

IMPACTS OF AUTHENTIC CHILDREN'S LITERATURE AND LITERACY STRATEGIES  
ON TEACHING MATHEMATICAL COMPREHENSION IN ELEMENTARY GRADES

by

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CERTIFICATION OF PROJECT WORK

We, the undersigned, certify that this project entitled *Impacts of Authentic Children's Literature and Literacy Strategies on Teaching Mathematical Comprehension in Elementary Grades* by Elizabeth M. Sliwa, Candidate for the Degree of Master of Science in Education, Literacy: Birth to Grade 6, is acceptable in form and content and demonstrates a satisfactory knowledge of the field covered by this project.

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## Abstract

In this Master's thesis project, empirical studies regarding the use of children's literature and literacy strategies to teach mathematics are researched. The impacts on mathematical comprehension are discussed and include: An increase in motivation, an increase in achievement, and increase in early numeracy, and an increase in interest of mathematics. The studies researched include findings on how using children's literature to teach mathematics can increase their motivation for learning and increase their interest in mathematics. Studies about using literacy strategies to teach mathematics include information on how activating prior knowledge, direct vocabulary instruction, and inferencing can have a positive impact on students' mathematical comprehension. A series of professional development workshops are prepared from the findings from the literature review. The workshop consists of small group and whole group discussions on ways to use children's literature and literacy strategies to teach mathematics in elementary classrooms.

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## Chapter One Introduction

### Statement of Problem or Issue

Reading comprehension is a student's ability to understand what he or she has read. Reading comprehension is involved whenever students read a text and "reading provides information across the curriculum," (Glenberg, Willford, Gibson, Goldberg, & Zhu, 2011, p. 316). Since reading is used in every subject area, students' ability to read and their ability to comprehend becomes a good indicator of their performance in other subject areas.

There are many indicators of reading comprehension and ways to increase reading comprehension. Literacy strategies lay a foundation for reading comprehension (Kinniburgh & Prew, 2010) and therefore, are part of this project. Along with literacy strategies, children's literature is used by teachers to increase students' comprehension. Therefore, the specific topic of investigation for this project is the impact of using authentic children's literature and literacy strategies on elementary students' mathematical comprehension. Students require certain reading and writing skills in order to perform well in mathematics, however, elementary teachers may not realize the use of literacy strategies while giving mathematics instruction. Some questions that arise from this issue are:

- How can teachers better prepare students to answer word problems?
- How can teachers help their students become literate in mathematics?

Although these are critical questions relating to the issue of students' mathematical comprehension, more specific research questions are formed for this project. Based on the concerns teachers have about the reading requirements involved in learning and comprehending mathematics, the following research questions are developed for this project:

1. *What are the impacts of using authentic children's literature on mathematical comprehension in elementary grades?*
2. *What are the impacts of literacy strategies on students' mathematical comprehension?*

A literature review is executed to find answers to these questions, and a professional development project is developed to share the findings with teachers for the purpose of enhancing students' mathematical comprehension.

## **Background**

Mathematics has always been a strong subject of mine. For this reason, it was my concentration during my undergraduate work. As a current graduate candidate in the Literacy program, I have found that reading comprehension is critical in order for students to understand what they are reading in all content areas. In order for students to comprehend mathematical word problems or concepts, reading comprehension skills are necessary.

It is important to integrate reading and writing in all subject areas. Reading comprehension is the foundation for understanding in all subject areas. Therefore, students who struggle with reading comprehension may also struggle with understanding content in other subject areas. From my teaching experiences, I have seen students struggle with reading comprehension, specifically when reading mathematical word problems and understanding mathematical concepts. Since reading comprehension is the foundation for understanding, teachers may find the benefits of using literacy strategies and children's literature in mathematical comprehension.

Many teachers have noticed that the state mathematics exams are, in essence, a reading test. There are mostly word problems on the exams and students need to "understand, define,

and analyze the content vocabulary found within those word problems” (Yates, Cuthrell, & Rose, 2011, p. 33). Having this knowledge, teachers should find ways in which they can increase students’ mathematical comprehension.

In my own experiences from proctoring state mathematics tests, I have noticed the increase in reading and writing that is involved in comprehending and answering mathematical questions. Students are not asked to simply find the answer to a problem by using an equation; rather, students are required to explain in written form how they came up with their answer to the mathematical problem. Students are also required to read and solve more mathematical word problems on state mathematics tests. This assesses both their reading comprehension skills and their ability to read as much as it assesses their procedural knowledge of mathematics. From my own experiences, I have noticed changes in state mathematical tests due to the new Common Core State Standards (CCSS) (2011) for mathematics. These new standards state that students must understand not only the procedural skill of mathematics, but they need to be assessed on their conceptual knowledge and their ability to justify their answers.

In this project, there are some terms which are frequently used. The term “mathematical comprehension” refers to the students’ understanding of mathematical concepts as it relates to their reading comprehension skills. Some of these mathematical concepts include addition, subtraction, multiplication, division, fractions, decimals, measurement, time, and numeracy that are often found in mathematical word problems. Mathematical word problems involve reading comprehension in order to solve the problem. These mathematical word problems are asked in the form of using words rather than written as an equation to be solved. In order to solve mathematical word problems, it requires not only a student’s mathematical comprehension but

also reading comprehension. A teacher needs to be aware that both of these types of comprehension are being assessed when using mathematical word problems.

Another term used for this project is “authentic children’s literature.” This refers to books that accurately represent the information being presented in the story and correspond with the information being taught. In the case of this project, this means an accurate representation of mathematical concepts and ideas. “Literacy strategies” are approaches that assist students in learning to read, write, and comprehend. This project discusses the impacts of children’s literature and literacy strategies on reading and comprehending in the area of mathematics.

### **Rationale and Theoretical Stance**

This topic is important to the field of literacy because there is a connection between reading comprehension and mathematics. Educators should be aware that as they teach literacy strategies for reading comprehension, these same literacy strategies can be applied to mathematics for comprehension. Rutherford-Becker and Vanderwood (2009) agree that “there is currently little research on the relationship between math and reading assessment tools” (p.25) and that more research needs to be done on this relationship. Most literature only consists of information for using literacy strategies in the classroom to teach mathematics (e.g., Bintz, 2011; Hoover, 2012; Kester Phillips, Bardsley, Bach, & Brown, 2009; Sarama & Clements, 2009; Yates, Cuthrell, & Rose, 2011). While there are very few studies that address which specific literacy strategies to use when teaching mathematics, there are studies that show the impacts on mathematical comprehension as a result of using literacy strategies.

