

The use of Children's Literature to Teach Mathematics to improve Confidence and Reduce Math Anxiety

By

Dedrian Barnaby

**A research paper submitted in conformity with the requirements
For the degree of Master of Teaching
Department of Curriculum, Teaching and Learning
Ontario Institute for Studies in Education of the University of Toronto**

Copyright by Dedrian Barnaby, April 2015



Abstract

Mathematics is one of the core subjects that students at the elementary level need to have a firm foundation of. Unfortunately, it is often perceived by some elementary school teachers as difficult to teach. Likewise, many children have a negative view of the subject, and have difficulty learning the concepts. Research has found that teachers who have a negative perception of the mathematics often project these feelings onto their students (Anderson, 2007; Ma & Xu, 2004; Relich, 1996). The purpose of this research paper is to examine the impact of using children's literature to teach mathematics at the elementary level. To conduct this qualitative research I will interview three elementary teachers who are integrating children's literature into their mathematics lessons to find out what strategies they are using and how they perceive children's literature impacting students' engagement with the mathematics curriculum.

Acknowledgement

This research would not have been successful if I did not have the support of; educators, instructor; family and friends to support me on this journey. I wish to acknowledge them and express my utmost gratitude. Firstly I would like to thank Dr. Larry Swartz my research supervisor for the guidance and unwavering support he extended to me during the compilation of this paper. I am really appreciative of his benevolence, wisdom and great sense of humour, throughout this entire process.

Next, I want to thank Dr. Angela McDonald for her guidance and preparation during the initial steps of this research project. Her thoughtful recommendations assisted in outlining this study. I would also like to express my appreciation to all my interview participants who contributed significantly to the validity of the research. Without their time and valuable insights this paper would not have been possible. I am appreciative of their passion, enthusiasm, openness and willingness to share their knowledge and experiences with me.

In addition, I would like to thank my course instructors, and colleagues for sharing their expertise and perspectives. I will always cherish the special bond we've created in taking this journey together. Their positivity and moral support have certainly contributed to my development as an educator. Most importantly, I want to thank my family who have loved and supported me throughout this journey. I owe my success to them.

Chapter 1: INTRODUCTION

Introduction to the Research Study: Research Problem

In Canada mathematics plays a big role in our society because we value intelligence. We can build students' minds by providing them with basic numeracy skills to function effectively in society and acquire meaningful and productive jobs that contribute to their personal and professional development (Lancaster, 2006). Mathematics is prioritized by the Ministry because it is associated with jobs in engineering, medicine and finance (Ontario Ministry of Education 2005). Research has found a phenomenon that children suffer from mathematics anxiety (Rubenstein & Kotsopoulos, 2007; Furner & Duffy, 2002). Math anxiety is a feeling of fear and hopelessness in understanding mathematical concepts (Bekdemir, 2010; Chinn, 2009; Hembree, 1990; Ma, 1999 and Rubinsten & Tannock, 2010; and Sheila Tobias 1976). Mathematics anxiety has been the topic of more research than any other area in the affective domain (Grouws, 1992). The literature is quite clear that math anxiety is associated with poor mathematical knowledge and low course grades (Ashcraft & Krause, 2007; Hembree, 1990 & Harter, 1982). Students who fear mathematics often lack the confidence to do well in the subject (Ashcraft & Krause, 2007). These students frequently exhibit a negative attitude towards mathematics (Hembree, 1990 & Harter, 1982).

Research has shown that teachers have used alternative strategies for teaching math that have been advocated for over the years to overcome math anxiety. Teachers have included humour in their math lessons. They have used games such as cards, Yahtzee, Battleships and Tangrams, to introduce many math concepts with the emphasis on having fun while learning.

Teachers have used cartoon from newspapers and books of math cartoons to try and alleviate or lessen math anxiety in the classroom Curtain-Phillips (2003). In light of the prevalence of math anxiety experienced by students, my research seeks to discover how teachers are using children's literature to reduce math anxiety at the elementary level.

Research Context

Integrated Curriculum

An integrated curriculum synthesizes the best approaches to curriculum development and implementation documented in the literature for learners (Benbow & Stanley, 1983; Maker, 1982; Ward, 1981). One specific strategy for integrating curriculum is through the use of children's literature. William James, a prominent psychologist and philosopher at the turn of the 20th century, and brother of esteemed novelist Henry James, is known for saying, the blending of the mathematician with the poet, enthusiasm with measure, passion with correctness, is actually the ideal.

