The Effects Of Literature On Student Motivation And Connections In Mathematics

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THE EFFECTS OF LITERATURE
ON STUDENT MOTIVATION AND CONNECTIONS
IN MATHEMATICS

by

ARNITA A. WASHINGTON
B.S. University of Central Florida, 1990

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Education in K-8 Mathematics and Science
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ABSTRACT

The purpose of this study was to determine the effects of literature use in the middle grades mathematics curriculum on student motivation and connections. This study involved collecting several types of data regarding students’ attitudes, motivation, and their abilities to make real-world connections. Findings from pre and post attitude surveys indicated that literature use in the mathematics curriculum has no effect on students’ attitudes towards mathematics. Furthermore, findings from journal entries, students’ work, and interview responses indicate that although students find storybooks fun and interesting, their use does not seem to lead to increases in students’ understanding of mathematics. However, findings from journal entries, students’ work and interview responses indicated that students were better able to make real-world connections through storybooks that were meaningful to their lives. Suggestions for future research should include comparative studies on the effects of literature on student performance in middle grades mathematics.
This thesis is dedicated to my wonderful family. To my devoted husband, Darrin, thank you for love and continued support of me in this endeavor. To Nadia and Katrina, thank you for your patience and ongoing concern for me. To all of my wonderful family members and friends, thank you for your continued prayers and encouragement. To God, for His continued guidance as I completed this project: Thank you.
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CHAPTER 1: INTRODUCTION

Literature imitates life. In the past, not only has literature served as the preferred choice for reading instruction, but it has also supported the social studies and the science curriculums, providing rich, authentic, real-world experiences (Griffiths & Clyne, 1991). These experiences have allowed the concepts that students learn to be vivid, relevant, and meaningful. According to Griffiths and Clyne, today, literature is being used in mathematics classrooms, allowing students to experience the same authentic, real-world experiences with mathematics that they have had with language, social studies, and science.

Mathematics and literature have strong links and when used together offer many benefits. One form of literature used in the mathematics classroom today, is the art of storytelling. According to Whitin and Wilde (1995), the teaching and learning of mathematics, can be changed tremendously if mathematics is viewed as a tool for telling stories. Griffiths and Clyne state, “The magic of telling and reading stories should be offered to all children” (1991, pg.5). The National Council of Teachers of Mathematics (NCTM) has stated that one of the primary goals of teaching mathematics should be to increase the amount and quality of children’s mathematical communication (2000). This has prompted teachers to use children’s books and storytelling as a way to facilitate and promote communicating mathematical ideas. Storybooks help to extend and develop children’s ideas of the world around them, which helps them to make their own mathematical connections.

As suggested by Shiro (1997), literature and storytelling also provide children with better attitudes toward mathematics. The use of books and storytelling allows mathematics to be more enjoyable in the classroom, as compared to traditional mathematics teaching. When children are given the opportunity to make their own mathematical connections, they can be very creative and
inventious. Stories and books make mathematics true and real and allow children to discuss, explore, and extend their thinking (Whitin & Wilde, 1992).

**Statement of the Problem**

I teach at a middle school that is a mathematics, science, and technology magnet school, which is also considered to be a Title I school. Title I is a federal program which originally began with the Elementary and Secondary Education Act (ESEA) of 1965. According to the U.S. Department of Education (2001), it was enacted as part of the “War on Poverty” (p. 2). Its primary purpose was to ensure that all children have an equal educational opportunity regardless of their socioeconomic background, and to close the achievement gap between poor and affluent children by providing additional resources for schools which serve disadvantaged students (USDOE, 2001). In order for a school to be identified as a Title I school and receive Title I funding, the school has to have a 50% or higher of the student population receiving free or reduced lunch. At my school, 51% of the students enrolled receive free or reduced price lunch.

Two years ago, due to consistently low Florida Comprehensive Assessment Test (FCAT) Reading scores; our school applied for and received a grant, specifically to fund a full-time Literacy Specialist. The FCAT is a statewide test that was created to determine whether students that are being educated in the state of Florida, are learning the content they are supposed to be learning in school. This content is described as the Sunshine State Standards (SSS). The Sunshine State Standards were created in the mid-1990’s by a group of Florida teachers who created a list of what they thought Florida’s students need to know in core academic areas such as reading, writing, and mathematics. Students within the state are tested annually to measure what they are learning.
The primary role of our Literacy Specialist was to facilitate a campus-wide reading program to increase overall time spent reading, while in turn, attempting to increase FCAT Reading scores. The reading program, entitled Reading for Understanding (RUN), would require all students to read twenty minutes per day, four days per week, in their homeroom class. Not only did our literacy specialist implement a program to increase the amount of time students spent reading, she also provided techniques and resources to assist teachers in integrating reading across all academic subjects.

In her presentation, the literacy specialist discussed the benefits of using literature across all academic areas. One benefit that was mentioned was how the use of storybooks could peak students’ interest by engaging them in learning. Since many of the students that attend my school do not perform on grade level, and do not seem to be interested in mathematics, I thought using literature could motivate my students to become interested in learning mathematics.

During the 2003-2004 academic year our school received a reading grant, which allowed our school to purchase mathematics storybooks, and other trade books. A staff development in-service was conducted, where teachers were given instruction as to how to integrate literature into any academic subject, including mathematics. Before the in-service, I had never used literature to teach middle grades mathematics. I was also not aware of any other middle grades mathematics teachers that integrated literature into their mathematics teaching.

The idea of using literature in my mathematics class sounded like a great idea and I became interested in discovering how my students would respond to the use of literature in a mathematics class. I became interested in knowing how effective using literature would be in motivating my students to learn mathematics. I also wanted to know if literature use would
allow students to make real-world connections, which would in turn lead to a better understanding of mathematics.

Purpose of the Study

The purpose of this study is to investigate the effect of literature on student motivation, while investigating students’ abilities to make real-world connections in middle school mathematics as a result of literature use.

Significance of the Study

According to Midgley and Urdan (1992), students’ motivation and performance declines for many middle school students, as they transition from elementary school to middle school. Further, by the time students reach middle school, many show a lack of interest in schoolwork (Brewster & Fager, 2000). Brewster and Fager also explain that although teachers have little control over the factors that contribute to students’ interest and level of engagement in learning, teachers can influence students’ motivation. They offer several suggestions that teachers can use to help motivate students to engage in class activities. One of which is that teachers should choose materials that relate to students’ lives, and is meaningful to students outside and within the classroom. Brewster and Fager state, “Students are more engaged in activities when they can build on prior knowledge and draw connections between what they are learning and the world they live in (p. 5).”

The significance of this study was two-fold. First, this study should help determine if literature integrated in the mathematics curriculum motivates students to learn mathematics. Second, this study could determine if literature such as story books in mathematics helps
students to use information that they gather in the story line, and connect it to their own real-world experiences.

**Definition of Terms**

1. **Real-world Connections**: the student’s ability to learn mathematics and understand how mathematics functions in their everyday world.

2. **Literature**: printed material such as mathematical storybooks, picture books, children’s books, rhymes, and stories.

3. **Middle School Students**: 7th grade students enrolled in a magnet mathematics class.

**Overview of Thesis**

Throughout this study, I will closely examine my practice of literature use in the mathematics classroom, while simultaneously examining the effects of using literature on students’ motivation to learn mathematics and their abilities to make real-world connections.
CHAPTER 2: REVIEW OF LITERATURE

Middle grades mathematics teachers are continuously searching for approaches to teaching mathematics that both motivate students to learn mathematics, and allow them to make real-world connections. The National Council of Teachers of Mathematics (NCTM) standards for grades 5-8 state that middle school students should have opportunities to use language, in the form of writing and speaking, to communicate their mathematical ideas. NCTM believes that communication is an essential part of mathematics and mathematics education (NCTM, 2000). According to Pinchback (2001), the use of literature plays an important role in communicating deep, meaningful, mathematical understanding among middle school students. This literature review will examine how the practice of using literature in the mathematics classroom can increase student motivation and enhance mathematical understanding and connections among middle school students. Several studies are presented that support the relationship that exists among literature, motivation, and mathematics connections. This chapter contains four sections, which will discuss the value of picture books, literature and real-world connections, students’ attitudes towards mathematics, and students’ motivation to learn mathematics.