The National Reading Panel (NRP) also suggests that this topic is important to the field of literacy. The NRP (2000) reports that literature “suggests that teaching comprehension in the

context of specific academic areas can be effective” (p.15). This proposes that reading comprehension skills should be embedded in all subject areas. The Report of the NRP addresses how comprehension is used in all subject areas by proposing that “it might be efficient to teach comprehension as a skill in content areas” (p.15). Again, the NRP is stressing the importance of strengthening reading comprehension and the use of reading comprehension skills in order to teach other subjects and content areas such as mathematics.

The new CCSS (2011) also require students to do more reading in mathematics for comprehension. Teachers instruct students on how to use literacy strategies for comprehension during reading and these same strategies can be used in all content areas. By using literacy strategies in mathematics, it can help explain and explore what students are thinking and help students develop new mathematical concepts (Whitin & Whitin, 2000). Literacy also helps students who are struggling to understand mathematical concepts (Whitin & Whitin, 2000). Since literacy supports students’ comprehension of mathematical concepts, encouraging the use of literacy strategies and children’s literature is important for elementary teachers who teach both literacy and mathematics daily.

I have chosen to do a professional development project to apply the findings to my research questions. This is most suitable because these research questions focus on what teachers can do in their classrooms to enhance mathematical comprehension. A professional development project is informative and gives the teachers the knowledge and resources that they can apply immediately after attending the professional development workshop. The CCSS are already in place so it is important for teachers to be knowledgeable of the standards. There are ways teachers can gain knowledge for teaching mathematics using literacy knowledge. By

implementing certain literacy techniques, it can help students enhance mathematical understanding.

I view teaching from a constructivist point of view. In the constructivist theory (Dewey, 1916), students learn from integrating new knowledge with already existing knowledge. Therefore, students can enhance mathematical comprehension by using the knowledge of reading comprehension they already have. This would include using reading comprehension strategies to assist in mathematical comprehension.

The schema theory (Bartlett, 1932) relates to the knowledge that students already have. A student's schema is the knowledge that he or she already has. Students use what they have in their schema and relate it to what they are learning. Teachers who understand the schema theory can help their students learn mathematics by relating what they learn to the knowledge already in their schema. Teachers can instruct students on how to use literacy strategies that they already have in their schema for reading and writing and incorporate it into how they learn mathematics. The schema theory is also an example of constructivism. High quality authentic children's literature is used in order to teach literacy and build on schema. The same activity can also be applied to teaching mathematics. In order to build on schema and have students recall knowledge they already have, teachers should consider using high quality authentic children's literature when teaching mathematical concepts the same way they use it in literacy.

The goal of this project is to stress the importance of reading comprehension and to discuss the impacts of using literacy strategies and children's literature on mathematical comprehension. Reading comprehension is the basis for understanding and is critical for learning in all subject areas, specifically mathematics. This project explores how using literacy strategies and children's literature impacts students' mathematical comprehension.

## Chapter Two Literature Review

The focus of this project is to educate teachers on the ways that reading comprehension impacts mathematical comprehension and to provide ways in which they can use literacy to teach mathematics. Literature addressing the impacts of using authentic children's literature and effective literacy strategies to increase students' mathematical comprehension are examined in order to develop a solid understanding of the research questions:

1. *What are the impacts of using authentic children's literature on mathematical comprehension in elementary grades?*
2. *What are the impacts of literacy strategies on students' mathematical comprehension?*

This literature review contains the synthesis of empirical studies through extensive research on this topic. Studies include the connections between reading and mathematics, the integration of literacy strategies when teaching mathematics, and the use of children's literature to teach mathematics.

While reviewing the theories and empirical studies, some common themes emerge from three categories. The first category is the relationship between literacy and mathematics. The themes emerging from this category include the impacts of an increase in early literacy numeracy and in reading and mathematical performance. The second category is the impact of literacy strategies on mathematics. The common theme of this category is the positive transfer of reading concepts to mathematics. The third category is the impact of children's literature on mathematics. One theme that emerges from this category is that children's literature creates an increase of interest in mathematics. The other theme that arises from using children's literature to teach mathematics is a higher level of mathematical achievement and a higher level of motivation.

### **Relationship between Literacy and Mathematics**

**Early literacy and numeracy.** Mathematics and reading are the two central subject areas in the primary grades. Purpura, Hume, Sims, and Lonigan (2011) examine whether literacy skills can predict numeracy skills of students in the early primary grades. They investigate which literacy skills predict numeracy skills and how. The authors find that vocabulary knowledge and print knowledge are the most indicative of later numeracy performance. This leads to a better understanding of how mathematical skills develop and the connection between mathematics and literacy. By using vocabulary strategies and increasing print knowledge to teach mathematics, this may have a positive effect on students' performance in numeracy.

Number sense is the key area of mathematics in Kindergarten. Jordan, Kaplan, Olah, and Locuniak (2006) observe 411 kindergarteners to see if reading proficiency predicts their number sense performance. They find that there is a significant relationship between early reading ability and the numeracy skills of counting, estimation, number patterns, number knowledge, and number transformation. While they acknowledge that "the data may also reflect a relationship between school-related skills and early home experiences" (p. 171), this is only the initial study of an investigation that continues until the students have completed third grade.

Pimperton and Nation (2010) strive to understand more about the mathematical profiles of poor comprehenders. Students from their study include children ages seven and eight who are labeled as having poor comprehension in reading. These students also show lower scores on mathematical reasoning. The authors conclude that poor comprehenders not only struggle with the literacy aspect of mathematics which involves the reading and written language of mathematics. There could also be a weakness in verbal language that impacts their mathematical ability and understanding.

Another study that suggests that oral language comprehension predicts numeracy performance is done by Cowan, Donlan, Newton, and Lloyd (2005). These authors examine how language comprehension relates to performance on number tasks and more specifically, story problems. The seven- to nine-year olds in this study show that language comprehension has a significant impact on how well students perform on number tasks and how well they understand story problems. However, this study only addresses the oral language aspect of literacy and not the reading comprehension aspect.

Donlan, Cowan, Newton, and Lloyd (2007) later complete another study regarding the role of language in mathematics. They suggest that basic number processing deficits cause arithmetic deficits and that reading impairments also play a role in numeracy performance. The authors identify different groups of students, who are those with reading difficulties only, those with mathematical difficulties only, those with both reading and mathematical difficulties, and those with neither. Children with only reading deficits perform below level on understanding place value, solving story problems, and written computation. This promotes the idea that literacy and reading comprehension play a role in students' mathematical comprehension, specifically, numeracy.

Numeracy is a specific area that involves mathematical comprehension and is positively affected by the use of reading comprehension skills. Reading comprehension strategies can also be used in teaching mathematical comprehension and teaching mathematical concepts other than numeracy.