For centuries, there has been a perceived connection between mathematics and the arts, including literature. This connection is now being introduced to children as part of an effective curriculum that includes subject integration. Educators worldwide have turned more attention toward working with themes and integrating different subject areas in the elementary curriculum, particularly the introduction of literature into mathematics instruction in an effort to improve students comfort level in the subject and reduce anxiety.

Research has shown that students who are more language oriented are more likely to learn mathematics when it is linked to language arts because it caters to their verbal-linguistic style of learning (Whitin, 2004). The Theory of Multiple Intelligences, developed by renowned

psychologist Howard Gardner, teaches that intelligence is not a single intellectual capacity. Instead, he suggests that there are multiple kinds of intelligences that people can possess: musical–rhythmic, visual–spatial, verbal–linguistic, logical–mathematical, bodily–kinesthetic, interpersonal, intrapersonal, and naturalistic. He claims that when students are given instruction in a manner that is responsive to their preferred intelligence, there is a greater possibility that learning will take place because children learn concepts easier and are better able to make an association to what they are taught. Therefore, if applying Gardner's theory of multiple intelligences, mathematics should be taught using a variety of strategies that caters to the diversity of the twenty first century classroom. Reading the children's book: "Sir Cumference and the Isle of Immeter," to introduce the concept and the math terminology of perimeter is one such strategy. By reading this book, and turning the pages to share the illustrations of the story with the students, the teacher includes the verbal –linguistic, the visual- spatial and the logical – mathematical learners. Mathematics should be taught using an integrated approach. The teacher's pedagogy should reflect lessons that integrate these intelligences at some stage of the lesson in an effort to improve students' confidence and reduce their anxiety in mathematics.

Wiley (1999) proposes that a growing body of research in the fields of mathematics education and literacy supports the inclusion of children's literature with the teaching and learning of mathematics. He posits that when mathematics is included within a story and presented using pictures, and a familiar language that students understand, students can more readily grasp the mathematical ideas and concepts. In addition, he argues that because children's literature often depicts real-life situations, it can serve as a catalyst for engaging students in authentic problem solving and inspire them to explore mathematical concepts actively and enthusiastically. The author suggests that teachers need to experience for themselves the power

and potential of children's literature as an educational tool in mathematics so that they are well prepared and motivated to teach in an engaging fashion with a focus on reading, writing, and communicating mathematically (Wiley, 1999). This author's insight has prompted me to research how teachers at the elementary level are integrating literature in the teaching of mathematics, how the strategies they are using impact students' engagement in mathematics.

In a world that is constantly evolving, it is essential to explore different methods and combine different subjects in the curriculum to encourage students to learn. Teaching mathematics in a way that encourages students to appreciate and value the subject is of great significance. Hyde (2006) argues that it is not only important for teachers to choose excellent pieces of children's literature to share with their students but also to help students make connections to their lives and other content areas while constructing meaning from those books. When read-aloud selections are also chosen to develop mathematical ideas, mathematics is humanized, its relationship to the arts is emphasized, and the picture books and extension activities stimulate positive reactions, interest, enjoyment, and confidence in children (Lawrence, Hope, Small, & Martin, 1996 as cited in Columba et al., 2005).

Hyde (2006) recommends that teachers use the time-tested comprehension strategies of asking questions, making connections, visualizing, inferring, predicting, determining importance, and synthesizing in both interactions with children's literature and interactions with the mathematics connections that stem from these texts.

Purpose of the Study

I have observed that a considerable amount of emphasis is placed on children learning to read and connects text to real life situation from an early age. Although numeracy is later privileged in schooling, it is not prioritized in the same way in children's early learning. Parents place much value on the significance of their children learning to read. They spend hours teaching them to write their names and spell new words. Columba et al. (2005) argue that picture books are usually the first type of children's literature that young children encounter. Teachers are responsible for helping young children make text- to -self, text- to-text, and text- to -world connections by scaffolding the learning experiences. The teacher's role in selecting and reading aloud children's literature to make these connections is a powerful one (Columba et al., 2005)

There are a number of picture books available that integrate mathematics. These include, for example: *The Fly on the Ceiling* (Glass, 1998), *The Math Curse* (Scieszka & Smith, 1995), *Sir Cumference* and *The Isle of Immeter* (Neuschwander, 2006) and *Zero the Hero* (Holub & Lichtenfeld, 2012)

The purpose of this qualitative study is to learn from a sample of teachers how they are integrating children's literature to teach mathematics in the elementary curriculum. This study will be important to the education community because it can contribute a range of instructional strategies in the teaching of mathematics that may have the potential to impact how students learn mathematics.

