in establishing middle school students' positive attitudes toward mathematics and high mathematics self-efficacy beliefs. When students hear genuine praise and encouragement from the mathematics teacher and other students, they feel more successful in mathematics.

Another commonality was grades. Students' attitudes toward mathematics improve and their mathematics self-efficacy beliefs increase when they receive high scores. Middle school students are distracted by grades, although that grade is arbitrary. Is the grade an indication of what the student knows and can do, or is the grade a reflection of what the student has done? Teachers should look critically at assignments and provide meaningful feedback to students, which may not be in the form of a traditional grade. Although the research delineates the difference between self-efficacy beliefs and attitudes (Friedel, Cortina, Turner, and Midgley (2007), middle school students appear to blur the difference. In addition, their mathematics self-efficacy beliefs and attitudes toward mathematics appear to be strongly connected to the grades they receive.

In addition, homework as well as in class assignments, should include hands-on activities as part of their instruction, and help students make connections to real-life. Middle school students have higher mathematics self-efficacy beliefs, and therefore more positive attitudes toward mathematics. Middle school mathematics teachers should reevaluate the use of homework, in terms of amount of time required and the nature of the assignments (i.e., engaging, relevant). While the need for practice is understood, students today have many activities and events that require time after school and evenings, as well as homework from other classes. It would be advantageous for middle school teachers to coordinate their homework assignments, not only with other teachers, but with the other activities students are involved in.

Limitations of the Study

Several aspects of this study could be perceived as limitations. Therefore, this section discusses these aspects and provides a rationale for the decisions that were made in the study.

One possible limitation in this study is related to sampling decisions. The study's sampling strategy was not designed to limit participation based on gender or academic ability of the participants. However, only six of the 18 students interviewed were male. Two of the male participants were special needs students, and one male student was Hispanic. It is important to note that all students in the three observed classrooms were given the opportunity to be interviewed. The parents/guardians made the decision whether their child was to be interviewed. These parental and student choices might have influenced the final gender, ethnic, and socio-economic status make-up of the participants. In addition, all students in 20 classes were encouraged to respond to the short-answer questionnaire, but this was voluntary. Students may have chosen not to respond.

The second potential limitation is related to the middle school setting selected. The researcher chose the district based on proximity and the researcher's ability to make frequent observations of the middle school classrooms. The middle school included in this study was chosen by the principal, in conjunction with the assistant superintendent. Teachers included in the study were then selected by the school principal and district mathematics coach, as well as the teachers themselves. The district, school, and teachers selected may not be representative of typical middle school settings.

The researcher also looked at the student responses from an educator's perspective, and not from the perspective of a psychologist. The researcher was not attempting to psychoanalyze the students, but to understand the attitudes toward mathematics and mathematics self-efficacy beliefs of middle school students from a teacher's viewpoint.

True assessment of attitudes and self-efficacy beliefs are a difficult construct to measure. The researcher asked students open-ended questions, and assumed that students were responding to questions of attitudes and self-efficacy beliefs. The open-ended questions were generated based on questions from validated instruments. It is not possible, however, to know how students interpreted such questions. Questions of success, for example, were designed to elicit self-efficacy beliefs related to the students' beliefs in their ability to "do mathematics," but seem to have been interpreted related to grades. Does this mean that mathematics self-efficacy beliefs are based on grades or do students interpret the word "success" as grades?

One of the researcher biases, after the fact, was that the researcher went into this study expecting to find that attitudes toward mathematics impact mathematics self-efficacy beliefs, but the researcher found that mathematics self-efficacy beliefs impact attitudes toward mathematics.

Future Research

The findings of this naturalistic inquiry of middle school students' attitudes toward mathematics and mathematics self-efficacy beliefs will promote a better understanding of the phenomenon of reaching middle school students. The major constructs that emerged from the data together formed a model of how middle school teachers can help increase student attitudes toward mathematics and mathematics self-efficacy beliefs.

The sample for this research included 273 middle school students who completed the short-answer questionnaire, 61 students observed in the mathematics classroom, and 18 students interviewed. It is unknown how representative the study population was of the population of middle school students. The same research approaches could be repeated with a larger sample, or a comparative study in another middle school may reveal differences in the attitudes toward mathematics and mathematics self-efficacy beliefs.

This study was conducted with qualitative methods, which limited generalizability, and might have made measuring the construct of mathematics self-efficacy beliefs more difficult. It would be helpful to create a mixed design that uses both quantitative and qualitative measures of self-efficacy and compare the two. Conducting a similar study using the themes from this study would be valuable. This research design could be repeated with a larger population that includes more middle schools.

The majority of student responses on the short-answer questionnaire and in one-on-one interviews indicated a positive attitude toward mathematics, but those same students showed signs of boredom and disinterest during the classroom observations. Future research could be conducted that focuses on these mixed messages.