**Reading and mathematical performance.** Many studies show that there is a distinct relationship between literacy and mathematics and that literacy is involved in learning mathematics. Carter and Dean (2006) look at how decoding, vocabulary, and comprehension are

used in mathematics in order to understand a problem. These authors agree that “content-area literacy includes many opportunities for students to read, write, and talk about the discipline they are studying” (p. 127). Reading and writing are essential to all content areas and strategies for reading and writing will enhance an understanding of content-area information. Therefore, the incorporation of reading and reading skills may be helpful for students in learning mathematics.

Rutherford-Becker and Vanderwood (2009) evaluate how reading performance is related to mathematic performance. They use curriculum-based measures (CBM) of oral reading fluency (ORF) and Maze reading comprehension as the forms of assessment for considering the impact that reading performance has on mathematical performance. Their participants include 180 students in grades four and five. Three ORF passages are administered, one Maze passage, and four basic mathematical concepts probes. The basic mathematical concepts the probes assess are number concepts, measurement, vocabulary, grid reading, charts and graphs, decimals, fractions, word problems, and geometry. The results of the study show that CBM oral reading fluency and Maze significantly predict how well a student performs in mathematics. Based on these results, they conclude that mathematics tests measure not only mathematical skill but reading comprehension as well.

Hanich and Jordan (2004) measure third graders’ mathematical and reading achievement. Students with mathematical deficits, reading deficits, and both mathematical and reading deficits are included in the study. Students with both reading and mathematical deficits had lower percentile scores. Although these students recognize their reading deficits while reading, they did not recognize that they have mathematical deficits as well. This suggests that reading does play a role in how well students perform in mathematics but it also illustrates how children perceive their own achievement in mathematics. While the students who have reading deficits

acknowledge the fact that they struggle with reading, students who have both reading and mathematical deficits only recognize that their reading deficit affects their mathematical achievement and do not consider themselves as having a mathematical deficit.

Reading achievement is also looked at when considering if it factors mathematical achievement of students. Two studies specifically observe second grade students with mathematical difficulties only (MD), reading difficulties only (RD), both reading and mathematical difficulties (MD/RD), and normal reading and mathematical achievement (NA) (Hanich, Jordan, Kaplan, & Dick, 2001; Jordan & Hanich, 2000). They measure 49 second graders' reading and mathematical levels using a *Comprehensive Tests of Basic Skills* assessment. They observe students' achievement in the areas of number facts, story problems, place value, and written calculation. Jordan and Hanich (2000) notice that children with MD/RD perform much worse on questions regarding mathematical thinking. From this observation, the researchers conclude that students' reading difficulties should be considered when doing research on mathematical achievement. For example, two separate groups should be formed to include students with MD only and students with MD/RD in order to more accurately research mathematical achievement.

Hanich, Jordan, Kaplan, and Dick (2001) conduct a similar study and obtain the similar results. Their study uses a larger sample size, of 210 second graders, and distinguishes each group of students using the same labels (MD, RD, MD/RD, and NA). The authors acknowledge that "story problem solving is an area of weakness for children with MD" (p. 619). If story problem solving is a weakness for students with only mathematical difficulties, it may predict a problem for students with reading and mathematical difficulties. The results of this study show that children with MD/RD perform the worst of all groups in the areas of exact calculation, story

problems, approximate arithmetic, place value, and written computation. Hanich, Jordan, Kaplan, and Dick (2001) conclude that children with MD/RD should be looked at as a separate group from children with only MD because the language aspect of mathematics may be what gives them the disadvantage over children with MD only. This is the same conclusion made by Jordan and Hanich (2000).

Leong and Jerred's (2001) study involves third, fourth, and fifth grade students and examines the ways that these students understand and solve mathematical word problems. Leong and Jerred (2001) identify that there are word problems which contain "too much or 'not needed' information in terms of level of adequacy" (p.281) in reference to how much reading is involved in the word problems. The amount of reading and information involved in a mathematical word problem affects how students perform and understand the problem. The authors also explain that there needs to be a consistency and order to the way information in a word problem is presented so that students have an easier time with comprehension. Therefore, the relationship between mathematics and literacy more specifically applies to mathematical word problems and the reading comprehension involved.

Vilenius-Tuohimaa, Aunola, and Nurmi (2008) also focus more on the connection and relationship that reading comprehension has on solving mathematical word problems rather than how the word problems are presented. The participants of this study are students in fourth grade whose reading skills were tested in order to categorize them by reading ability. Their findings illustrate that reading fluency does predict reading comprehension which as a result, affects the ability to comprehend and solve mathematical word problems.

Mathematical word problems and the reading comprehension involved mostly apply to older elementary students. The connection shown in the previous studies is that reading ability

and comprehension affects mathematical comprehension and skill in older students. A connection between reading comprehension and mathematics occurs in young children as well. This connection is more evident in the mathematical concept of number sense rather than the ability to solve and comprehend mathematical word problems.

### **Impact of Literacy Strategies on Mathematics**

**Transfer of reading concepts to mathematics.** Many literacy strategies are used in order to teach reading comprehension. Kinniburgh and Prew (2010) study how question answer relationships (QAR) can be taught to primary grade students in order to lay a foundation for later reading comprehension. The classes included in their study are Kindergarten, first grade, second grade, and a Kindergarten through second grade special education class. They find that using QARs helps to lay a strong foundation in reading comprehension. The authors suggest that further study can incorporate the use of this strategy in other subject areas. One subject area that this and other literacy strategies can be applied to is mathematics.

Carter and Dean (2006) point out that mathematical reading involves word recognition, the activation of prior knowledge, and the understanding of explicitly taught vocabulary. They discuss strategies teachers can use to teach decoding mathematical texts and understanding the vocabulary as well as activating prior knowledge to comprehend the problem. The findings of their research reveal that the majority of strategies used during the teaching of mathematics relate to vocabulary instruction. This direct vocabulary instruction increases students' mathematical comprehension. Their study also shows that direct comprehension instruction in mathematics teaches readers to monitor their comprehension and assists them in knowing which literacy strategy to use when struggling with comprehension.

One strategy that can be transferred to other subject areas such as mathematics is inferencing while conducting read-alouds. Ouellette, Dagostino, and Carifio (1999) acknowledge that early experiences with books determine later comprehension. They study fifth graders' ability to recall stories and concepts and relate them to other subject areas. Using the schema theory as the theoretical background, the authors suggest that the extension of read-alouds to other content areas and the use of literacy strategies in other content areas lead to better comprehension. They also stress that teachers need to model how to use literacy strategies in other content areas in order for the strategies to be effective. Although they do not test the effect of using inferencing and strategies to increase knowledge of story structure, the authors suggest that using these strategies will be beneficial in increasing mathematical comprehension.