Based on my extensive experience learning and teaching mathematics, teachers are often blamed for students' poor performance in mathematics. It seems like they are often pressured to find creative methods to deliver mathematics to students that will foster learning. I believe that if

the curriculum is tailored to accommodate integration of literature in the teaching of mathematics the possibility of students grasping mathematical concepts may increase.

Research has also found that when mathematics is integrated with literacy students who are not typically “good” at math frequently excel in the subject (Worley, 2002). Therefore, children’s literature books should have authentic context that includes life experiences, personal or cultural episodes, and enjoyable plots. When students are given guided instruction through a subject they are more comfortable with they are more likely to comprehend concepts taught to them; thus, marked improvement can be made in the subject (Worley, 2002).

Research Questions

What are the perceived impacts of using children’s literature to teach mathematics?

Sub-question

- What resources and factors support teachers’ integration of children’s literature to teach mathematics?
- What impacts have teachers observed the integration of children’s literature to teach mathematics having on their students?
- What challenges do teachers experience integrating children’s literature in their mathematics curriculum?

Background of the Researcher

I found it difficult throughout my pre-university years, to appreciate mathematics. The teachers who laid the foundation for me as a child were very unwelcoming. I was often afraid to ask for assistance when I needed it. I was also fearful to participate in class discussions because I had no confidence in mathematics

I was taught mathematics in a very rigid way. Mathematics had to have a very formal structure. Mathematics was not integrated with other subjects across from the curriculum. My teachers encouraged me to memorize everything: time tables, equations, rules, and formulas. I was expected to learn mathematical concepts and terminologies by rote learning. There was only one acceptable way to solve a math problem. There was little room for experimenting. I could not “think outside the box to solve a math problem.” Mathematics was primarily about figures and worded problems were seldom used. Many of my classmates suffered from math anxiety.

Mathematics became less intimidating for my classmates and I when we were introduced to worded problems. We were able to read and understand the concepts and then represent them in a numeric form, because we were verbal- linguistic learners. We appreciated associating mathematics with words.

According to Gambrell (2009), when parents and teachers offer children opportunities to share and discuss the books they read, children are motivated to read even more; therefore, if picture book are integrated in the math curriculum, there is a possibility that students will develop a better appreciation of the subject. I endorse the notion put forward by Gambrell. I believe if this strategy is implemented, students will become less fearful of mathematics. Mathematics is not a series of rules and formulas that should be memorized, tested, and contained within the boundaries of the mathematics classroom (2009). This author's work is essential to my research because mathematics is part of our everyday life. Mathematics can be brought alive through books that children, teachers, and parents enjoy reading. Such a shared delight as that of a good book makes mathematics little less scary and more enjoyable.

Sadly, enough is still not being done to encourage the integration of mathematics with other subjects to stimulate learning in elementary schools. I am cognizant of this, and therefore I

hope that the findings of this research study will support more teachers to incorporate children's literature into their mathematics instruction.

Organization of This Study

In Chapter One I have introduced the study including the research problem, purpose of the study, overarching research questions and background of the researcher. A detailed review of the literature relevant to the study is outlined in Chapter Two. I reviewed the literature in the areas of math anxiety, curriculum integration, and using children's literature to teach mathematics because these areas stood out in my readings.

Chapter Three provides a complete guide to my methodologies including participant sample and strategies for my research procedures. In Chapter Four I presented an interpretation of my findings, and in Chapter Five I discuss the research findings and their implications for classroom teaching practice. All scholarly works that I referenced in the preparation of this study is recorded in the section references. The appendix contains the interview questions that were used to compile the data.

Chapter 2: LITERATURE REVIEW

There is a grave concern among school administrators, teachers and parents surrounding students attitude to math and how mathematic is being taught to students (Rushowy, 2014). The National Council of Teachers of Mathematics (1989) promotes a mathematics curriculum that involves students in communicating mathematically, relating and applying ideas to real life, and cultivating an interest in the subject. Literature provides students with these beneficial experiences as well as a multitude of others (Alvermann, Swafford, Montero, 2004; Daisey, 1994; Griffiths & Clyne, 1988; Halsey, 2005; Hellwig, Monroe, Jacobs, 2000; Hunsader, 2004; Kliman, 1993; Moyer, 2000; Schiro, 1997; Whitin & Wilde, 1995).