The majority of student responses indicated a relationship between grades and mathematics self-efficacy beliefs and attitudes toward mathematics. Conducting a similar study in a school that does not use the traditional system of grades would be valuable.

Another area of future research is a longitudinal study could be conducted. Students could be followed over the course of their elementary and middle school years to investigate the long-term changes in attitudes toward mathematics and mathematics self-efficacy beliefs. Longitudinal data would provide more in depth analysis of students' descriptions over time. It also would allow the researcher to gather more solid evidence regarding changes in attitudes toward mathematics and mathematics self-efficacy beliefs.

References

Adler, P. A., & Adler, P. (1994). Observational techniques. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 377-392). Thousand Oaks, CA: Sage Publications.

Anderman, E. M. & Midgley, C. (1992, August). *Student self-efficacy as a function of classroom goal orientation.* Paper presented at the annual meeting of the American Psychological Association, Washington, DC. Abstract retrieved from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/13/60/2a.pdf

Anfara, V. A. (Ed.). (2001). *The handbook of research in middle level education.* Connecticut: Information Age Publishing.

Anfara, V. A. (2004). Creating high-performance middle schools: Recommendations from research. In S. C. Thompson, (Ed.), *Reforming middle level education: Considerations for policymakers* (pp. 1-18). Greenwich, CT: Information Age Publishing.

Anfara, V. A., & Brown, K. M. (2001). Advisor-advisee programs: Community building in a state of affective disorder? In Anfara, V. A. (Ed.), *The handbook of research in middle level education* (pp. 3-34). Connecticut: Information Age Publishing.

Alexander, W. M., Williams, E. L., Compton, M., Hines, V A., & Prescott, D. (1968). *The emergent middle school.* New York: Holt, Rinehart, and Winston, Inc.

Allport, G. W. (1935). Attitudes. In C. Murchinson (Ed.), *Handbook of social psychology* (pp. 798-844). Worcester, MA: Clark University Press.

Atkins, N. P. (1968). Rethinking education in the middle. *Theory Into Practice, 7*(3), 118-119. DOI: 10.1080/00405846809542134

Bandalos, D., Yates, K., Thorndike-Christ, T. (1995). Effects of math self-concept, perceived self-efficacy, and attributions for failure and success on test anxiety. *Journal of Educational Psychology, 87*(4), 611-623.

Bandura, A. (1971). *Social learning theory*. New York: General Learning Press.

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*(9), 1175-1184.

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.) *Encyclopedia of human behavior* (pp. 71-81). New York: Academic Press. Retrieved from http://www.des.emory.edu/mpf/BanEncy.html

Bandura, A. (1995). Exercise of personal and collective efficacy in changing societies. In A. Bandura (Ed.), *Self-efficacy in changing societies* (pp. 1-45). New York: Cambridge University Press.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares & T. Urdan (Eds.). *Self-efficacy beliefs of adolescents,* (Vol. 5., pp. 307-337). Greenwich, CT: Information Age Publishing.

Battista, M. (1999). The mathematical miseducation of America's youth: Ignoring research and scientific study in education. *Phi Delta Kappan, 80*(6), 424-433.

Bong, M. & Clark, R. E. (1999). Comparison between self-concept and self-efficacy in academic motivation research. *Educational Psychologist, 34*(3), 139-153.

Borst, R. W., & Rorvig, V. (2006). A national mathematics curriculum for the United States: Two perspectives. *Teaching Mathematics in the Middle School*, *12*(2), 70-72.

Bossing, N. L., & Cramer, R. V. (1965). *The junior high school.* Boston: Houghton Mifflin.

Bouchey, H., & Harter, S. (2005). Reflected appraisals, academic self-perceptions, and math/science performance during early adolescence. *Journal of Educational Psychology*, 97, (4), 673-686.

Braswell, J. S., Lutkus, A. D., Grigg, W. S., Santapau, S. L., Tay-Lim, B., & Johnson, M. (2001). *The nation's report card: Mathematics 2000.* Retrieved from http://nces.ed.gov/nationsreportcard/pubs/main2000/2001517.asp

Brown, D. F. (2001). Flexible scheduling and young adolescent development: A perfect match. In Anfara, V. A. (Ed.), *The handbook of research in middle level education* (pp. 125-139). Connecticut: Information Age Publishing.

Brown, K. M. (2001). Get the big picture of teaming: Eliminate isolation and competition through focus, leadership and professional development. In Anfara, V. A. (Ed.), *The handbook of research in middle level education* (pp. 35-71). Connecticut: Information Age Publishing.

Carnegie Corporation of New York. (1995). *Great transitions: Preparing adolescents for a new century*. *Concluding report.* Waldorf, MD: Carnegie Council on Adolescent Development.