The Value of Picture Books

Today, there is a new trend where picture books are not just read by younger readers, but older readers find picture books just as appealing (Miller, 1998). According to Miller, the combination of stimulating artwork, short text, and readability, make picture books appealing to middle school students. Henry and Simpson (2001) suggest that because students are visually stimulated by watching TV, playing video games, and using computers, picture books are a good resource for middle school students, for the same reasons. Children’s books
can also enhance mathematical learning and offer many advantages when used in the mathematics classroom. A primary advantage discussed by Henry and Simpson (2001) is that picture books are quite useful for mathematics when introducing new concepts or ideas. Students can read a picture book about mathematics, and then use what they have learned to explain a concept by creating their own picture books. Another advantage to using picture books is their brevity. Henry and Simpson state that unlike novels, picture books can typically be read within 15-30 minutes, which leaves time in a classroom for discussion and lesson activities.

Additionally, Sanacore (2000) explains that not only are picture books valuable because of their appeal and their brevity, middle school students enjoy it when the story is read aloud by the teacher. Sanacore further adds that, contrary to what some educators may believe, reading aloud is an appropriate approach in the middle grades. Hamilton and Weiss (1990) explain that listening to stories that are read aloud offers numerous instructional benefits, and affects children in many ways. Listening to stories stimulates children’s imagination, motivates children to read, improves listening skills, and helps to broaden vocabulary.

*Literature and Real-World Connections*

Mathematics reform movements of today are continuously calling for mathematics curricula to address the learning of mathematics through communication and real-world connections (NCTM, 2000). Griffiths and Clyne (1991) explain by saying:

“Using books, stories, and rhymes to stimulate thinking about mathematics and to develop and reinforce mathematical concepts enhance children’s understanding of mathematics, allows them to enjoy the subject, and helps them to make mathematical representations and connections” (p. 9).
Whitin and Wilde (1995) add that as mathematics is linked to real-world situations that take place in a story, children can connect that mathematics to their own personal experiences. Whitin and Wilde also state, “When mathematics is relevant to the lives of children, fun and learning can occur simultaneously” (p.99). Also, according to McDuffie and Young (2003), as teachers and students use books for discussion, it creates a classroom environment that promotes discourse. McDuffie and Young further explain that as teachers use discourse in mathematics, they discover that literature offers another opportunity for students to make meaning and build connections between mathematics and their lives.

In terms of literature and how it supports one’s ability to make real-world connections in general, according to Giorgis and Johnson (2003), each time we read a book aloud, discuss it, or respond to it, we are making our own connections. Giorgis and Johnson state, “Readers can experience the drama of everyday life through literature that echoes familiar situations…” (p. 841). Johnson, Giorgis and Brown (2003) say, “Literature illuminates life. It brings meaning to our human existence and helps us deal with the world in which we live” (p. 710).

Students’ Attitudes Towards Mathematics

Within the last ten years, researchers have noted that students’ beliefs and attitudes about mathematics directly affect their mathematics learning (Diaz-Obando et al., 2003). As cited in Ma (2003), Neale (1969), in his definition of attitudes towards mathematics, defined it as a construct with many phases that describes “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” (p. 439).
Specifically, in the study conducted by Diaz-Obando et al. (2003) on the impact of students’ beliefs and attitudes towards mathematics, they discussed that students’ beliefs have a powerful impact on the ways in which students learn and use mathematics in certain contexts. Moreover, they explained that in terms of their study, students who believe that mathematics will be useful to them in the future develop a desire to learn mathematics. In Ma’s (2003) study, it was stated that students construct attitudes about certain subjects just as they construct attitudes about other aspects of their world. This process is influenced by environmental factors, such as students, family, and school characteristics, as well as individual influences. Additionally, Ma (2003) explains that research shows that students who excel in mathematics maintain a positive attitude towards mathematics and a motivation to learn mathematics.

Students’ Motivation to Learn Mathematics

Strong motivation and engagement in learning have been consistently linked to increased student success (Brewster & Fager, 2000). However, studies have shown that students’ motivation and performance declines for many middle school students, as they transition form elementary school to middle school (Midgley & Urdan, 1992). Student motivation is defined as a student’s willingness, need, desire and compulsion to participate in, and be successful in the learning process (Brewster & Fager, 2000). According to Midgley and Urdan (1992), middle school is a difficult stage for many young adolescents, and the decline in motivation and performance is to be expected and could be due to developmental factors, students’ perceptions, social factors, and many other influences.

Student motivation is often divided into two categories, extrinsic motivation and intrinsic motivation (Brewster & Fager, 2000). Extrinsic motivation can be described as when a student
engages in learning to obtain a reward or to avoid being punished; while intrinsic motivation can
be described as when students actively engage themselves in learning out of curiosity, interest,
 enjoyment, or to achieve a personal goal (Brewster & Fager, 2000).

Several studies were examined to investigate the relationship that exists between
literature and mathematical connections (Greenlaw & Tipps, 1997; Pinchback, 2001; Jenner,
2002; Karp et al., 1998). Each study examined how integrating literature into the mathematics
curriculum stimulates mathematical learning, through engaging students in literature that is
relevant, realistic and interesting to them. This, in turn, allows students to make real-world
connections. A review of the study conducted by Greenlaw and Tipps (1997) focused on how
teachers can use printed materials to teach middle grades mathematics. Greenlaw and Tipps
declared printed materials as picture books, chapter books, poems, newspapers, and reference
materials.

The study took place in a seventh grade mathematics classroom where the teacher used a
wordless picture book entitled *Zoom*, written by Istvan Banyai, to begin a unit on proportions,
percentages, and fractions (Greenlaw & Tipps, 1997). The teacher took this approach to
introducing her unit on fractions because she wanted the students to no longer view fractions as a
concept that is too hard to understand, and has no meaning in their everyday lives. Using the
idea of “zoom”, the students used an office copy machine to reduce and enlarge photographs
taken with a digital camera. At the conclusion of the activity, the students discovered that
fractions and percentages were not as difficult to understand as they had originally thought.
They were able to see that fractions and percentages have meaning in their everyday lives, and
they are simply ways of recording and communicating ideas about related sizes and amounts.
The results of the study suggested when teachers choose printed materials that are relevant,
interesting, and engaging; students’ mathematical understanding can be enhanced, because literature allows them to make the appropriate connections.

Another study that was examined was conducted by Pinchback (2001). Pinchback also discussed the use of literature in mathematics, and how literature is used to communicate students’ understanding of mathematical concepts. There were six students who took part in the study, which took place in a 6th grade prealgebra class in what the author refers to as a gifted and talented program. The participants of the study were taught by an algebra teacher four days per week, and participated in an enrichment activity once a week for four weeks. A gifted specialist taught the enrichment session.

The study began with the specialist introducing the students to a short chapter book entitled *A Gebra Named Al* (Isdel, 1993), as part of their enrichment activity. *A Gebra Named Al* (Isdel, 1993) is a short chapter book about a frustrated algebra student who falls asleep while contemplating a mathematical problem. She wakes in the Land of Mathematics and meets Al the Gebra and other creatures as she journeys to meet the mathematician who will help her to find her way home. In order for her to return home, she has to answer a series of questions relating to different mathematical concepts.

The students were assigned one section per week, where they were required to read independently and answer four questions. The four questions, which were given as the final assignment, were all related to the characters in the book, specific mathematical concepts, and the students’ abilities to communicate the mathematical concepts accurately in their responses to the questions. One question was related to the order of operations, while others related to solving equations, and exponents. At the end of the fourth week, the students were assessed to gauge how well they understood the mathematical concepts within the book. According to
Pinchback (2001), they chose literature that was engaging and mathematically rich, which encouraged the students to express their mathematical knowledge of the content. At the conclusion of the study, Pinchback (2001) learned that the students in the study responded differently in their explanations. According to Pinchback, the students’ responses enlightened the teacher about how well the students understood the mathematical concepts. Some of the students connected what they knew about related concepts to the concepts in the story.