Improving reading comprehension also has an impact on comprehension in all other content areas that involve reading. Glenberg, Willford, Gibson, Goldberg, and Zhu (2011) point out that reading comprehension strategies assist in the understanding of reading a text. The third and fourth grade classes in their study use reading comprehension strategies to comprehend and understand the meaning of a text. These students' reading comprehension of the texts increases due to the usage of strategies. More specifically, the authors promote that the use of teaching reading comprehension strategies in reading can improve students' performance in solving mathematical story problems.

Bilsky, Blachman, Chi, Mui, and Winter (1986) investigate the differences in inferencing mathematic problems and story contexts. Although this study is not as recent as others, the authors explore whether students can apply different comprehension strategies in mathematics. They find that context plays an important role in comprehension and different types of inferential processing occur when reading mathematical story problems as opposed to listening to verbal

mathematical problems. In both of their experiments, the exposure to mathematical problem solving helped the subjects to treat the mathematical problems as verbal arithmetic problems and successfully solve the problems. The authors' findings show that there is a positive impact on mathematical comprehension when using inferences to solve story problems.

### **Impact of Authentic Children's Literature on Mathematics**

**Increase of interest in mathematics.** Research has shown that using authentic children's literature to teach mathematics helps students learn mathematical concepts (e.g., Hong, 1996; Jennings, Jennings, Richey, & Dixon-Krauss, 1992; Young-Loveridge, 2004). As addressed previously in this chapter, there is a relationship between mathematics and reading. Many studies discuss the connection of children's literature and mathematics in very young children. Jennings, Jennings, Richey, and Dixon-Krauss (1992) test the hypothesis that using children's literature to teach mathematical concepts to kindergarten children improves their mathematical achievement and interest in mathematics. They use twenty authentic pieces of children's literature and manipulatives with 61 kindergarten students from two school districts over a five-month period. The authors record the frequency of vocabulary used during play after the teacher's use of children's literature in instruction and evaluate the pre- and post- test scores of the students. The results show that the experimental group's post-test scores are significantly higher than the control group which does not incorporate children's literature into instruction. The results also show that students use more mathematical vocabulary, have an increased interest in mathematics, and have a positive effect of hands-on mathematical experiences. These results show that using children's literature increases the amount of mathematical vocabulary used and

an increase in comprehension and interest. Although this study was published in 1992, these findings are similar to those in more recent studies.

Hong's (1996) research also relates to the impact of using children's literature on mathematical interest. Hong points out that "children's storybooks containing mathematical concepts can be used for making connections between mathematics and real-life situation" (p.480). Primary grade teachers use picture books or children's literature in order for students to make a connection with their real-life experiences so the same can be used in order to teach mathematics. This research involves 57 kindergarten students. The control group has storybooks related to a weekly theme for reading and they complete mathematical activities for mathematics in that area of the classroom. The experimental group has storybooks related to the theme that can also be used to teach mathematical concepts. Their activities also relate to the storybook that is read. Hong finds that although there is no significant difference between the groups' scores for the pre-tests and for the post-tests given, there is a significant difference in the students' interest in engaging in mathematic activities during play. The students from the experimental group display mathematical comprehension of concepts through play. The experimental group shows an increase in interest of mathematical concepts, which suggests that using authentic children's literature to teach mathematics increases students' interest and achievement. This difference may be because teaching mathematics through children's literature gives the students more opportunities to learn and view mathematics expressed in a new way. Children's literature may also be the cause of motivation for students to engage in mathematical activities during play because picture books make learning mathematics more relatable to their lives. By relating mathematics to their everyday lives, children become more competent comprehending the mathematical concepts and have more interest in learning about mathematics.

Mink and Fraser (2005) conduct a one-year study of fifth graders to determine how a program of mathematics integration with literature exposure influences students' attitudes towards mathematics. They promote the use of literacy strategies for teaching mathematics through the use of professional development workshops for teachers. After attending the workshops, the teachers implement the strategies from this program called Project SMILE (Science and Mathematics Integration with Literary Experiences). The findings from their quantitative investigation of students' attitudes before and after implementing Project SMILE, illustrate that students find mathematics more fun and they gain more interest in mathematics. The Project SMILE is only in place in the state of Florida so the authors contend that the program could benefit other states as well.

**Increase of mathematical comprehension.** Elia, Heuvel-Panhuizen, and Georgiou (2010) examine the cognitive activity taking place when a picture book is read for a mathematical purpose. The authors identify what mathematical related thinking results with the use of picture books by observing four kindergarten students who receive organized mathematics instruction. Picture books are read to each student and the students' reactions to the books are recorded. These reactions include prediction, counting, describing pictures, and time and spatial concepts. The results of the study reveal that certain books are found to provoke mathematical thinking. Because of the way they are written and illustrated, they encourage students to actively construct mathematical knowledge. Since these types of children's literature provoke mathematical thinking, there is an increase in their comprehension of the mathematical concepts. Therefore, using authentic children's literature has a positive impact on the mathematical comprehension of young students. The findings may not be applicable to all picture books, as the picture books used in this study contain specific mathematical content and information.

An investigation performed by Heuvel-Panhuizen and Boogaard (2008) illustrates how picture books help kindergarteners to think mathematically. They use picture books that do not contain specific mathematical content in their study. Since many studies find that the use of picture books affects mathematical achievement scores of young children, the researchers look at the cognitive aspect of using picture books to teach mathematics instead. Their findings suggest that children can be mathematically engaged by reading a picture book and that the book does not have to contain specific mathematical concepts in order for the children to verbally express mathematically concepts and think mathematically. The authors conclude that authentic children's literature has a positive impact on mathematical comprehension.

Young-Loveridge (2004) also addresses using picture books for mathematic instruction of kindergarteners. The purpose of her study is to examine the effectiveness of using picture books and games to teach numeracy. Unlike Hong's (1996) research that involves a whole group, Young-Loveridge (2004) uses small group instruction to teach mathematical concepts using picture books. Her results show that the use of picture books and games in small groups has a significant impact on students' early numeracy skills. This study suggests that authentic children's literature has a positive effect on mathematical comprehension, specifically in the area of number sense. Young-Loveridge does recognize, however, that there are many reasons that the impact shown in this study is higher than the effects shown in other previous studies. In this study, picture books are used in small group instruction rather than only whole group instruction. This study also incorporates mathematical games and manipulatives after reading the picture books, which may play a role in the improvement of the students' early numeracy as well.