Carnegie Council on Adolescent Development. (1989). *Turning points: Preparing American youth for the 21st century*. Washington, DC: Carnegie Council on Adolescent Development.

Carnegie Task Force on Education of Young Adolescents. (1989). *Turning points: preparing American youth for the 21st century*. Washington, D.C.: Carnegie Council on Adolescent Development.

Charles, R. I., Illingworth, M., McNemar, B., Mills, D., Ramirez, A., & Reeves, A. (2010). *Prentice-Hall Mathematics.* Boston: Pearson.

Chen, P., & Zimmerman, B. (2007). A cross-national comparison study of self-efficacy beliefs of middle-school mathematics students. *Journal of Experimental Education, 75*(3), 221-244.

College and Career Readiness Standards for Mathematics: Draft for Review and Comment, September 21, 2009. Retrieved from http://www.corestandards.org/Files/ Math Introduction.pdf

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches.* Thousand Oaks: Sage.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches.* Thousand Oaks: Sage.

Denzin, N. K. & Lincoln, Y. S. (2005). (Eds.). *The sage handbook of qualitative research (3rd Ed.).* Thousand Oaks: Sage Publications.

Dewey, J. (1917). The need for social psychology. *Psychological Review, 24*, 266-277. Retrieved from http://www.brocku.ca/MeadProject/Dewey/Dewey_1917.html

Dewey, J. (1966). *Democracy and education.* New York: Macmillan.

Dickinson, T. S. (2001). Reinventing the middle school: A proposal to counter arrested development. In T. S. Dickinson, (Ed.), *Reinventing the middle school* (pp. 1-20). New York: RoutledgeFalmer.

Doob, L.W. (1947). The behavior of attitudes. *Psychological Review, 54*(3), 135-156. Retrieved from http://ft.csa.com.er.lib.k-state.edu/ids70/resolver.php?sessid =nl83uripuna5tjmaaqmkh16ns2&server=csaweb108v.csa.com&check=d7d382dd309135 92fe73b0515947552b&db=psycarticles-set-c&key=REV%2F54%2Frev_54_3_135 &mode=pdf

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75-146). San Francisco, CA: W. H. Freeman.

Eccles, J. S. & Midgley, C. (1989). Stage-environment fit: Developmentally appropriate classrooms for young adolescents. In C. Ames & R. Ames (Eds.), *Research on motivation in education,* (Vol. 3, pp. 139-186). San Diego: Academic Press.

Eccles, J. S., Midgley, C., & Adler, T. F. (1984). Grade-related changes in the school environment: Effects on achievement motivation. In J. G. Nicholls (Ed.), *Advances in motivation and achievement* (pp. 283-331). Greenwich, CT: JAI Press.

Epstein, J. L., & McPartland, J. M. (1976). The concept and measurement of the quality of school life. *American Educational Research Journal, 13*(1), 15-30.

Erlandson, D. A., Harris, E. L., Skipper, B. L., & Allen, S. D. (1993). In M. M. McCue (Ed.), *Doing naturalistic inquiry: A guide to methods.* New Delhi, India: Sage.

Fennema, E., & Sherman, J. (1976). Fennema-Sherman mathematics attitudes scales: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *Journal for Research in Mathematics Education*, *7*(5), 324 326.

Friedel, J. M., Cortina, K. S., Turner, J. C., & Midgley, C. (2007). Achievement goals, efficacy beliefs and coping strategies in mathematics: The roles of perceived parent and teacher goal emphases. *Contemporary Educational Psychology*, 32, 434-458. doi: 10.1016/j.cedpsych.2006.10.009

Gallagher-Polite, M. M. (2001). Hope for Sandy: Transformation points: A reinvention paradigm. In T. S. Dickinson (Ed.), *Reinventing the middle school* (pp. 39-75). New York: RoutledgeFalmer.

George, P. S., & Alexander, W. M. (2003). *The exemplary middle school.* Thomson: Wadsworth.

Germain-McCarthy, Y. (2001). *Bringing the NCTM standards to life: Exemplary practices for middle schools.* Larchmont, NY: Eye on Education.

Ghee, A.C. & Khoury, J. C. (2008). Feelings about math and science: Reciprocal determinism and catholic school education. *Catholic Education: A Journal of Inquiry and Practice, 11*(3), 333-354.

Gilroy, M. (2002). Waking up students' math/science attitudes and achievement. *The Hispanic Outlook in Higher Education*, *13*, 21-23.

Hackett, G., & Betz, N. E. (1989). An exploration of the mathematics self-efficacy/mathematics performance correspondence. *Journal for Research in Mathematics Education, 20*(3), 261-273.

Haladyna, T., & Thomas, G. (1979). The attitudes of elementary school children toward school and subject matters. *Journal of Experimental Education, 48*, 18-23.