Another study that was examined was conducted by Jenner (2002) and took place in her 2nd grade classroom. This study was conducted from a different perspective than the two previous studies mentioned. The motivation behind this study resulted from what Jenner refers to as “narrow perspectives” (p. 167) on how children’s books can be used in the classroom. According to Jenner, teachers should not use literature in the classroom solely to introduce mathematics concepts. However, teachers should use literature so that children can discover the mathematics that is embedded in a story. Jenner states, “I am interested in the mathematics that the children “see” in the story” (p. 167).

The study began in Jenner’s classroom during shared reading sessions, where a series of the sessions were videotaped. Throughout the study, books were chosen by Jenner, that were mathematically rich in content, but with no specific mathematical goal in mind. At the conclusion of the study, the videotapes were reviewed, and the results supported her theory that children’s books could be used not only to introduce mathematics concepts, but also to develop mathematical understanding. Jenner further explained that teachers should use stories as opportunities for “incidental, unintended mathematical understanding” (p.171). Although Jenner shares that literature should be used for more than introducing concepts, she agrees that the use of literature does indeed enrich mathematical learning by saying:
“…I have become increasingly convinced that something exciting happens to my students’ mathematical understanding when we read and talk about stories together” (p. 167)

Karp, Brown, Allen and Allen (1998) investigated the use of role models in children’s literature to promote understanding of mathematics, specifically among girls. In their research, Karp et al. worked with upper elementary aged students in multi-aged classroom settings. The students ranged in age from eight to eleven years of age; with an age range of at least two years. In each classroom, a book was read aloud in its entirety with no interruptions. A discussion would follow where the children would discuss the characters, and their qualities and personalities, as they made connections between the characters’ lives and their own.

Karp et al. (1998) explained by saying that the use of children’s literature is “a way to supply a powerful context in which to build mathematical tasks and is a strong influence in the development of children’s perceptions about their world” (p. 89). Karp et al.’s strategy was to use storybooks to present what they refer to as “feisty females”, with hardy personalities. A hardy personality is defined as the propensity to look forward to changes and challenges. At the conclusion of their study, they discovered that through hands-on, cooperative tasks that connect mathematics to both girls and stories, an exciting opportunity to engage students in important mathematical concepts could emerge. Additionally, the research group went on to suggest that if we wish to develop and strengthen problem-solving abilities in females, we need to use female models with hardy personalities.

In the last fifteen years, using literature in the mathematics classroom has become very popular (NCTM, 2004). Although many studies have been conducted during that time frame, which discuss integrating literature in a mathematics class, some concerns have been raised. One concern addresses the result of how popular literature use has become. Literature use in the form
of children’s books in mathematics has become so popular that many newly written books are of low quality. According to NCTM (2004), books are being published that promote the book, not the curriculum. This, in turn, may lead to inaccurate information and present mathematics that is not worthwhile or meaningful to students. NCTM states, “another concern involves maintaining the integrity of the book” (p. xi). Experts state that a book that is chosen should be used in the classroom as children’s literature, in its entirety, not just sections. The reader risks losing the story line when only parts of books are used separately and when sections are used in excess.

Although there are many suggestions and reasons to integrate literature into mathematics instruction, there are very few formal studies that link literature use in the classroom to student achievement, specifically in middle school students. One study in particular, which was conducted by Hong (1996), linked literature use to achievement in kindergarten students. Hong (1996) conducted a study in order to analyze the effectiveness of using children’s literature to promote mathematics learning. Specifically, Hong’s primary purpose in conducting the study was to confirm that using literature to teach mathematics improves young children’s dispositions towards mathematics. Hong also wanted to investigate the effects of literature use on mathematics achievement. Hong’s study was conducted in a private kindergarten classroom located in a residential area of a large city in Korea. Each of the 57 participants (32 boys and 25 girls) ranged in age from four years, two months to six years, four months. The children were randomly assigned to two separate classrooms, which were divided into the experimental group and the control group.

The study began the 1st week of April and concluded the 5th week of May. Each week, a theme was chosen, followed by a concept map of intended learning outcomes. Teachers then selected storybooks for group time, and organized theme ideas into curricular areas. The final
step was developing mathematics activities or games. Both classrooms were typical kindergarten classrooms with child-centered, play-oriented programs. The lesson plans for both classes were the same, except for the selection of the storybooks and developing mathematics activities. In the experimental group, storybooks were chosen in terms of their relation to the weekly theme and how they contained ideas that could be developed into a mathematics activity or game. Also, the experimental group had access to mathematical materials and activities that related to the content of the storybook, whereas the control group had access to mathematics materials and activities that had no particular relation to the storybook content. In the control group, the storybooks related only to the weekly theme, with no consideration given to developing related mathematics activities or games.

The results of the study indicated that using literature in mathematics could increase students’ dispositions to voluntarily pursue mathematics learning (Hong, 1996). The results also indicated that there were no significant differences in achievement between the experimental group and the control group at the conclusion of the study. The same standardized mathematics achievement test was administered to both groups with no significant differences in scores. Hong suggested that this could be attributed to the fact that mathematics learning that is produced by children’s literature does not affect the type of achievement measured by standardized tests.

In the literature review, several studies were examined that discussed how literature in the mathematics classroom could enhance students’ mathematical understanding and learning. The results of the first study suggested that teachers could develop fun and engaging lessons by using printed materials such as picture books, or chapter books, to stimulate mathematical learning (Greenlaw and Tipps, 1997). The results of the second study paralleled the findings of the initial study by also suggesting that literature that is engaging allows students to express their
mathematical knowledge of the content (Pinchback, 2001). The study, which was conducted by Jenner (2002), took a different perspective than the two previous studies discussed. Jenner discussed that the use of literature in mathematics was not only used, but also used to foster unintended mathematical understanding, as well, with no particular mathematics goal in mind. Karp et al. (1998) in their study suggested that using storybooks with feisty female personalities might help in developing and strengthening problem solving in females. The final study conducted by Hong (1996) in a 2nd grade classroom indicated that although literature use in mathematics has no effect on achievement, literature use in mathematics does increase students’ dispositions to voluntarily pursue mathematics learning.

Of the studies reviewed, throughout each study, a similar theme continued to occur. Literature use in the mathematics classroom, according to the results of each study, helped to stimulate and foster students’ interest in learning mathematics. When teachers used literature and activities that were engaging to the students, students more readily participated in classroom learning.
CHAPTER 3: METHODOLOGY

Design of the Study

In the fall of 2004, I conducted a study using a qualitative research method to examine my teaching practice. Specifically, to examine how literature use in the mathematics classroom effects students’ motivation to learn mathematics and their abilities to make real-world connections. The qualitative research method used was action research. Action research, also known as teacher research, is an approach that is designed to provide teachers the opportunity to study and improve their own teaching practice (Gay and Airasian, 2003).

The data that were gathered to investigate the effects of literature on student motivation and connections, included teacher observations, student work, journals, interviews and attitude surveys. Teacher observations were used consistently throughout the study. Gay and Airasian (2003) state, “Observing participants in action and recording your observations is a common way to collect data in action research” (p. 267). According to Gay and Airasian, when teachers gather information by observing their students, it allows teachers to better understand their students’ interests or behavior in a subject area. Interviews were conducted at the conclusion of the study to gain insight as to whether students were motivated to learn mathematics as a result of literature in the classroom, and to measure their feelings about literature use in the classroom. Student work and journals were also included in the data collection process. At the beginning of the study, students were provided a composition notebook to be used to record student work along with journal entries. Students recorded a combination of entries and student work in their journals, weekly. The journal entries and student work were both used to measure students’ abilities to understand the mathematics learned, in order to make real-world connections.
Students’ attitudes toward mathematics were also measured. An attitude survey was used to measure students’ attitudes toward mathematics. The survey was administered at the beginning of the study, then, the same survey was re-administered at the conclusion of the study to determine if students’ attitudes had improved as a result of literature use.

Assumptions

The assumptions for this study were as follows:

1. The students participating in the study will use literature to motivate them to learn mathematics.
2. The students participating in the study will use literature to assist them in understanding mathematics.
3. The students participating in the study will use literature to make real-world connections.
4. The students participating in the study will provide honest answers and feedback to all data collection methods used.
5. The attitude toward mathematics instrument used in the study will provide reliable data.