**Later mathematical achievement and motivation.** O'Neill, Pearce, and Pick (2004) find that the use of picture books with preschoolers plays a role in their mathematical ability later

on. The authors observe and record the children's self generative narratives of picture books. Then they assess five areas of academic achievement that students have later on which include: General information, reading recognition, reading comprehension, mathematics, and spelling. All of these areas are assessed using the Peabody Individualized Achievement Test-Revised. They find that the early narrative ability, which is displayed in their self generative narratives of the picture books, predicts later mathematical ability but does not always predict later achievement in the other four areas. However, there is no firm conclusion as to why there is a significant relation between early narrative ability with mathematical achievement. This is a surprising finding considering that preschoolers have only just begun learning how to read and there is a connection found between their later mathematical ability and early narrative ability.

Ouellette, Dagostino, and Carifio (1998) examine fifth graders' knowledge of children's literature and their reading ability. The authors use read-alouds and inferencing to find the affects of early experiences with authentic children's literature. More specifically, they strive to determine if the early experiences with authentic children's literature determines later mathematical achievement. They find a direct relationship between the readers' sense of story structure and their reading ability. They also find that early exposure to authentic children's literature plays a critical role in students' reading and mathematics abilities later on. A suggestion they make is to extend the reading aloud of children's literature to other content areas besides mathematics in order to increase achievement and comprehension.

Literature also shows that besides the positive effect on mathematical comprehension, there is also a positive effect on students' and teachers' attitudes toward using authentic children's literature to teach mathematics. Cotti and Schiro (2004) and Van den Heuvel-Panhuizen and Elia (2012) investigate teachers' beliefs of using authentic children's literature

and picture books to teach mathematics. Cotti and Schiro (2004) observe that teachers use authentic children's literature to teach mathematics differently depending on their ideological beliefs. Four ideologies are presented, which include the *Scholar Academic*, *Social Efficiency*, *Child Study*, and *Social Reconstruction* positions. The Curriculum Belief Inventory administered indicates that both experienced teachers and pre-service teachers from the study are in favor of using authentic children's literature for the purpose of teaching, learning, knowledge, childhood, or evaluation.

Van den Heuvel-Panhuizen and Elia (2012) investigate whether or not teachers are in favor of the use of picture books to teach mathematics. They also look for characteristics of picture books that aid in the instruction of mathematics to motivate students. Three major findings are: The importance of using picture books, the criteria for selecting picture books, and directions for using picture books. Their findings show that teachers are in favor of using picture books to teach mathematics and the teachers attribute making connections with children's life and experiences as the most important use of picture books. By making these connections, it motivates students to use mathematics in their everyday lives.

In sum, authentic children's literature is used with very young children in order to increase mathematical achievement and mathematical thinking in the previously mentioned studies. The studies all show a positive effect in using authentic children's literature to teach mathematics and increase motivation. Students' mathematical comprehension increases in the areas of vocabulary and number sense specifically.

After extensive research on the topic of reading and mathematics, there is not much research on the specifics of how reading ability affects mathematical achievement and ways teachers can use literacy to assist in the teaching of mathematics. However, the research

synthesized contained valuable information and recommendations for further study on this topic. Most importantly, this research shows that there is a connection between literacy and mathematical comprehension. Authentic children's literature and literacy strategies both have a positive impact when used to increase mathematical comprehension. There is also a positive effect on teaching mathematical concepts using authentic children's literature. The findings suggest that authentic children's literature and literacy strategies can and should be applied to the teaching of mathematics.

### **Professional Development Research**

When designing this professional development workshop, research is carried out in order to determine the most effective ways to conduct a professional development and to determine the most important components of a successful professional workshop. After researching this topic, the major findings are that teachers need to be engaged during the professional development and it needs to be relevant to what they teach. The time period of the professional development should be convenient for the participants and different evaluation tools should be used in order to determine how effective the professional development is.

Morewood and Bean (2009) recognize that professional development is a very important way for teachers to provide effective, higher quality education to their students. They intend to find which aspects of professional development are the most influential. Some guidelines suggested for providing effective professional development are: Focusing on subjects taught by the teachers in attendance, using authentic assessments that can be transferred to actual classrooms by the teachers, planning a convenient time that allows teachers to attend the professional development, and using an evaluation tool to determine the impact of the

professional development (American Educational Research Association (AERA), 2005).

Morewood and Bean (2009) find that teachers are willing to attend professional development workshops regarding reading instruction as long as the workshops meet their specific needs.

Garet, Porter, Desimone, Birman, and Yoon (2001) also examine what makes professional development effective. They survey over 1,000 mathematics and science teachers in order to determine what professional development activities have a positive impact on their knowledge of best practices for their classrooms. The results indicate the important features as content, opportunity for active learning, design of professional activity, collective participation, and duration of activity. These findings are very similar to the ones found by Morewood and Bean (2009) and the guidelines mentioned by AERA (2005).

While these studies contain valuable information on the components of an effective professional development workshop, they do not address the role of the facilitator. Linder (2011) conducts a study in which she interviews teachers to determine which characteristics of professional development facilitators are most important to them. The participants suggest that the facilitators of professional development workshops should allow time for group work and discussion, show interest and make connections with the participants, and use reflection after the professional development. These findings about the facilitator are just as important as the content and delivery of the professional development.

This information found from researching the best practices for professional development will be used in order to design and administer the most effective professional development project for this topic. The design will also adhere to the International Reading Association (IRA) (2011) standards for professional development.

### Chapter Three Methodology

#### Data Collection

In finding answers to the research questions, literature related to mathematics and literacy was researched by using various search engines. The search engines used in order to find empirical studies were: Education Full Text, Education Research Complete, ERIC, PsycINFO, and PsycARTICLES. Literature was found by searching many keywords such as mathematics, reading, and comprehension. In order to keep the search focused, some specific terms were used which included children's literature, picture books, and specific literacy strategies such as inferencing and accessing prior knowledge. For the professional development literature review, key words such as teaching workshops, professional development, and adult learning theories were searched. By using more specific literacy terms, more empirical studies were found that closely related to the topic of the impacts of using effective literacy strategies and authentic children's literature on students' mathematical comprehension.

In order to find empirical studies to answer the research questions, peer reviewed academic journals were also examined which included *Early Childhood Research Quarterly*, *Journal of Educational Research*, *Journal of Mathematics Teacher Education*, *Journal of Educational Psychology*, and *Reading Psychology*. Once studies were found from academic journals, criteria were created in order to select which professional sources most relevant to the research questions. Studies that only consisted of research on mathematics without any discussion of the role of literacy and reading were not chosen for this project. The empirical studies had to include information on reading and mathematics. The studies regarding children's literature had to contain information on the effects of using it when teaching mathematics.