Hamburg, B. A. (1974). Early adolescence: A specific and stressful stage of the life cycle. In G. V. Coelho, B. A. Hamburg, & J. E. Adams (Eds.), *Coping and Adaptation* (pp.101-124). NY: Basic Books.

Higgins, J. (1970). Attitude changes in a mathematics laboratory utilizing a mathematics-through-science approach. *Journal for Research in Mathematics Education*, *1*(1), 43-56.

Holloway, I. (1997). *Basic concepts for qualitative research.* London: Blackwell Science.

House, J. D. (2006). Mathematics beliefs, instructional strategies, and algebra achievement of adolescent students in Japan: Results from the TIMSS 1999 assessment. *International Journal of Instructional Media, 33*(4), 443-462.

Howard, A. W., & Stoumbis, G. C. (1970). *The junior high and middle school: Issues and practices.* Scranton: Intext Educational Publishers.

Juvonen, J., Le, V., Kaganoff, T., Augustine, C., & Constant, L. (2004). *Focus on the wonder years: challenges facing the American middle school.* Santa Monica, RAND.

Kirk, K. (2009). Self-efficacy: Helping students believe in themselves. Retrieved from http://serc.carleton.edu/NAGTWorkshops/affective/ efficacy.html

Kloosterman, P. K., & Stage, F. K. (1992). Measuring beliefs about mathematical problem solving. *School Science and Mathematics,* 92(3), 109-115.

Kramer, L. R. (1992). Young adolescents' perceptions of school. In J. L. Irvin (Ed.), *Transforming middle level education: Perspectives and possibilities* (pp. 28-45). Boston: Allyn and Bacon.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Newbury Park: Sage Publications.

Lipka, R. P., Lounsbury, J. H., Toepfer, Jr., C. F., Vars, G. F., Allessi, Jr., S. P., & Kridel, C. (1998). *The eight-year study revisited: Lessons from the past for the present.* Columbus: National Middle School Association.

Lounsbury, J. H. (n.d.). Understanding and appreciating the wonder years. Retrieved from http://www.nmsa.org/moya/PlanYourCelebration/PRResources/Wonder Years/tabid/1198/Default.aspx

Ma, X., & Kishor, N. (1997). Assessing the relationship between attitude toward mathematics and achievement in mathematics: A meta-analysis. *Journal for Research in Mathematics Education, 28*(1), 26-47.

Ma, X., & Xu, J. (2004). Determining the causal ordering between attitude toward mathematics and achievement in mathematics. *American Journal of Education*, *110*, 256-280.

Mack, N., Woodsong, C., MacQueen, K. M., Guest, G., & Namey, E. (n. d.). *Qualitative research methods: A data collector's field guide.* Retrieved from http://www.fhi.org/NR/rdonlyres/emgox4xpcoyrysqspsgy5ww6mq7v4e44etd6toiejyxalhbmk5sdnef7fqlr3q6hlwa2ttj5524xbn/datacollectorguideenrh.pdf

Martinie, S. (2006). Some students do not like mathematics. *Mathematics Teaching in the Middle School*, *11*(6), 274.

McCoy, L. (2005). Effect of demographic and personal variables on achievement in eighth-grade algebra. *The Journal of Educational Research*, *98*(3), 131-135.

McLeod, D. (1994). Research on affect and mathematics learning in the JRME: 1970 to the present. *Journal for Research in Mathematics Education*, *25*(6), 637-647.

Meece, J. L., Wigfield, A., & Eccles, J. S. (1990). Predictors of math anxiety and its influence on young adolescents' course enrollment intentions and performance in mathematics. *Journal of Educational Psychology, 82*(1), 60-70.

Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., Gregory, K. D., Garden, R. A., O'Connor, K. M., Chrostowski, S. J., & Smith, T. A. (2000). *TIMSS 1999 international mathematics report: Finding from IEA's repeat of the Third International Mathematics and Science Study at the eighth grade.* Chestnut Hill, MA: Boston College, Lynch School of Education, International Study Center. Retrieved from http://www.timss.org/timss1999i/math_achievement_report.html

Nardi, E. & Steward, S. (2002). I could be the best mathematician in the world… If I actually enjoyed it. *Mathematics Teaching, (179)* 41-44.

National Committee on Mathematical Requirements. (1923). *The reorganization of mathematics in secondary education: A report of the national committee on mathematics requirements under the auspices of the mathematical association of America, Inc.* Oberlin, OH.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: National Council of Teachers of Mathematics.

National Council of Teachers of Mathematics. (2006). *Curriculum focal points for prekindergarten through grade 8 mathematics.* Reston, VA: National Council of Teachers of Mathematics.

National Education Association. (1899). *Report of committee on college entrance requirements.* University of Chicago Press.

National Education Association. (1927). *The junior high school curriculum.* Washington, DC: Department of Superintendence.