Research Questions

Three research questions were investigated in this research:

1. Does literature integrated into the mathematics curriculum affect students’ attitudes towards mathematics?
2. Does literature integrated into the mathematics curriculum motivate 7th grade students to learn mathematics?
3. Does literature integrated into the mathematics curriculum allow 7th grade students to make real-world connections?

Setting

The study was conducted in my 5th period classroom of 7th grade mathematics students in a middle school in Central Florida. The school has a population of 1,414 students in 6th – 8th grades. Fifty-two percent (52%) of the student population is minority (27.6% Black, 16.1% Hispanic, 4% Asian, 0.2% Native American, and 3.6% Multiracial). The school, which is a mathematics, science, technology magnet school, offers two general programs of instruction, the Pre-International Baccalaureate (Pre-IB) Program and the Magnet Program. According to the Seminole County Public Schools Choices website (2005), magnet programs or schools are designed to offer a specialized curriculum based on a specific theme, such as mathematics, science, technology, or fine arts. The purpose of many magnet schools and programs, is to eliminate, reduce, or prevent minority group isolation in elementary and secondary schools while simultaneously strengthening students’ knowledge of academic subjects and their understanding of marketable vocational skills (USDOE, 2005).

The school also offers an Exceptional Student Education (ESE) Program along with the English for Speakers of Other Languages (ESOL) Program.

Participants

The students who participated in the study were students enrolled in the magnet program at the school with which I teach. The class consisted of general education mathematics students,
enrolled in the magnet program of which four of the students were ESOL students. Of the students who participated in the study, seven were boys and twelve were girls. The racial make-up of the class included eight Black, four White, and seven Hispanic students. Since I teach three sections of classes with students enrolled in the magnet program, I used the students’ FCAT scores in reading and mathematics from the 2003-2004 academic year to determine the class that would participate in the study. I chose the class that was the most heterogeneously grouped based on FCAT scores. The scores that students earn on the FCAT test range from Level 1 – Level 5, with Level 1 being the lowest score and Level 5 being the highest score. My students’ scores were as follows: In reading I had six students who scored at Level 1; four who scored at Level 2; three who scored at Level 3; three who scored at Level 4; no students scored at Level 5; and three students who had no score. In mathematics, six of my students scored at Level 1; five of my students scored at Level 2; four of my students scored at Level 3; one of my students scored at Level 4; no student scored at Level 5; and three had no score. Overall, according to our 2003-2004 School Improvement Plan, 40% of the population of students at the school with which I teach, scored at Level 1 and Level 2 on both the 2003 FCAT Mathematics and Reading Test.

Procedures

Before beginning my study, I requested and was granted permission to conduct research in my classroom by the University of Central Florida Institutional Review Board (Appendix A), and by the principal of the school in which I teach. After I was granted permission to begin my study, I received permission (Appendix B) from TERC (not an acronym), to use the TERC Math Attitude Survey (1997). The TERC Math Attitude Survey (Appendix C) is a modified version of
the Fennema-Sherman Mathematics Attitudes Scales. A scoring rubric accompanies the survey, and is provided in Appendix D. The survey was administered at the beginning of the study. After administering the survey, I began each new mathematics concept by reading aloud a mathematics storybook or picture book that coincided with that particular mathematics concept. Summaries of the picture books are provided in Appendix E. After reading the book to the students a class discussion would ensue, followed by an activity, throughout the ten-week study.

The criterion that I used to select each storybook was based on several factors. First, I chose books that related to the content of my 7th grade mathematics curriculum scope and sequence. I wanted to ensure that I continued to teach the content that my students needed to learn as they progress through 7th grade mathematics. Second, I attempted to choose books that were age appropriate. I wanted to select books whose characters were as close in age as my students, in order to foster personal connections. Finally, in continuing to foster my students’ abilities to make personal and real-world connections, I chose books that included illustrations and/or storylines that promoted cultural and ethnic diversity.

During week one, the mathematics attitude survey was administered to determine students’ attitudes toward mathematics. Students were also asked to complete a journal prompt that questioned them as to how they felt about literature use in the classroom. The mathematics skill taught during week one was estimation. The book entitled Betcha! (Murphy, 1997) was read aloud to introduce the skill of estimation, which was followed by a class discussion. The students were then asked to respond by completing a series of estimation problems in their journals.

During weeks two and three, the students were introduced to the books On Beyond a Million (Schwartz, 1999) to introduce powers and exponents, and Divide and Ride (Murphy,
1997) to introduce the concept of dividing whole numbers. After reading and discussing the concepts, students were instructed to complete a combination of journal prompts and mathematics problems on each of the two concepts. A list of the journal prompts and mathematics problems is provided in Appendix F.

Capacity and counting money were introduced during weeks four and five. The books used in these lessons were *Room for Ripley* (Murphy, 1999) and *Picking Peas for a Penny* (Medearis, 1990). After reading and discussing *Room for Ripley*, students completed a journal prompt explaining how capacity is used in daily life. After reading *Picking Peas for a Penny*, students were instructed to write their own story as to how they would spend a dollar at their favorite store.

Bar graphs and fractions were introduced during weeks six and seven, and the books *Lemonade for Sale* (Murphy, 1998) and *Eating Fractions* (McMillan, 1991) were used to spark the students’ interest. After reading *Lemonade for Sale*, aloud, a brief activity ensued where students were instructed to create a frequency table and bar graph of their favorite theme parks. When we began to discuss fractions, the book *Eating Fractions*, which is a wordless picture book that has only pictures and fractions, was discussed. Students were then given a story map and instructed to write their own wordless story using only illustrations to demonstrate what they know about fractions.

During weeks eight and nine, students were introduced to solving equations and integers. To introduce solving equations to the students, I read the book entitled *Safari Park* (Murphy, 2002), which is a story about finding unknowns. After discussing the book, and the concepts, students were given a mathematics problem to complete in their journals. *Less than Zero*
(Murphy, 2003), a story about the concept of negative numbers was introduced, followed by a class discussion and journal prompt.

As we approached week ten, circumference of a circle was introduced using the book, *Sir Cumference and the Dragon of Pi* (Neuschwander, 1999). The book was read aloud, a classroom discussion ensued, and students were prompted to write the formula for circumference of a circle. Also, during week ten, the mathematics attitude survey was re-administered to determine if the students’ attitudes toward mathematics had improved as a result of using storybooks. Additionally, each student was interviewed separately and asked a series of questions to determine how students felt about using literature in mathematics. The purpose of the interviews was to determine if students were motivated to learn mathematics as a result of literature use as an instructional tool, and if the use of literature allowed them to make real-world connections.

*Data Collection*

Data for this study were collected using scores from the TERC Math Attitude Survey (1997), journals, student work, and videotaped interviews. The TERC Math Attitude Survey was developed by TERC in 1997. TERC is a leading education research and development organization located in Cambridge, MA. I was granted permission to use the instrument for this study. The instrument, which was constructed to measure students’ attitudes towards mathematics before and after the use of interventions in mathematics, was developed based on the Fennema-Sherman Attitude Scales. The Fennema-Sherman Attitude Scales were constructed in the early 1970’s in an effort to study high school students’ attitudes towards mathematics.

Scores from the TERC survey were obtained in a pre survey, administered at the beginning of the study and in a post survey, which was re-administered at the conclusion of the
study. The students made weekly journal entries after each book was read, and the new concept was discussed. The journal entries included student responses to specific journal prompts, which consisted of either a question relating to the mathematics skill and how it relates to the real world, or their feelings about literature in mathematics instruction (Appendix F). I recorded the mean number of correct responses in student work. I also recorded the frequency of positive feelings reported toward literature use as an instructional tool.