In this chapter I reviewed the literature in the areas of the role children's literature plays in enhancing students' confidence in mathematics and reducing math anxiety. I considered how teachers are using children's literature to teach mathematics and the challenges and or benefits experienced by teachers who practice this method of integration in their classroom. I thought it was also necessary to research the effect teachers' attitude towards mathematics may have on their students' confidence and anxiety in the subject.

A definition of math anxiety:

The term "mathematics anxiety" popularized first by Sheila Tobias (1976) with her article, "Math Anxiety: Why is a Smart Girl Like You Counting on Your Fingers?" in Ms. Magazine. Tobias described the panic, helplessness, paralysis, and mental disorganization that occur in math anxious people when they are required to solve mathematical problems.

Math anxiety is a persistent feeling of tension, apprehension and fear about performing mathematical tasks (Ashcraft & Ridley, 2005). Math anxiety has been associated with negative feelings surrounding Math and adverse outcomes on both Math performance and the confidence

to learn Math (Bekdemir, 2010, Chinn, 2009, Chiu and Henry, 1990, Hembree, 1990, Ho et al., 2000, Ma, 1999 and Rubinsten & Tannock, 2010).

Math anxiety usually comes from a lack of confidence when working in mathematical situations. Many people incorrectly assume that math anxiety and an inability to be successful in Mathematics are inherited from one's parents. However, there are several contributors to an increase in the severity of this perception. Gender and ethnic backgrounds are not determining factors in mathematical competence, but peers' and teachers' attitudes toward gender and ethnicity may increase or decrease one's confidence in mathematical skills (Tobias 1978).

The development of a child's mathematics skills may be threatened by math anxiety and feelings of incompetence. Stress which can be encouraged by math anxiety can alter the chemical composition of the human body in an undesirable way (Krpan, 2013). High levels of math anxiety can severely undermine a student's ability to acquire the mathematical knowledge needed to function effectively in the 21st century workplace (Hembree, 1990). Thus, my research aims to integrate children's literature in mathematics teaching so that children's capabilities override their fears.

Who experiences mathematics anxiety?

Children at the elementary level are not exempted from math anxiety (Rubenstein & Kotsopoulos 2007). The anxiety they experience at this level can be attributed to a wide variety of factors among these are fear of failure and lack of confidence. Rubenstein & Kotsopoulos (2007) found that students struggle with mathematics terminology because they only hear them in mathematics and it takes great effort to relate or use them in everyday language. Therefore, students do not gain a comfortable understanding and use of the math terminologies (Furner &

Duffy, 2002). The authors stated that only about 7% of Americans have had a positive experience with mathematics (Furner & Duffy, 2002). They wondered why so little is being done if so many people have a fear of math or loathe the subject. Nevertheless, Bandura (1986) states that young students are generally overconfident about their abilities, he argues that some overestimation of capability is useful, since it increases effort and persistence. However, attention is needed for the protection of children from the danger of disappointment, in the case of continual failures. Children's beliefs become more accurate and stable over time, and it is very difficult to change (Bandura, 1997). My research seeks to be helpful for students' lifelong application of math.

Current research acknowledges that it is imperative for elementary teachers to nurture and inculcate in students from an early age the significance of developing a liking for mathematics (Yara, 2009; Kloosterman & Cougan 1994). It is only when this is done that student will gain the confidence they need to do well at mathematics and experience less anxiety (Yara, 2009). A study applied to secondary school students by Yara (2009) found that the students at this level had a positive attitude towards math and they think that math is crucial and necessary for their future life.

Countering arguments that literature is beneficial in mathematics pedagogy, Kloosterman and Cougan's study of elementary school students found that most students wanted to be good at mathematics and have better self-confidence. Students also needed to feel that they were capable of doing just that (1994). They suggest that journaling is the preferred way to improve students' confidence in mathematics and reduce math anxiety. Similar to the National Council of Teachers of Mathematics (NCTM), Furner and Berman believe that letting the students express what they are feeling while working out a problem with peers and with the teacher will reduce math

anxiety. The researchers' position is that students having an input into their own evaluations and the use of cooperative groups may also prove helpful in increasing student confidence in this area (Furner & Berman, 2002, NCTM, 2000). Journaling may help to reduce math anxiety in students, but based on overwhelming research, children's literature included in mathematics instruction is a very prominent and responsive pedagogy to the math anxiety experienced by students in the elementary classroom.