### **Data Analysis**

Categories emerged while reviewing the empirical studies. The categories that first emerged were comprehension and using children's literature for mathematics. Studies that dealt with the relationship between mathematics and reading were then broken up into subcategories involving the impacts had on students. These subcategories were: Increase in early numeracy and literacy, and increase in reading and mathematical performance. Studies addressing the impacts of literacy strategies were placed under the subcategory of transferring reading skills to mathematics. Finally, the studies involving the impacts of children's literature were broken up into three subcategories labeled: Increase of interest in mathematics, increase in mathematical comprehension, and increase in mathematical achievement and motivation.

As the studies were organized by commonality, they were placed into one of two folders, either the comprehension folder or the children's literature folder. Post-its were placed on the folders to label the two areas of picture books for mathematical instruction, numeracy, and literacy. Post-its were also used in order to label the information on the relationship of reading and mathematics. The labels show how reading affects mathematical comprehension and the impacts of using effective literacy strategies when teaching mathematics. Mathematical word problems and story problem studies were labeled with post-its as well. After these three steps listed above were taken, themes were generated to address the research questions for this study. One theme is that using authentic children's literature causes an increase in early numeracy. Another theme is that using literacy strategies helps to increase reading and mathematical performance. Literacy strategies are also a way for students to transfer reading concepts to mathematics. The last two themes which emerged are the increase of interest in mathematics, motivation, and later mathematical achievement.

## **Chapter Four Professional Development Project**

### **Rationale for Designing Professional Development Workshop**

This professional development project was designed based upon the research from the previous chapter on adult learning theories and professional development. The participants for this professional development workshop are elementary teachers who teach reading and mathematics. Morewood and Bean (2009) explain that it is important for the focus of the workshop to be on the subject area the participants teach. Since this professional workshop addresses ways to use literacy when teaching mathematics to elementary students, the audience for this workshop was chosen accordingly. Morewood and Bean also find that using an evaluation tool to determine the impact of a professional development workshop is an important aspect of an effective workshop. An evaluation form will be used at the end of every workshop in order to determine the effectiveness of the workshop and the presentation itself.

Garet, Porter, Desimone, Birman, and Yoon (2001) suggest for the researcher to create an active learning experience with collective participation when conducting a professional development workshop. In order to have a more successful professional development, participants of the workshop will work and have discussions in both small groups and as a whole group. This requires the participants to take an active part in the professional development workshop and discuss their own experiences with each other.

The researcher of the professional development project also plays an important role in an effective workshop. Linder (2001) indicates that the facilitator of a professional development workshop needs to show interest in the topic he or she is presenting. The researcher of this project has a background in both literacy and mathematics and is an elementary teacher who has a strong interest in this topic. Linder also finds that facilitators, who self reflect on their

professional development workshops, are able to change and adapt their workshops to better meet the needs of the participants. Based on this finding, the researcher chose to include a self reflection form that will be completed after every workshop given.

### **Professional Development Workshop**

There will be a series of three workshops for teachers to discuss the relevance of the topic, the relationship between mathematics and literacy, and the impacts of using literacy strategies and children's literature on teaching mathematics. There will also be insight on ways to use literacy to teach mathematics in the classroom, ways to select children's literature to teach mathematics, and the findings from implementation of literacy usage to teach mathematics. The three workshops will be held once every month for three consecutive months so that teachers have a chance to implement what they learn from the workshop and comment on if it is successful. Each workshop session will be 90 minutes long and will take place either during the school day or after the school day at the discretion of the school district.

The goal of this professional development is to educate teachers on the relationship between reading and mathematics. By discussing ways children's literature and literacy strategies can be used to teach mathematics, teachers can find ways to use these tools in their own classrooms to increase mathematical comprehension. The objectives of this series of workshops are as follows:

1. Teachers will reflect on ways they use literacy to teach other content areas in their classroom.
2. Teachers will learn the relationship between reading and mathematics.

3. Teachers will select authentic children's literature for teaching mathematics by using the selection criterion developed by the researcher.
4. Teachers will learn the impacts of using children's literature to teach mathematics.
5. Teachers will learn the impacts of using literacy strategies to teach mathematics.
6. Teachers will engage in an ongoing blog to share information on what they have learned and how they are using what they have learned in their own classrooms.

At the beginning of the first workshop, the teachers will spend approximately 10 minutes discussing ways they use literacy in their classroom to teach other content areas. The next 15 minutes will be a whole group discussion on teachers' attitudes and beliefs toward using literacy strategies and children's literature to teach other content areas. Teachers will also share their view on the relationship between literacy and mathematics in order to build prior knowledge. This will be followed by a PowerPoint presentation to discuss the connection between literacy and mathematics and the impacts of implementing literacy in mathematical instruction. Lesson ideas will be shared and modeled for teachers to use in their classrooms. The remaining time will be spent discussing other ways for integrating literacy and mathematics. The teachers will take part in a lesson using children's literature and a literacy strategy to teach mathematics (see Appendix A). For homework, the teachers will find another piece of children's literature that they deem appropriate to teach mathematics. Teachers will complete an evaluation form afterward (see Appendix B) and have a question and answer session.

For the second workshop, teachers will begin by spending the first 10 minutes completing a survey about how well the techniques from the first workshop are implemented in their classrooms. Teachers will discuss the children's literature they locate to teach mathematics or a mathematical concept in small groups. Then as a whole group, teachers will share which books

they use to when teaching mathematics. A PowerPoint presentation will then be conducted in order to illustrate the selection criteria for children's literature to be used in order to teach mathematics (see Appendix C). Two lessons will then be demonstrated. One sample lesson will be taught using a picture book that has mathematical concepts and is geared toward Kindergarten through second grade students. Another sample lesson will be taught using a picture book that does not contain specific mathematical concepts and is geared toward upper elementary students. The reason behind using two different types of children's literature is because studies have showed impacts on mathematical comprehension when using both picture books that contain mathematical information and picture books without it. The researcher will also give the participants a list of sample children's literature (see Appendix D) that is appropriate to use when teaching mathematics based on the selection criteria discussed. There will be time at the end of the PowerPoint and lesson presentations for the teachers to come up with ideas of suitable children's literature that could be used to teach mathematics using the selection criteria discussed.

The researcher will also set up and explain the use of an ongoing blog so that participants can continue to discuss their experiences with integrating literacy and mathematics. During this second workshop, there will be an introduction for the participants in order to model how to use the blog. The blog will be used to offer support, knowledge, and suggestions for the teachers who participate in the professional development workshops. They will be encouraged to post literacy strategies and children's literature that can be used to teach mathematics before meeting again for the third workshop. For the final workshop, their homework will be to make a post or comment on the blog about using children's literature or literacy strategies to teach mathematics. The last few minutes of the workshop will be time the teachers will use to fill out an evaluation form of the presentation and to have a question and answer session.