At the beginning of the study students completed the TERC survey, in order for me to gauge their attitudes towards mathematics. In the survey, students responded to questions using responses such as agree, disagree or not sure. I used the TERC scoring rubric to calculate scores. At the conclusion of the study, the same survey was re-administered and the scores were compared to see if students’ attitudes toward mathematics had improved as a result of literature use. I interviewed each student asking a series of questions to gather information as to whether literature use as an instructional tool affected their motivation to learn mathematics (Appendix G). The journal entries, which included sample student work and responses to journal prompts, were used to measure students’ ability to make real-world connections, and students’ motivation to learn mathematics. The interviews, journal entries, and students’ work were used to measure the extent to which literature use as an instructional tool motivates students to learn mathematics, and if students were better able to make real-world connections.
CHAPTER 4: DATA ANALYSIS

The purpose of this study was to investigate the effects of literature on students’ motivation and their abilities to make real world connections in middle school mathematics. The study was conducted during the fall of 2004. Three research questions were investigated in this study:

1. Does literature integrated into the mathematics curriculum affect students’ attitude towards mathematics.

2. Does literature integrated into the mathematics curriculum motivate 7th grade students to learn mathematics?

3. Does literature integrated into the mathematics curriculum allow 7th grade students to make real-world connections?

When reviewing all of the data collected during this study, other conclusions were made, based on several themes, which emerged from the data. Those themes will be explained in the following paragraphs.

In this study, I used an attitude survey, journal entries, students’ work, and interviews, to collect data. As I began to analyze the data, I used the scoring rubric that accompanied the survey to measure students’ attitudes towards mathematics at the beginning of the study. At the conclusion of the study, I re-administered the same survey, and used the same scoring rubric to measure if students’ attitudes towards mathematics had changed as a result of using literature. I read the journal entries and students’ work, looking for common themes in correct responses to problems, in order to measure if students were able to make real-world connections. I also used student interviews, again, looking for common themes and patterns examining responses in an attempt to measure if literature use motivated students to learn mathematics. Several themes
emerged from the data. One theme that emerged in the study was that literature use does not improve students’ attitudes towards mathematics as indicated by the pre and post attitude surveys. Another theme that emerged included an increase in students’ motivation to learn mathematics using literature. Although students were motivated to learn mathematics as a result of using literature in mathematics, students showed no improvement in their overall understanding of mathematics as a result of using literature. A final theme that emerged related to students’ abilities to make real-world connections. This appeared to have no effect on how well students performed. Table 1 includes the research questions and the data sources (D.S.) and shows how the data were triangulated.

Table 1: Research Questions and Triangulation

<table>
<thead>
<tr>
<th>Questions</th>
<th>D.S. 1</th>
<th>D.S. 2</th>
<th>D.S. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes</td>
<td>Pre and Post Survey</td>
<td>Journal Entries</td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td>Journal Entries</td>
<td>Students’ Work</td>
<td>Interviews</td>
</tr>
<tr>
<td>Real-World Connections</td>
<td>Students’ Work</td>
<td>Journal Entries</td>
<td>Interviews</td>
</tr>
</tbody>
</table>

Students’ Attitudes

The TERC Mathematics Attitude Survey (1997) was administered to measure student attitudes towards mathematics at the beginning of the study. I analyzed these data by using the scoring rubric to calculate students’ attitudes. According to the TERC Survey, students can score up to 22 points, and higher scores indicate positive attitudes toward mathematics. With that, I calculated and recorded each student’s score from the pre survey. I then recorded the
mean, median and mode scores to establish a baseline score range which would indicate which
students have a positive attitude. In the pre survey, the mean, median and mode scores was 17,
therefore, students who had a score of 17-22 were considered to have a positive attitude towards
mathematics. On the pre survey, 63% (twelve) of the students surveyed, scored within the 17-22
point range, while the remaining 37% (seven) of students surveyed, scored within the 8-14 point
range.

At the conclusion of the study, the same survey was re-administered, to see if students’
attitudes towards mathematics had improved as a result of using literature in mathematics. On
the post survey, again, 63% (twelve) of the students surveyed scored within the 17-22 point
range, while the remaining 37% of students scored within the 13-16 point range. Figure 1
summarizes the data.

![Figure 1: Pre and Post Attitude Surveys](image)

The purpose of the pre and post attitude survey was to gauge changes in students’
attitudes based on literature use in mathematics. Of the students surveyed, four students showed
no change in attitudes between the pre and post surveys. Of those four students, three of them
scored within the 17 to 22 point range, indicating that they had a positive attitude towards
mathematics to begin with. The other student, who did not show a change in attitude, scored a 13 on both the pre and post attitude surveys.

The scores of the remaining students surveyed indicated either a decrease in their survey scores or an increase in their survey scores. Eight of the remaining fifteen students surveyed showed a decrease in their attitude scores. Although those students’ scores decreased, six of the eight students’ scores remained in the 17-22 point range, indicating that those students continued to maintain a positive attitude towards mathematics, before and after literature use. The remaining students (Kyle and Darryl), who showed a decrease in attitude scores, scored within the 17-22 point range (18) on the pre survey, however, scored a 13 and 15 respectively, on the post survey. Of the remaining seven students surveyed, each of the seven students showed an increase in their attitude scores. Two of those seven students’ scores (Katie and Christy), increased from below the 17-22 point range on the pre survey, to within the 17-22 point range on the post survey. Of the remaining five of the seven students whose score increased, although their score showed an increase, they continued to score below the 17–22 point range. The results of the pre and post attitude surveys are summarized in Table 2, which includes a column that shows the amount of change in students’ attitudes.

<table>
<thead>
<tr>
<th>Student</th>
<th>Pre-Attitude Survey Results</th>
<th>Post Attitude Survey Results</th>
<th>Change in Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasmine</td>
<td>18</td>
<td>17</td>
<td>-1</td>
</tr>
<tr>
<td>Jessica</td>
<td>18</td>
<td>17</td>
<td>-1</td>
</tr>
<tr>
<td>Beth</td>
<td>11</td>
<td>13</td>
<td>+2</td>
</tr>
<tr>
<td>Katie</td>
<td>10</td>
<td>18</td>
<td>+8</td>
</tr>
<tr>
<td>Jason</td>
<td>19</td>
<td>18</td>
<td>-1</td>
</tr>
<tr>
<td>Kyle</td>
<td>18</td>
<td>13</td>
<td>-5</td>
</tr>
<tr>
<td>Tyler</td>
<td>17</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Brittany</td>
<td>22</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Billy</td>
<td>13</td>
<td>15</td>
<td>+2</td>
</tr>
</tbody>
</table>
Overall, of the 19 students surveyed, 63% (12 out of 19) of them had an overall positive attitude towards mathematics, while 37% (7 out of 19) of the students’ change in survey scores indicated that they did not have a positive attitude towards mathematics. Additionally, although 63% of the students surveyed had scores within the positive range, only 11% (2 students out of 19) showed improved scores, increasing from below the 17-22 point range on the pre survey, to within the 17-22 point range on the post survey. The theme that emerged from the results of the pre and post attitude surveys was that literature use in the mathematics classroom did not improve students’ overall attitudes towards mathematics.

**Students’ Motivation to Learn Mathematics Using Literature**

To analyze students’ motivation to learn mathematics using literature in the mathematics classroom, I examined journal entries, students’ work, and interview responses. At the beginning of the study, students were asked in journal prompt #1, “How do you feel about using literature to learn mathematics?” One student said, “I feel that [using] literature [in mathematics] is not a good idea because I feel that it is not going to help us understand math any more.” Although there were some responses that were not in favor of literature use in
mathematics, the majority of the students responses were positive, where students were in favor of using literature in mathematics. Some of the responses were as follows:

1. “I think its [using storybooks] okay because it makes it easier.”
2. “I feel that it is okay. I also think that it might help if you don’t understand something.”
3. “I think it is a good idea because before we even get into the lesson we can learn a little bit about the thing we will learn.”
4. “I feel that it’s kind of a good idea because maybe using books it (sic) can be easier to learn and you can learn better.”

The responses to the journal entries provided insight to me, in terms of whether or not students were motivated to learn mathematics as a result of literature being used in the mathematics classroom. As I further examined students’ responses to the journal prompt, I discovered that 58% (11 out of 19) of the students responded positively to using literature in mathematics, while 21% responded negatively (4 out of 19). Of the remaining students’ responses, 5% (1 out of 19) were indifferent, indicating that it did not matter to them either way, and 21% (3 out of 19) of the students gave no response, as they were absent from school on that particular day. The students’ positive responses to literature use, as indicated above, indicated to me that they were motivated to learn mathematics using literature. Table 3 summarizes the responses.