Research has shown that children's literature provides students with the opportunity to freely explore mathematical ideas in a nonthreatening manner. Jenner (2002) and Shatzer (2008) expand on the idea of engaging students in mathematical literature. These authors state that children's literature provides children with a highly personal learning experience in which they can engage in a story that can potentially spark curiosity about math. Jenner (2002) and Shatzer (2008) explain that children's literature is ideal and should be used to enrich the entire learning process. Moreover, they say that children's literature is to be used to explore mathematics and to promote mathematical disclosure. These researchers posit that when children's literature is read in mathematics classes it sets the stage for discussion. In effect, students become alert and respond to mathematics lessons more readily. Their research encourages the use of children's literature to develop mathematical understanding, because students are able to link mathematical concepts that are linked to characters in a story after they have read it. Jenner (2002) and Shatzer (2008) also claim that when children's literature is effectively administered it helps students become aware of different perspectives and strategies. In addition, they say that it can also be used to clarify and expand students' own thinking and approaches (Jenner, 2002; Shatzer, 2008). The above research elaborates on the objective of my research to provide an exciting and comfortable learning opportunity for students who struggle with mathematics.

Many studies have found that there is a connection between teachers' attitudes and their students' attitudes (Anderson, 2007; Ma & Xu, 2004; Relich, 1996). For instance, Relich (1996) found that teachers who had been identified as having math anxiety and low self-confidence in mathematics attributed this feeling to negative experiences they had with a teacher when they were students. Also found in this study was that these teachers had low expectations of their own students thus perpetuating their attitudes and beliefs about mathematics. The counterpoint belief was found as well, as teachers who had been identified as having high self-confidence in mathematics, attributed their success and enjoyment of mathematics to a previous teacher or teachers who had had a positive effect on them. Consequently, these teachers tended to believe that anyone could do mathematics successfully and therefore had higher, more positive expectations of their students (Relich, 1996). Anderson (2007) furthers Relich's research on teacher-student relationship to mathematics finding that, "The most significant potential to influence students' identities exists in the mathematics classroom" (p.12). When students, especially younger ones, are encouraged by teachers and find success in mathematics, their attitudes and beliefs can drastically improve (Ma & Xu, 2004).

Similarly, Midgely, Feldlaufer, and Eccles (1989) reckon that teachers' beliefs in their efficacy to teach mathematics had an impact on their students. These researchers discovered a significant relationship between teacher efficacy and students' confidence and belief in their ability to do mathematics. Specifically, students in the classes of teachers with a positive sense of efficacy in teaching were more likely to believe that they were performing better in mathematics than students in the class of teachers with a lower sense of efficacy in teaching mathematics. In addition, students of teachers with high efficacy believed mathematics to be less difficult than students of lower efficacy teachers (Midgely et al., 1989). Overall, teachers' attitudes had a

stronger relationship to the beliefs in mathematics of low-achieving students than to the beliefs in mathematics of high-achieving students. It is the existence of the shared ideas of these researchers that strengthen my own research idea that it is important for teachers across all levels of mathematics instruction to display positive attitudes and beliefs in order to allow their students to develop positive attitudes and beliefs towards mathematics.

Teachers have a responsibility to their students to include different strategies in their pedagogy to cater to the diverse needs of students at the elementary level and deliver these strategies in a supportive manner. Perina (2002) and Wood (1998) suggest that teachers' attitude and willingness to help students who struggle with mathematics may affect the student's confidence in the subject. Perina indicated that more students were afraid to ask for help if they felt that the teacher was giving off a negative feeling towards helping them. The writers believe that a teacher's attitude and their delivery method will affect their students' confidence in mathematics (Perina, 2002; Wood, 1998).

The research clearly states that many teachers are suffering from math anxiety and they tend to project this fear onto their students (Johnston, 2010; Perina, 2002; Wood, 1998; Williams 1988; Bush, 1989; Hembree, 1990). Johnston (2010) stated that elementary education majors have been found to be particularly afraid of math more so than any other college major, but often have little chance to overcome this fear, because the math requirements of their programs are usually minimal. Johnston noted that over 90 percent (Johnston, 2010) of elementary school teachers are female, combined with the high level of math anxiety that many of them transfer to their students, and does not bode well for girls' future in math. She suggests that when it comes to math, elementary school teachers need, at the very least, try to put on a much braver face before they do a math problem with their students. Johnston believes that teachers with high

math anxiety have a significant effect on the math achievement of especially their female students. Girls with anxious teachers scored lower on math achievement tests at the end of the year than girls with more confident teachers. I endorse the views postulated by Johnston, being a female myself I must say that the encounters that I have had with my female university mathematics teachers have lessened my anxiety towards mathematics because they brought much zeal and excitement to the mathematics lessons. I equally looked forward to attending mathematics classes as I did other subjects.