National Middle School Association. (1995). *This we believe.* Ohio: National Middle School Association.

National Research Council, Mathematical Sciences Education Board and the Board on Mathematical Sciences. (1989). *Everybody counts: A report to the nation on the future of mathematics education.* Washington, DC: National Academy Press.

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

Neale, D. (1969). The role of attitudes in learning mathematics. *The Arithmetic Teacher, 8,* 631-640.

No child left behind act of 2001, Pub. L. No 107-110, 115 Stat. 1425 (2002). Retrieved from http://www.ed.gov/policy/elsec/leg/esea02/107-110.pdf

Noddings, N. (1992). *The challenge to care in schools: Alternative approaches to education.* New York: Teachers College Press.

O'Brien, V., Martinez-Pons, M., & Kopala, M. (1999). Mathematics self-efficacy, ethnic identity, gender, and career interests related to mathematics and science. *Journal of Educational Research, 92*, 231-236.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, *66*(4), 543-578.

Pajares, F. (2000). Current directions in self-efficacy research. In M. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement,* Volume 10, (pp. 1-49). Greenwich, CT: JAI Press. Retrieved from http://www.des.emory.edu/mfp;effchapter.html

Pajares, F. (2006). Self-efficacy during childhood and adolescence: Implications for teachers and parents. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents*, (pp. 339-367). Greenwich, CT: Information Age Publishing.

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology, 86*(2), 193-203.

Pajares, F., & Miller, M. D. (1995). Mathematics self-efficacy and mathematics performances: The need for specificity of assessment. *Journal of Counseling Psychology, 42*(2), 160-198.

Patton, M. Q. (2002). *Qualitative evaluation and research methods* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Pearson Education Inc. (1986). Reciprocal Determinism. [Graph illustration the model of reciprocal determinism April 8, 2009]. Retrieved from http://www.integratedsociopsychology.net/reciprocal_determinism.html

Picker, S., & Berry, J. (2001). Your students' images of mathematicians and mathematics. *Mathematics Teaching in the Middle School, 7*(4), 202.

Pietsch, J., Walker, R., & Chapman, E. (2003). The relationship among self-concept, self-efficacy, and performance in mathematics during secondary school. *Journal of Educational Psychology, 95*(3), 589-603.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research, and Applications (2nd Ed.).* Columbus, OH: Merrill-Prentice Hall.

Pitton, D. E., (2001). The school and the child and the child in the school. In T. S. Dickinson, (Ed.), *Reinventing the middle school* (pp. 21-38). New York: RoutledgeFalmer.

Powell, R., & Van Zandt Allen, L. (2001). Middle school curriculum. In Anfara, V. A. (Ed.), *The handbook of research in middle level education* (pp. 107-124). Connecticut: Information Age Publishing.

Reynolds, A. J. (1991). The middle schooling process: Influences on science and mathematics achievement from the longitudinal study of American youth. *Adolescence, 26*(101), 133-159.

Reynolds, A. J. & Walberg, H. J. (1992). A process model of mathematics achievement and attitude. *Journal for Research in Mathematics Education, 23*(4), 306-328.

Sampson, H. (2004). Navigating the waves: The usefulness of a pilot in qualitative research. *Qualitative Research, 4,* 383-402. doi: 10.1177/1468794104047236

Schommer-Aikins, M., Duell, O. K., & Hutter, R. (2005). Epistemological beliefs, mathematical problem-solving beliefs, and academic performance of middle school students. *The Elementary School Journal, 105*(3), 289-304.

Schunk, D. H. (1981). Modeling and attributional effects on children's achievement: A self-efficacy analysis. *Journal of Educational Psychology, 73*(1), 93-105.

Schunk, D. H. (1989a). Self-efficacy and achievement behaviors. *Educational Psychology Review, 1*(3). 173-208. doi: 10.1007/BF01320134

Schunk, D. H. (1989b). Social cognitive theory and self-regulated learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theory, research, and practice* (pp. 83-110). New York: Springer-Verlag.

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*(3 & 4), 208-231.

Schunk, D. H. (1996). Goal and self-evaluative influences during children's cognitive skill learning. *American Educational Research Journal, 33*(2), pp. 359-382. Retrieved from http://www.jstor.org/stable/1163289

Schunk, D. H., & Pajares, F. (2002). The development of academic self-efficacy. In A. Wigfield & J. Eccles (Eds.), *Development of Achievement Motivation.* Retrieved from http://www.des.emory.edu/mfp/SchunkPajares2001.PDF

Siegel, M. A., & Ranney, M. A. (2003). Developing the changes in attitude about the relevance of science (CARS) questionnaire and assessing two high school science classes. *Journal of Research in Science Teaching*, *40*(8), 757-775. doi: 10.1002/tea.10110

Stake, R. E. (2005). Qualitative Case Studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research (3rd Ed.)* (pp. 443-466). Thousand Oaks: Sage Publications.