Table 3: Students’ Responses to Journal Prompt #1

<table>
<thead>
<tr>
<th>Student</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasmine</td>
<td>No Response</td>
</tr>
<tr>
<td>Jessica</td>
<td>Positive</td>
</tr>
<tr>
<td>Beth</td>
<td>Positive</td>
</tr>
<tr>
<td>Katie</td>
<td>Positive</td>
</tr>
<tr>
<td>Jason</td>
<td>Positive</td>
</tr>
<tr>
<td>Kyle</td>
<td>No Response</td>
</tr>
<tr>
<td>Tyler</td>
<td>Positive</td>
</tr>
<tr>
<td>Brittany</td>
<td>Positive</td>
</tr>
<tr>
<td>Billy</td>
<td>Negative</td>
</tr>
<tr>
<td>Laurie</td>
<td>Positive</td>
</tr>
<tr>
<td>Lily</td>
<td>Positive</td>
</tr>
</tbody>
</table>
Student work completed in journals was also carefully examined to analyze if students were motivated to learn mathematics as a result of using literature. As I examined students’ work, I looked for correct responses to problems, which indicated to me whether or not they responded correctly as a result of their understanding of the mathematical concept, due to use of the storybook. Throughout the course of the study, students were assigned a combination of mathematics problems (also referred to in this study as student work), and journal prompts. Each student was required to record his/her responses in their student journals. As students completed their weekly problems, each problem was scored as either correct or incorrect. Since there were six problems, students could score as high as 100% (6 out 6 correct responses), or as low as 0% (0 out of 6 correct responses).

Of the 19 students who completed the problems, 21% (four) provided correct responses to five out of the six problems, receiving a score of 83% on their student work. Thirty-two percent (six) of the students provided correct responses to four out of the six problems, while 47% (nine) provided correct responses to three or less problems, receiving scores ranging from 50% to 17%. Table 4 summarizes the data.
The four students that scored an 83% on student work were those students who maintained positive attitudes in mathematics according to the pre and post survey scores (Jason, Sarah, Justin, and Nicole). This confirms what was stated in Ma’s (2003) study, regarding students’ attitudes. According to Ma (2003), students who excel in mathematics maintain positive attitudes towards mathematics and motivation to learn mathematics.

Videotaped interviews, at the conclusion of the study, were also used to measure students’ motivation to learn mathematics using literature. During the interview students responded to five questions. Question #5 asked, “Would you be more interested in learning mathematics if storybooks were used as an instructional tool?” The purpose in asking Question #5 was to gauge if students’ motivation to learn mathematics using literature had improved as a result of actually using literature in mathematics throughout the 10-week study. At the beginning of the study, students were asked in Journal Prompt #1, “How do you feel about using

<table>
<thead>
<tr>
<th>Student</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasmine</td>
<td>67%</td>
</tr>
<tr>
<td>Jessica</td>
<td>67%</td>
</tr>
<tr>
<td>Beth</td>
<td>33%</td>
</tr>
<tr>
<td>Katie</td>
<td>67%</td>
</tr>
<tr>
<td>Jason</td>
<td>83%</td>
</tr>
<tr>
<td>Kyle</td>
<td>33%</td>
</tr>
<tr>
<td>Tyler</td>
<td>17%</td>
</tr>
<tr>
<td>Brittany</td>
<td>67%</td>
</tr>
<tr>
<td>Billy</td>
<td>33%</td>
</tr>
<tr>
<td>Laurie</td>
<td>17%</td>
</tr>
<tr>
<td>Lily</td>
<td>50%</td>
</tr>
<tr>
<td>Sarah</td>
<td>83%</td>
</tr>
<tr>
<td>Stephanie</td>
<td>50%</td>
</tr>
<tr>
<td>Jamal</td>
<td>17%</td>
</tr>
<tr>
<td>Justin</td>
<td>83%</td>
</tr>
<tr>
<td>Christy</td>
<td>67%</td>
</tr>
<tr>
<td>Nicole</td>
<td>83%</td>
</tr>
<tr>
<td>Darryl</td>
<td>67%</td>
</tr>
<tr>
<td>Johanna</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 4: Percent of Correct Responses on Student Work
literature in mathematics?” Fifty-eight percent of the students responded positively to using literature in mathematics. In contrast, at the conclusion of the study, all of the students (100%) responded positively in favor of using literature in mathematics. Some of the responses were as follows:

1. “Yes ma’am. It [storybooks] would help you to understand more, and it would get to your brain faster.”
2. “Yes, because it [storybooks] helps you to understand something. It helps make math more interesting.”
3. “Yes I would. Learning math straight out of the book is sometimes kinda (sic) hard.”

Students were also asked, in Question #3, “Do you feel you are better able to understand mathematics as a result of using storybooks?” One student said, “Yes. It’s a lot more helpful.” While many of the students responded that literature helped them to learn mathematics, others responded that using the storybooks was fun, but it did not help them to learn mathematics. As shown in Table 5, 75% (12 out of 16) of the students interviewed, responded positively that they were better able to understand mathematics as a result of using literature; 25% (four) responded that using literature in mathematics did not help them to better understand mathematics. Some of the responses were as follows:

1. “I don’t know, about the same. It [storybooks] makes it more funner (sic).”
2. “Kinda (sic) like the same thing. I get it [mathematics] with or without the books. It’s just easier with the books.”
3. “I think it’s the same, the books just make it easier and funner (sic).”

Table 5: Students’ Responses to Interview Question #3

<table>
<thead>
<tr>
<th>INTERVIEW QUESTION</th>
<th>YES</th>
<th>INDIFFERENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you feel you are better able to understand mathematics as a result of using storybooks?</td>
<td>75%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Journal entries, students’ work, and interview questions, were used to measure changes in students’ motivation to learn mathematics using literature. Students’ responses to Question #5 and Question #3 indicated that students were motivated to learn mathematics using storybooks because the storybooks were fun, and the storybooks helped to make mathematics more interesting. Further, as I continued to analyze these data, I discovered that although 75% of the students who responded to Question #3 indicated that using storybooks helped them to better understand mathematics, their performance in completing student work indicated otherwise. Specifically, only 21% of the students (four students that scored 83% on student work) provided correct responses to the six problems they were required to complete. This indicates to me that the storybooks did not help the majority of students understand mathematics better.

Real-World Connections

Students’ abilities to make real-world connections were examined using students’ work, journal entries, and interviews. Students’ work was analyzed to determine if students were able to connect the mathematics concept that was presented in the storybooks to their world. Throughout the study, students were asked to complete problems that related to the storybook or mathematics concept presented in the story line. On problem #1, students were required to use estimation strategies to complete estimation problems. Of the nineteen students that completed the problem, 53% (ten) responded with correct answers. On problem #2, which required students to use what they had learned about powers of ten and exponents, 53% (ten) of the students responded with correct responses. On problem #3, which required students to use division skills, 74%, or fourteen of the 19 students, responded correctly. Problem #3 was a problem that allowed the students the opportunity to relate the problem to their own world,
which may have contributed to the students’ success in arriving at the correct answer. Problems
#1 and #2 were more computational in nature, which may have contributed to students arriving at
incorrect responses.

Problem #4, while it was a statistical problem in nature, students were required to create a
bar graph based on a list of students’ favorite theme parks. Before completing the bar graph,
students created a frequency table of their classmates’ favorite theme parks. Eighty-nine percent
(89%) of the students that completed the bar graph completed a correct illustration of a bar
graph, while 11% of the students offered no response due to being away from school on that day.
On problem #5, which involved counting money, 68% (thirteen) of the students’ responses were
correct, while 21% (four) of the students’ responses were incorrect. Two students, or 11% did
not respond to problem #5. On problem #6, 68% of the students’ responses were incorrect, 32%
responded either “I don’t know”, or gave no response, and no students provided a correct
response. For example, many students provided 3.14 (pi) as the formula for circumference.