The final workshop will begin by spending ten minutes discussing the lists of children's literature and lesson ideas teachers are able to come up with or able to use in their classrooms since the last workshop. The teachers will share which lessons they use in their classrooms. They will also share examples of children's literature they find useful when teaching mathematics. After, there will be a PowerPoint presentation on the ways different literacy strategies can be used to teach mathematics. Teachers will discuss ideas and strategies that they predict will be useful to use with their students. As a whole group, the researcher will go over the blog entries that participants created since the last workshop. Then a list of strategies and ideas will be created to be used with elementary students within the whole group to be added to the blog. At the end of the workshop, the teachers will fill out a final evaluation on the overall success of the professional development. There will also be time at the end to have a question and answer session along with time for the researcher to receive immediate feedback from the participants. The researcher will also complete a self-evaluation after every workshop to determine the strengths and areas in need of improvement (see Appendix E).

### **IRA Standards**

Table 1 below includes the IRA Standards (2010) that are addressed for this entire project. The project will meet the IRA Standards 1.1, 1.2, 2.1, 2.2, 2.3, 5.1, 6.1, and 6.3 and increase teachers' use and knowledge of using literacy in teaching mathematics. The following matrix discusses how IRA standards were addressed throughout this entire project.

**Table 1****IRA Standards Addressed**

| <b>IRA Standard</b>   | <b>Project Component</b>  |
|---|---|
| 1.1- <i>Candidates understand major theories and empirical research that describe the cognitive, linguistic, motivational, and sociocultural foundations of reading and writing development, processes, and components, including word recognition, language comprehension, strategic knowledge, and reading–writing connections.</i> | Examining constructivist theory and empirical studies to answer the research questions.   |
| 1.2- <i>Candidates understand the historically shared knowledge of the profession and changes over time in the perceptions of reading and writing development, processes, and components.</i>   | Researching on Common Core Standards for reading and mathematics and identifying a relationship between mathematics and reading within the new standards.   |
| 2.1- <i>Candidates use foundational knowledge to design or implement an integrated, comprehensive, and balanced curriculum.</i>   | Researching of schema and constructivist theories; using literacy to teach mathematics in a balanced curriculum.  |
| 2.2- <i>Candidates use appropriate and varied instructional approaches, including those that develop word recognition, language comprehension, strategic knowledge, and reading–writing connections.</i>  | Researching different comprehension strategies; using different approaches to teaching mathematics (using literacy).  |
| 2.3- <i>Candidates use a wide range of texts (e.g., narrative, expository, and poetry) from traditional print, digital, and online resources.</i>   | Using children’s literature in different genres (poetry, narrative, and expository) to teach mathematics.   |
| 5.1- <i>Candidates design the physical environment to optimize students’ use of traditional print, digital, and online resources in reading and writing instruction.</i>  | Using children’s literature and reading comprehension strategies to teach mathematics; developing professional workshops including components of PowerPoint, ongoing wiki or blog online, and survey. |
| 6.1- <i>Candidates demonstrate foundational knowledge of adult learning theories and related research about organizational change, professional development, and school culture.</i>  | Researching adult learning theories in order to develop professional development project.   |
| 6.3- <i>Candidates participate in, design, facilitate, lead, and evaluate effective and differentiated professional development programs.</i>   | Designing and leading professional development project; incorporating small group discussion, whole group discussion, technology (ongoing blog), and surveys.   |

## Chapter Five Discussion

### Overview of the Study and Findings

The purpose of this project is to explore the impacts of using children's literature and literacy strategies to teach mathematical comprehension. The project is guided by the following research questions:

1. *What are the impacts of using authentic children's literature on mathematical comprehension in elementary grades?*
2. *What are the impacts of literacy strategies on students' mathematical comprehension?*

The findings of this master's project reveal the relationship between literacy and mathematics. It highlights the ways literacy strategies can be used in teaching mathematics and how children's literature can be used in order to teach mathematical concepts. Findings from this project illustrate that using children's literature and literacy strategies to teach mathematics increases mathematical interest, motivation, and achievement (Hanich & Jordan, 2004; Hong, 1996; Mink & Fraser, 2005; O'Neill, Pearce, & Pick, 2004). In most of the cases where literacy is used to teach mathematics, children's literature is used to teach mathematical comprehension and concepts. The use of children's literature supports the growth in early numeracy skills on young children (Cowan, Donlan, Newton, & Lloyd, 2005; Donlan, Cowan, Newton, & Lloyd, 2007; Jordan, Kaplan, Olah, & Locuniak, 2006; Purpura, Hume, Sims, & Lonigan, 2011).

Researchers also find that literacy strategies can be transferred to other subject areas to increase reading comprehension. Inferential processing, activating prior knowledge, and question answer relationships (QAR) are all reading comprehension strategies that have been identified as increasing mathematical comprehension as well (Carter & Dean, 2006; Kinniburgh & Prew, 2010; Ouellette, Dagostino, & Carifo, 1998). The findings from these studies

strengthen the belief that there is a connection between literacy and mathematics. The findings from this master's project present a number of impacts on using children's literature and literacy strategies to teach mathematics.

### **Significance of Findings**

The integration of literacy in other subject areas is an important topic in education. The findings of this master's project are significant for elementary teachers because of the changes in Common Core State Standards (2011). According to the new Common Core State Standards, students are required to show mathematical comprehension by reading word problems and giving a written answer. Since reading and writing are required to solve these mathematical equations, there is a strong relationship between a student's mathematical ability and how well they read. The findings of this project reveal this relationship and the many ways that literacy instruction can impact mathematical comprehension. This is significant because teachers are not always aware of the ways that reading can impact mathematics. Some students struggle with mathematics because they struggle with reading comprehension. The transfer of reading comprehension strategies to mathematics can assist these struggling students. The findings from this project also provide teachers with ways to use children's literature and literacy strategies to increase mathematical comprehension.

There are not many studies that give teachers information on using literacy to teach mathematics so the findings of this master's project are applied to create a series of professional workshops. From the information presented in the professional workshops, teachers will be able to utilize children's literature and literacy strategies in their classrooms in order to increase their students' mathematical comprehension.

From the literature review conducted on professional development, findings included the ways teachers benefit most from professional development workshops. These findings are significant because the series of professional development workshops for this project are created based upon the research on professional development. The professional development workshops are centered on a topic that is relevant to elementary teachers. The workshops have components such as PowerPoint presentations, an ongoing blog, modeled lesson plans, self-evaluation forms, and evaluations of the researcher's presentations. All of these components are included based upon the findings from the research on professional development.