Stemnock, S. K. (1969). *Middle schools in action. Educational research circular number two.* Washington, DC: Educational Research Service. Retrieved from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/32/35/53.pdf

Sutton, J., & Krueger, A. (Eds.). (2002). *EDThoughts: What we know about mathematics teaching and learning.* Aurora, CO: Mid-continent Research for Education and Learning.

Swafford, J. O., & Brown, C. A. (1989). Attitudes. In M. M. Lindquist (Ed.), *Results from the fourth mathematics assessment of the national assessment of educational progress.* Reston, VA: National Council of Teachers of Mathematics, Inc.

Tapia, M., & Marsh, G. (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly, 8*(2), 16-21.

U.S. National Research Center (1996). Summary from the national press conference releasing the first four reports of US TIMMS October 15, 1996: *Summary of Findings.* Retrieved from http://ustimss.msu.edu/summary.htm

Usher, E. (2009). Sources of middle school students' self-efficacy in mathematics: A qualitative investigation. *American Educational Research Journal, 46*(1), 275-314.

Weiner, B. (1986). *An attributional theory of motivation and emotion.* New York: Springer-Vergag.

Wigfield, A., Eccles, J. S., Mac Iver, D., Reuman, D. A., & Midgley, C. (1991). Transitions during early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across the transition to junior high school. *Developmental Psychology*, *27*(4), 552-565.

Wigfield, A., & Meece, J. L. (1988). Math anxiety in elementary and secondary school students. *Journal of Educational Psychology, 80*(2), 210-216.

Wilkins, J., & Ma, X. (2003). Modeling change in students attitude toward and beliefs about mathematics. *The Journal of Educational Research*, *97*(1), 52-63.

Willems E. P., & Raush, H. L. (1969). *Naturalistic viewpoints in psychological research.* New York, NY: Holt, Rinehart, and Winston.

Williamson, R. D., & Johnston, J. H. (2004). Creating academically challenging middle level schools for every child. In S. C. Thompson (Ed.), *Reforming middle level education: Considerations for policymakers* (pp. 33-48). Greenwich, CT: Information Age Publishing.

Yenilmez, K., Girginer, N., & Uzun, O. (2007). Mathematics anxiety and attitude level or students of the faculty of economics and business administrator: The Turkey model. *International Mathematics Forum, 2*, (41), 1997-2021.

Yin, R. K. (2003). *Case study research: Design and method* (3rd ed.). Thousand Oaks, CA: Sage.

Zimmerman, B. J. (1989). Models of self-regulated learning and academic achievement. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theory, research, and practice* (pp. 1-25). New York: Springer-Verlag.

Zimmerman, B. J. (1995). Self-efficacy and educational development. In A. Bandura (Ed.), *Self-efficacy in changing societies* (pp. 202-231). New York: Cambridge University Press.

Appendix A - Letter to Principal

Dear Middle School Principal,

My name is Janet Stramel and I teach mathematics methods at Fort Hays State University in Hays, Kansas. In addition, I am a doctoral student at Kansas State University. I am writing to ask you to allow me to observe your students as part of a qualitative research study on middle school students' attitudes toward mathematics and the ways in which those attitudes influence their self-efficacy beliefs. This is part of the requirements for a doctoral degree. I hope that you will agree to participate.

I have spoken with your Assistant Superintendent XXXX, who has given me permission to conduct my research at your school.

By participating in this study, I will be asking your mathematics teachers to allow me to sit in your classroom strictly as an observer. I will be observing the students for evidence of their attitudes toward mathematics and self-efficacy beliefs. After the classroom observations, I will randomly select some of the students to interview after school. I will also be asking your teachers to give me approximately 10 minutes of their class time to give their students a short-answer questionnaire.

I will seek parent permission before I conduct any research. Participation in this study will be completely voluntary, and will not affect the students' grades. All identities will be kept strictly confidential. Your name, school, teachers' names and students' names will not appear in the study. Stories will only be referenced by pseudo names. All transcripts will be kept in a secure location in my home. I will be willing to share my findings with you at the completion of my research.

Please contact me by replying by e-mail to jkstramel@fhsu.edu or by mail to 411 W. 8th #1, Hays, KS 67601. Or please feel free to contact me by phone, at 785-628-4474 or 785-341-2754.

Thank you for allowing me to conduct my research in your school.

Sincerely,

Janet Stramel

Appendix B - Letter to Teachers

Dear Middle School Mathematics Teacher,

My name is Janet Stramel and I teach mathematics methods at Fort Hays State University in Hays, Kansas. In addition, I am a doctoral student at Kansas State University. In order to gain insight into the middle school students' attitudes toward mathematics and the ways in which those attitudes influence their self-efficacy beliefs, I would ask that you allow me to observe your students as part of a qualitative research study. This is part of the requirements for a doctoral degree. I hope that you will agree to participate.