As these data show, students performed better on those problems in which they could
make real-world connections (Problems #3, #4, and #5), indicating a better understanding of the
problem. Students did not perform as well on the problems that were more computational in
nature, such as Problems #1, #2, and #6. Table 6 summarizes the data.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Percent Correct</th>
<th>Percent Incorrect</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53%</td>
<td>42%</td>
<td>5%</td>
</tr>
<tr>
<td>2</td>
<td>53%</td>
<td>42%</td>
<td>5%</td>
</tr>
<tr>
<td>3</td>
<td>74%</td>
<td>26%</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>89%</td>
<td>0%</td>
<td>11%</td>
</tr>
<tr>
<td>5</td>
<td>58%</td>
<td>32%</td>
<td>10%</td>
</tr>
<tr>
<td>6</td>
<td>0%</td>
<td>68%</td>
<td>32%</td>
</tr>
</tbody>
</table>
Journal entries were also used to measure students’ abilities to make real-world connections. The journal prompts relating to division; capacity, integers, and fractions provided me with meaningful insight in terms of how students were able to make real-world connections. On journal prompt #2, students were required to explain ways in which liquid capacity was used in daily life. While many students responded with appropriate answers, others’ responses were unclear. The following statements represent a sample of responses:

1. “A pool. A fish tank.”
2. “Gas tank.”
3. “We use capacity when we cook, clean, grocery shop.”
4. “I use capacity everyday when I put up supper.”
5. “Water in body— you have to drink 8 glasses of water.”
6. “When you iron, you have to measure how much water you put in the iron. If you put too much [water in] the water will flow out the top of the iron.”

The responses to many of the students’ journal prompt relating to capacity, indicated to me that many of the students connected the use of capacity to their world, much like the author did in the storybook. Since the storybook used an aquarium to represent capacity, many of the students’ responses included a pool, or fish tank, as they related capacity to their world. Sixty-three percent of the students provided a correct response as they connected capacity to their world. On journal prompt #3, which related to counting money, students were required to write a story about how they would spend a dollar. Students were allowed to be as creative as they wished as they created their story line, provided they used correct representations of spending money. As I read each story, I discovered that 79% of the students used correct representation of money, while 21% did not. I also discovered that many of the students used increments of $0.25, $0.50, and $0.75 as they made their calculations. Using numbers that were easy to add or subtract may have contributed to such a high percentage of correct responses.
On journal prompt #4, students were given a story map and were instructed to write a wordless story about fractions. Many of the students’ stories related to ideas that were representative of an idea or topic to which the students could relate. For example, students created stories relating to food, video games, friends, and faces. In one sample of a correct display of fractions, the student’s story began with a picture of what appeared to be one pizza pie and four people. The pie was then cut into two halves, then fourths, and finally cut into eighths. The last frame of the story shows four people, each with one slice of pizza, and four slices of pizza left over (Appendix H). While the stories were original and creative, and many displayed correct representations of fractions and fractional parts, some of the stories did not display a correct use of fractions or fractional parts. For example, one student drew pictures of apples, oranges, bananas, hot dogs, hamburgers, and pizzas, cut into sections, however, did not write the fractional representation illustrated in the story (Appendix I). Fractions are also incorrect when fractional sections are not represented as equal parts. Forty-seven percent of the students provided correct representations of fractions, while 53% did not.

Journal prompt #5 required students to explain how integers were used in everyday life. While 68% of the students provided correct explanations, 11% provided incorrect explanations. Due to absences, 21% of the students did not respond. Many of the examples provided by the students in terms of using integers in real life, related to the use of money. This can be contributed to the fact that the story used to introduce integers, involved a penguin that kept losing, spending, and earning his clams (money). Journal prompt #6 required students to explain how to find circumference of a circle. Students’ responses to journal prompt #6, were similar to their responses to problem #6, which also involved circumference of a circle. None of the
students provided a correct answer to the prompt, while 53% responded incorrectly, and 47% did not respond to the prompt at all. Table 7 summarizes students’ responses to journal prompts.

Table 7: Students Responses to Journal Prompts

<table>
<thead>
<tr>
<th>Journal Prompt</th>
<th>Correct Response</th>
<th>Incorrect Response</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>63%</td>
<td>37%</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>79%</td>
<td>21%</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>47%</td>
<td>53%</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>68%</td>
<td>11%</td>
<td>21%</td>
</tr>
<tr>
<td>6</td>
<td>0%</td>
<td>53%</td>
<td>47%</td>
</tr>
</tbody>
</table>

Aside from using journal prompts and student work, videotaped interviews were used as well, to measure students’ ability to make real-world connections as a result of literature use in mathematics. Students were asked a series of questions that relate to literature and real-world connections. Students’ responses to those question provided meaningful information to me, as to whether or not literature use allowed students to make real-world connections. In particular, I was most interested in how students responded to question #4, which asked, “Do you think storybooks helped you to better understand mathematics as it is used in the real world?” Of the sixteen students that participated in the interview, all of the students (75%), with the exception of four, responded favorably that using storybooks in mathematics helped them to understand mathematics as it is used in the real world. The students who did not respond favorably, responded as follows:

1. “Maybe, I don’t know.”
2. “A little bit. I don’t really know.”
3. “It’s kinda (sic) like the same thing. It really wouldn’t make a difference.”
4. “Kinda (sic). I don’t know.”
In an effort to measure if students were able to make real-world connections, students’ work, journal entries, and interview responses were all analyzed. The theme that emerged as a result indicated that students performed better on the mathematical problems that they were able to connect to their own lives, hence, make a real-world connection. For example, when discussing integers, students connected their use to money. As students discussed capacity, many connected capacity to fish tanks, pools, gas tanks, glasses of water, and measuring water to go into an iron. However, the fact that students had difficulty with some of the problems and journal prompts, indicates to me that students had difficulty making a real-world connection.

Chapter five will conclude my study on the effects of literature on student motivation and their abilities to make real-world connections. In Chapter Five, I will review the findings and make recommendations for future research in the area of literature use in the middle grades mathematics classroom.
CHAPTER 5: CONCLUSION

The purpose of this study was to determine the effect of using literature in mathematics on students’ motivation to learn mathematics and their abilities to make real-world connections. Throughout the research period, data were collected to measure students’ overall attitudes towards mathematics, using a pre and post survey. The use of journal entries, students’ work, and responses to interview questions assisted in examining students’ motivation to learn mathematics. Students’ abilities to make real-world connections were investigated using students’ work, journal entries, and interview responses. These data were collected and analyzed to provide feedback as to whether or not literature use motivates students to learn mathematics, and to confirm or disconfirm the idea that literature use helps students to make real-world connections, furthering their understanding of mathematics. In general, the students in my seventh grade mathematics class were excited about using storybooks to learn mathematics, appeared to enjoy responding to the journal prompts in their journals, and gave their best effort in completing the required problems. Conclusions for the research questions, which guided this study, along with themes that emerged from the study, are discussed below.

The first research question was, “Does literature integrated into the mathematics curriculum affect students’ attitudes towards mathematics?” Through the use of pre and post attitude surveys, it was discovered that literature use in the mathematics curriculum has no effect on students’ attitudes towards mathematics. The pre and post surveys were used to measure changes in students’ attitudes towards mathematics as a result of using literature. It was discovered that although students’ attitudes did not improve as a result of literature use, the vast majority of students had positive attitudes towards mathematics.
The second research question was, “Does literature integrated into the mathematics curriculum motivate 7th grades students to learn mathematics?” Journal entries, students’ work, and interview responses were all collected to measure if literature use had any affect on students’ motivation to learn mathematics. Through careful analysis of these data, it was discovered that literature use does motivate students to learn mathematics. Many students were motivated to learn mathematics using the storybooks because they reported that the storybooks made learning mathematics fun and interesting. Although the storybooks helped to motivate students to learn mathematics, use of the storybooks did not ensure a better understanding of mathematics concepts and computations.

The third research question was, “Does literature integrated into the mathematics curriculum allow 7th grade students to make real-world connections?” Students work, journal entries, and interview responses were all collected and analyzed to measure students’ abilities to make real-world connections. After analyzing these data, it was indicated that students were able to make real-world connections in mathematics as long as the mathematics concept was meaningful to their own lives. Again, although some students were able to make real-world connections, this did not ensure a better understanding of mathematics concepts and an ability to arrive at correct answers.