### **Limitations of the Project**

The research discussed in the project covers a wide range of databases and multiple journals. Most of the journals were educational and some were mathematical journals. However, the research for this project is limited by the number of databases available through SUNY Fredonia. The results are also limited by the specific keywords and terms used to search for studies relating to the topic.

Although there was thorough research done on this topic, many of the empirical studies found were done more than ten years ago (e.g., Hong, 1996; Jennings, Jennings, Richey, and Dixon-Krauss, 1992). However, the information and topic is still relevant today. Since there are not many empirical studies currently conducted on this topic, this is another limitation for the project.

Another limitation of this project is that many empirical studies that were initially found were done in countries other than the United States. Priority of empirical studies cited in this project was given to studies conducted and published in the United States. While the findings

from other countries are similar to those used for this project, empirical studies included were limited to ones used in American journals.

Sample size and ages of participants is also a limitation of this project. Small sample sizes are a commonality in many of the studies in this master's project. Some studies are only conducted using one or two small classes or a small group of children. For the most part, the ages of participants in many of the studies are limited to one grade level. Most of the studies done with younger elementary students are limited to kindergarteners without any studies on first and second graders.

Furthermore, this study is limited by the diversity of the student populations which were researched. Some of the studies for this project included students with recognized reading deficiencies and/or mathematical deficiencies. However, most of the studies did not specifically identify students having special needs or deficiencies in mathematics or reading. Various socio-economic populations and minority populations were also excluded from many of the studies included in this project. These are the limitations that were most significant when researching empirical studies for this master's project.

### **Opportunities for Further Research**

There are many opportunities for further research on this topic. Jennings, Jennings, Richey, and Dixon-Krauss (1992) recommend further study to find out more about how children's literature can be used to teach mathematics. The recommendations they make are to use a larger sample size and to measure mathematical achievement over more than one grade level. These recommendations are common among many studies. The studies reviewed involved kindergarteners and/or used only one or two grade levels.

Another opportunity for further research is to address which types of children's literature elicit mathematical thinking. Elia, Heuvel-Panhuizen, and Georgiou (2010) also suggest this as an opportunity for further research. Many of the studies illustrate the impacts of using children's literature but there is not any research on which types of children's literature support children to think about and understand mathematical concepts.

## **Conclusion**

Research suggests that there is a relationship between reading and mathematics and that literacy can impact mathematical comprehension. This project explores the impacts of using children's literature and literacy strategies to teach mathematical comprehension. This master's project enables teachers to have a better understanding of the relationship between literacy and mathematics. The series of professional workshops is developed in order to inform participating teachers of the impacts literacy has on mathematical comprehension. The teachers also gain knowledge from the workshops for using children's literature and literacy strategies that can be transferred to their own classrooms. This knowledge of the relationship between literacy and mathematics can help teachers in addressing the new Common Core State Standards (2011) which involve more reading and writing for mathematical comprehension. By using children's literature and literacy strategies to teach mathematics, teachers are supporting their students with their mathematical comprehension and overall academic performance.

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## **Appendices**

## Appendix A

### Selection Criteria for Children's Literature

(created by Researcher)

- Is the mathematical content in the book accurately represented?
- Is there vocabulary in the book that can be related to mathematics?
- If the book does not have specific mathematical content, can it be used to teach a mathematical lesson?
- Is the format and presentation visually and verbally appealing?
- Does it provide a context for students to make a connection between mathematics and their everyday lives?
- Does the book provide mathematical content in a way the audience can relate to and understand?

**Appendix B**

**General Evaluation Form (to be used at the end of every workshop)**

What insights and knowledge have you gained from this professional workshop?

Do you find this topic and information relevant and why?

What was the most important thing you learned from the professional development workshop?

How ready and willing are you to use what you have learned in this workshop with your students?

How can the researcher make the professional development better and more beneficial for you?

What aspects of the professional workshop did not work well or can be improved?

## Appendix C

### List of Recommended Children's Literature

- Geehan, W. & Neuschwander, C. (1999). *Sir Cumference and the dragon of Pi (A math adventure)*. Watertown, MA: Charlesbridge Publishing.
- Geisel, T. S. (1960). *Green eggs and ham*. New York, NY: Random House Inc.
- Hutchins, P. (1986). *The doorbell rang*. New York, NY: William Morrow & Co.
- LeSieg, T. (1961). *Ten apples up on top!* New York, NY: Random House Inc.
- Murphy, S. J. (1996). *Give me half!* New York, NY: HarperCollins.
- Pallotta, J. (2002). *Apple fractions*. New York, NY: Scholastic, Inc.
- Scieszka, J. (1995). *Math curse*. New York, NY: Penguin Books.

## Appendix D

### Lesson Plan Using Children's Literature for grades K-5

Book Used: *The Doorbell Rang* (Hutchins, 1986)

Concepts Addressed: Number sense, sharing (younger elementary students, K-2)

Fractions, division (older elementary students, 3-5)

Literacy Strategy (Comprehension): Sequencing

Objectives: K-2- Students will increase number sense by counting out cookies. Students will practice the concept of dividing by sharing the cookies equally. 3-5- Students will practice writing fractions and solving division problems by using manipulatives to share cookies among children.

Common Core Standards: K.CC.4- Count to tell the number of objects, 1.OA.1 and 2- Represent and solve problems involving addition and subtraction, 2.OA.3 and 4- Work with equal groups of objects to gain foundations for multiplication, 3.OA.2- Represent and solve problems involving multiplication and division, 4.OA.2- Use the four operations with whole numbers to solve problems, 5.NF.3- Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

Procedure: This piece of children's literature was chosen because it can be used to teach mathematical concepts to younger and older elementary students. This book also shows how the literacy strategy of sequencing events can be used to assist in mathematical comprehension.

When reading this story with younger students, use manipulatives to represent the cookies. The students are using number sense skills to discover how many cookies the children can get after the doorbell rings each time. This also introduces the concept of sharing which is a form of division. With older students, instead of using manipulatives, use actual numbers. The older

students can use fractions to show how many cookies each child receives out of how many there are in all. The students can also show how the cookies are shared (or divided) by creating division problems. The comprehension strategy of sequencing events is used throughout the story in order to show how the number of cookies each child can have changes.

**Appendix E**

**Self-Evaluation Form (used by Researcher)**

How do you feel this workshop went?

What worked well and what did not work well?

How were you able to keep the participants actively involved?

Were there any questions asked by the participants that you were unable to answer?

What can you change or do next time to make this workshop more successful?