I have spoken with your Assistant Superintendent XXXX and your Principal XXXX, who have both given me permission to conduct my research at your school.

If you agree to participate in this study, the following is what I will be asking of you:

- Give your students a short-answer questionnaire. This should take approximately 10 minutes of your class time.
- Allow me to sit in your classroom strictly as an observer. I will be observing your students' attitudes toward mathematics and self-efficacy beliefs. After the classroom observations, I will randomly select some of your students to interview after school.
- I will be seeking parent permission, so I would ask that you help me distribute and collect permission forms.

Participation in this study is completely voluntary. If you agree to participate in this study, your identity will be kept strictly confidential. Your name, school, and students' names will not appear in the study. Stories will only be referenced by pseudo names. All transcripts and field notes will be kept in a secure location in my home. I will be willing to share my findings with you at the completion of my research.

Please contact me by replying by e-mail to jkstramel@fhsu.edu or by mail to 411 W. 8th #1, Hays, KS 67601. Or please feel free to contact me by phone at 785-628-4474 or 785-341-2754.

Thank you for your consideration.

Sincerely,

Janet Stramel

Appendix C - Letter to Parents

Students to be Interviewed

Dear Parent/Guardian,

My name is Janet Stramel and I teach mathematics methods in the Teacher Education Department at Fort Hays State University in Hays, Kansas. In addition, I am a doctoral student at Kansas State University. I am writing to ask you to allow me to interview your child as part of a qualitative research study on middle school students' attitudes toward mathematics and the ways in which those attitudes influence their self-efficacy beliefs. This is part of the requirements for a doctoral degree. I hope that you will agree for your child to participate.

I was a middle school mathematics teacher for 25 years. I was concerned with my students' dislike of mathematics and wanted to understand why they hated mathematics and how to change those attitudes and beliefs.

I have spoken with the Assistant Superintendent XXXX and the Principal XXXX, who have both given me their permission to conduct my research at your child's school.

Participation in this study will include an interview conversation that will last approximately 30 minutes and will be conducted after school in a quiet location in the school. The conversation will be recorded by a tape recorder, and I will also be taking written notes.

Participation in this study is completely voluntary, and your child may withdraw from the study at any time. Participation in this study will not affect your child's grade. If you agree for your child to participate in this study, his/her identity will be kept strictly confidential. His/her name and school will not appear in the study. Stories will only be referenced by pseudonyms. All transcripts will be kept in a secure location in my home. I will be willing to share my findings with you at the completion of my research.

I will be contacting you to schedule a time for the interview.

If you have any questions, please contact me, either by e-mail at jkstramel@fhsu.edu or by mail to 411 W. 8th #1, Hays, KS 67601. Or please feel free to contact me by phone, 785-341-2754.

Thank you for your consideration.

Sincerely,

Janet Stramel

Appendix D - Consent Document

INFORMED CONSENT

PROJECT TITLE: **A Naturalistic Inquiry into the Attitudes toward Mathematics and Mathematics Self-Efficacy Beliefs of Middle School Students**

APPROVAL DATE OF PROJECT: **4-4-10** **EXPIRATION DATE OF PROJECT:** **4-4-11**

PRINCIPAL INVESTIGATOR: CO-INVESTIGATOR(S): **Dr. Gail Shroyer**
Janet Stramel

CONTACT AND PHONE FOR ANY PROBLEMS/QUESTIONS: **Janet Stramel;**
785-341-2754 or 785-628-4474

IRB CHAIR CONTACT/PHONE INFORMATION: Rick Scheidt, Chair,
Committee on Research Involving Human Subjects,
203 Fairchild Hall
Kansas State University
Manhattan, KS 66506
785-532-3224.

SPONSOR OF PROJECT: **Dr. Gail Shroyer**

PURPOSE OF THE RESEARCH: **The purpose of this research project is to seek to understand the nature of middle school students' attitudes toward mathematics and the ways in which those attitudes influence their mathematics self-efficacy beliefs. This research is being done as part of the requirements for a doctoral degree.**

PROCEDURES OR METHODS TO BE USED: **One-on-one interviews**

LENGTH OF STUDY: **Interviews will last approximately 60 minutes.**

RISKS ANTICIPATED: **There are no known risks to the participants.**

BENEFITS ANTICIPATED: **The expected benefits of this study will be:**

1) **The voices of the middle school child will be heard regarding their attitudes toward mathematics and their self-efficacy beliefs,**
2) **Teachers will know when and where to intervene so that their students can be successful.**
3) **Insights will be gained about we train future teachers to mathematics to middle school children.**
4) **To the field of education.**