Throughout this study, although literature use in the mathematics classroom had not effect on students’ attitudes towards mathematics, a vast majority of the students reported that they thought using the storybooks was fun, interesting, and helped them to understand mathematics. One theme that emerged, which was not presented as one of my research questions, was that literature use does not improve student performance, as evidenced by the results of students’ work.
Recommendations

This research study allowed me the opportunity to learn a great deal more about my students and how they feel about mathematics and literature use in the mathematics curriculum. It also provided me the opportunity to learn more about my own teaching practice. After developing the study, and collecting and analyzing the data, I have come to some conclusions about my teaching practice. The data collected provided me with insight as to how I will proceed in teaching mathematics with future students. As a result of this study, I will no longer use literature in mathematics as a part of my daily routine of teaching mathematics. I will, however, periodically use storybooks to introduce specific mathematics concepts or topics. As I reflect upon the studies that were discussed in my literature review, one study in particular concluded that literature integrated in the mathematics classroom has no effect on students’ performance (Hong, 1996). Although measuring student performance was not a goal of my study, poor student performance did emerge as a theme, evidenced in how poorly students performed on the assigned mathematics problems. The results of my study support the findings of Hong’s study. Other studies concluded that storybooks used in mathematics are interesting, and appealing and visually stimulating to older students, which leads to making real-world connections (Karp et al., 1998; Jenner, 2002). The results of my study support the findings of the studies conducted by Karp et al. and Jenner. My students reported that the storybooks made learning math interesting, fun, and felt as if they were able to connect mathematics to the real world.

As I continue to reflect on upon the results of the study, I wish I had interviewed my students to find out why their attitudes towards mathematics had not changed as a result of using literature in the classroom.
One limitation to this study was the small sample size. Action research, which is what this study was categorized as, cannot be generalized to include all seventh grade students. More quantitative research would need to be conducted that would include a larger sample size in order to generalize findings.

Another limitation to this study is the quality and variety of picture books available. Although there are a variety of picture books, storybooks, and trade books available for mathematics teachers to choose from, many of the books, I believe are difficult to fit with specific mathematics concepts. Although research shows that storybooks are appealing to older students, I personally believe many of the books that were used in my study were too elementary for a seventh grade mathematics class.

Suggestions for further research would include comparative studies that examine the effects of literature on student performance in middle grades mathematics, provided storybooks are carefully selected to ensure an appropriate fit with the mathematics concept being taught, and the storybooks are academically appropriate.
APPENDIX A: UCF IRB APPROVAL
July 19, 2004

Armita Washington  
2839 Copper Ridge Court  
Lake Mary, FL 32746

Dear Mrs. Washington:

With reference to your protocol entitled, "The Effects of Literature on Student Motivation and Connections in Mathematics," I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office.

Please be advised that this approval is given for one year. Should there be any addenda or administrative changes to the already approved protocol, they must also be submitted to the Board. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur. Further, should there be a need to extend this protocol, a renewal form must be submitted for approval at least one month prior to the anniversary date of the most recent approval and is the responsibility of the investigator (UCF).

Should you have any questions, please do not hesitate to call me at 823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Barbara Ward
Barbara Ward, CIM  
Institutional Review Board (IRB)

Copies: Juli Dixon, Ph.D., College of Education, Teaching and Learning Principles  
IRB office
APPENDIX B: PERMISSION TO USE TERC MATHEMATICS ATTITUDE SURVEY
Yes, you have permission to use the modification of the Fennema instrument developed by TERC.

Jan Mokros
APPENDIX C: MATHEMATICS ATTITUDE SURVEY
Math Attitude Survey

Name: ____________________________ Age: ____________________________

HOW DO YOU FEEL ABOUT MATH?

1. Math isn't my strength and I avoid it whenever I can.
   Agree  Disagree  Not sure

2. I'm pretty good at math.
   Agree  Disagree  Not sure

3. I hate the challenge of Math.
   Agree  Disagree  Not sure

4. I don't think I could learn math, even if I really tried.
   Agree  Disagree  Not sure

5. Boys are no better at math than girls.
   Agree  Disagree  Not sure

6. Doing math lets me think creatively.
   Agree  Disagree  Not sure

7. Math helps you learn to think better.
   Agree  Disagree  Not sure

8. Math isn't that important for most jobs and careers.
   Agree  Disagree  Not sure

9. Girls are no better at math than boys are.
   Agree  Disagree  Not sure

10. To succeed in school you don't need to be good in math.
    Agree  Disagree  Not sure

11. To succeed in life you need to be able to do math.
    Agree  Disagree  Not sure
APPENDIX D: SCORING RUBRIC
**Scoring Rubric**

Student's can score up to 22 points. Higher scores indicate positive attitudes towards mathematics. Questions 5 and 9 probe student's view about gender/math and may be interesting to analyze separately.

Positive responses = 2 points  
Not Sure = 1 point  
Negative responses = 0 points

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Disagree</th>
<th>Not Sure</th>
</tr>
</thead>
<tbody>
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<td>2 points</td>
<td>1 point</td>
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<td>2 points</td>
<td>0 points</td>
<td>1 point</td>
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<td>9.</td>
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<td>2 points</td>
<td>1 point</td>
</tr>
<tr>
<td>11.</td>
<td>2 points</td>
<td>0 points</td>
<td>1 point</td>
</tr>
</tbody>
</table>

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APPENDIX E: SUMMARY OF PICTURE BOOKS
Summary of Picture Books

*Betcha!* (Murphy, 1997)- Two friends use estimation strategies to estimate costs of toys, how many jelly beans are in a jar, and how many people are on their bus.

*Divide and Ride* (Murphy, 1997)- Division is demonstrated as eleven friends divide to fill up seats on their favorite carnival rides.

*Eating Fractions* (McMillan, 1991)- A wordless picture book about fractions that illustrates fractional parts of food, using only fractional representations to describe them.

*Lemonade for Sale* (Murphy, 1998)- Bar graphs are used as a few kids and their parrot run a lemonade stand and keep track of their sales using bar graphs.

*Less than Zero* (Murphy, 2003)- The concept of negative numbers is demonstrated using a line graph, as Perry the Penguin earns, spends, finds, loses, and borrows clams.

*On Beyond a Million* (Schwartz, 1999)- This book introduces power counting and multiples of ten.

*Picking Peas for a Penny* (Medearis, 1990)- A book dealing with money, children pick peas for a penny a pound and then enjoy what those pennies buy.

*Room for Ripley* (Murphy, 1999)- Capacity is demonstrated as Carlos pours cups, pints, and quarts of water into a fish bowl.

*Safari Park* (Murphy, 2002)- Five cousins, each with 20 tickets, use algebra to tell them how many rides they can try at a theme park (solving equations/finding unknowns).

*Sir Cumference and the Dragon of Pi* (Neuschwander, 1999)- Sir Cumference has been changed into a dragon and his son Radius needs the magic number (pi) to change him back.
APPENDIX F: JOURNAL PROMPTS AND MATHEMATICS PROBLEMS
Journal Prompts

1. How do you feel about using literature in mathematics?

2. Explain ways in which capacity is used in daily life.

3. Write a story about how you would spend a dollar at your favorite store.

4. Based on the story that was discussed about fractions, create a picture story about fractions.

5. Based on the story that was read about integers, explain how integers are used in the real world.

6. Explain how to find circumference of a circle.

Mathematics Problems

1. Estimate.  
   A.) $9.82  
   B.) 29.53  
   C.) 8.9  
   $8.71  
   - 18.12  
   + $6.18

2. Solve.  
   
   $0.702 \times 10^2$  
   $5.149 \times 10^3$  
   $6.2 \times 10^5$  
   $2.587 \times 10^0$  
   $9.57 \times 1000$

3. Divide 14 new best friends to ride on a ferris wheel which seats 3 people per chair.

4. Using the frequency table, create a bar graph of favorite theme parks.

5. You have 4 dimes, 3 nickels, and some pennies. Your total is $0.57. How many pennies do you have?

6. What is the formula for finding circumference of a circle?
INTERVIEW QUESTIONS

Name__________________________________________

1. What was your favorite mathematics topic covered?

2. How do you feel about using storybooks to learn mathematics?

3. Do you feel you are better able to understand math as a result of using storybooks? Explain.

4. Do you think the storybooks helped you to better understand math as it is used in the real-world? Explain.

5. Would you be more interested in learning math if storybooks were used as an instructional tool?
APPENDIX I: INCORRECT REPRESENTATION OF FRACTIONS
REFERENCES