EXTENT OF CONFIDENTIALITY: **All participants will be given pseudo names and/or codes in order to protect their identity.**

PARENTAL APPROVAL FOR MINORS:

TERMS OF PARTICIPATION: I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name: ______________________________

-
- **Participant Signature:** ______________________________ **Date:** ____________________

Witness to Signature: (project staff) ______________________________ **Date:** ____________________

Appendix E - Survey Instructions for Teachers

Dear Mathematics Teacher,

Thank you again for your assistance with the short-answer questionnaire. Please give the questionnaire at the beginning of class. Before giving the questionnaire, please read the following information:

This questionnaire is for a study about mathematics attitudes and self-efficacy beliefs. The questionnaire is completely anonymous. Participation in this study is completely voluntary, and will not affect your grade.

Do not write your name on your paper, but please write in your grade level. There are no right or wrong answers. If there is a question that is unclear, or that you don't understand, please leave it blank.

This questionnaire should take no more than 5 minutes of your class time. If you have any questions, please let me know.

Thank you again for your willingness to participate in this study.

Janet Stramel

Appendix F - Short-Answer Questionnaire

This questionnaire is strictly voluntary. There is no penalty for not completing the questionnaire and it will not affect your grade. The questionnaire will take approximately 10 minutes to complete. You may skip any questions that make you feel uncomfortable.

By continuing with this survey, you are agreeing/providing your assent to continue.

1. I am in the ________ grade.

2. Do you like math? _________________________

3. Do you believe you can do mathematics? ______________________________

4. When I think of mathematics, I feel ______________________________________.

5. I believe I will be ________________________________ in mathematics this year.

6. I feel mathematics is ____.

7. Mathematics homework is ____.

8. My favorite part of mathematics is ____.

9. My least favorite part of mathematics is ____________________________________.

Appendix G - Observation Protocol

Class ______________________ Time Observed ____________________________

Grade Level Observed _______ Number of students in the class ______________

Technology/manipulatives ____

Mathematics topic ____

Curriculum used ____

Kinds of problems given to students ____

Opportunities for students to work together ____________________________________

The nature of the questions the teacher poses ___________________________________

Category	Includes	Notes
Verbal behavior and interactions	Verbal frustrations; Support and encouragement from teacher/peers	
Non-verbal behavior	Engagement in class; body language; Enjoyment; Enthusiasm levels	
Physical behavior and gestures	What students do, who does what, who interacts with whom, who is not interacting	
Experiences	Student success or failure; teacher praise and encouragement; peer encouragement;	
People who stand out	Identification of people who receive a lot of attention from others	

Adapted from Mack, Woodsong, MacQueen, Guest, Namey (n. d.)
Other notes:

Appendix H - Interview Protocol

A Naturalistic Inquiry into the Attitudes toward Mathematics and
Mathematics Self-Efficacy Beliefs of Middle School Students

Time of interview: ____________________________________

Date of interview: ____________________________________

Location: ____________________________________

Interviewer: ____________________________________

Interviewee: ____________________________________

Thank you for consenting to participate in this study. I would like to record the interview so the study can be as accurate as possible. You may request that the tape recorder be turned off at any point of the interview.

Questions that the participants will be asked include:

1. Please tell me a little about yourself.

2. How is school going for you?

3. What is your favorite subject in school?

4. If mathematics, why do you think it is your favorite?

5. What is your least favorite subject in school?

6. If mathematics, why do you think it is your least favorite?

7. Let's talk about mathematics.

   What are you currently studying in mathematics?

8. Is there something that you really have liked in mathematics this year?

9. Is there something that you really disliked in mathematics this year?

10. Overall, do you like mathematics?

    If yes, then ask: Have you always liked mathematics?

If yes, then skip to Q14. If no, then ask Q11.

11. Can you remember a time when you liked mathematics?

12. What were you doing in mathematics when you liked it?

13. You said that you don't like mathematics now, but you used to like mathematics. Any ideas why?

14. Do you feel successful in mathematics? Why or why not?

    If no, then ask Q15:

15. Do you remember a time when you did feel you could be successful in mathematics?

16. Do you remember what you were doing in mathematics or what was different when you felt successful in mathematics?

17. What mathematics activities are most helpful to you?

18. Tell me how you feel about mathematics.

19. Who was your mathematics teacher last year?

20. What was different about mathematics last year compared to this year?

21. Do you think your attitude toward mathematics has changed? When did it change? Has it changed from elementary school?

22. Do you know anyone who loves mathematics?

23. Do you know anyone who hates mathematics?

24. How do you feel when you study/learn mathematics?

25. What do you believe about yourself and mathematics?

26. Tell me about your best experience in mathematics.

27. Tell me about your worst experience in mathematics.

28. If you were the mathematics teacher, what would you do differently?