Teachers need to be mindful of the diverse intelligences in the classroom to help everyone learn mathematics. Research has found that having a supportive and positive teacher can make a world of difference (NCTM, 2000). A mathematics friendly environment will likely promote learning at the elementary level (Williams, 1988; Bush, 1989; Hembree, 1990). Children's literature is now recognized as a means to assist the teaching and learning of mathematics, although the responsibility to maintain the integrity of both curriculum areas is a challenge for many teachers (Perger, 2004). Over time, a range of resources have been produced to support teachers in using literature in their mathematics programmes which may lessen the challenges experienced by teachers.

As mathematics educators, we need to be aware that math anxiety is a real affliction that affects many of our students. However, we also need to know that with appropriate teaching strategies and sensitivity, we can reduce or even eliminate the problem (Williams, 1988, p. 101). The integration of children's literature in the teaching of mathematics is one such strategy.

Why Practice integration- benefits and challenges

“Research has consistently shown that students in integrated programmes demonstrate academic performance equal to, or better than, students in discipline-based programmes. In addition, students are more engaged in school, and less prone to attendance and behaviour problems.” (Drake & Reid, 2010)

For the purposes of my research I will define integration as a combination of two or more subject usually taught under the same instructor. It is a curriculum approach that purposefully draws together knowledge, skills, attitudes and values from within or across subject areas to develop a more powerful understanding of key ideas. (Drake, 1991) Over the years, numerous educational researchers have described various interpretations of curriculum integration, referring to the curriculum as interwoven, connected, thematic, interdisciplinary, multidisciplinary, correlated, linked and holistic (Drake, 1991; Jacobs, 1989; Beane, 1997; Vars, 1991). Some teachers found mathematics more difficult to integrate (except when there was a “natural fit” as, for example, with data management). Some teachers were concerned that subject-specific expectations did not receive adequate coverage. (Drake & Reid, 2010)

According to Giorgis and Johnson (2001), literature that interacts with the curriculum extends the focus to include books and readers along with content area knowledge. Teachers at the Primary grades' cite a number of benefits to curriculum integration that includes: building on prior knowledge and experiences, allowing for flexibility, unifying the students' learning, reflecting the real world and matching the way students think (Giorgis & Johnson, 2001). Alberta Education further notes that curriculum integration enables primary teachers to: identify the connections within and among the content of subject areas, provide a relevant context for learning based on the needs of students, assess students' skills and understandings in a variety of

learning contexts and increase students' motivation and participation (2007). A personal goal within the classroom is to reach a wider body of students needs through using integrated teaching methods.

Integration across the curriculum can be challenging for teachers at any level. Elementary teachers who integrate children's literature into the teaching of mathematics also experience challenges. Undeniably, elementary teachers are faced with their meles as they try to balance the diverse range of their students' attitudes and abilities towards mathematics. Elementary teachers may try to execute and do justice to the mathematics curriculum by including children's literature but they are faced with challenges as they try to make meaningful connections to the books they include in their mathematics instructions. Curriculum integration should be connected and related in meaningful ways by both the students and teachers (Fogarty, 1991).

Similarly, numerous authors of early literacy learning including: Neuman, Copple and Bredekamp (2000), Heroman and Jones (2004), Bennett-Armistead, Duke, Snow and Moses (2005), Vukelich, and Christie (2008), provide examples of children's use of print in play contexts and give suggestions for using field trips and play with concrete materials to enhance children's oral vocabulary, literacy and math skills. For example, before visiting a local supermarket, the teacher reads a book to the children about supermarkets. After the field trip, the children can calculate the items purchased at the supermarket. Reading the book before going to the supermarket allows students to make a link to the concept of mathematics before doing so practically or physically.

Children's literature has the potential to produce several outcomes: a) motivate students to learn by providing a meaningful context for math, b) celebrate math as a language, c)

demonstrate that math develops out of human experiences, d) foster the development of number sense and e) integrate math into other curriculum areas (Whitin & Wilde, 1992). Giorgis and Johnson further the importance of children's literature claiming that children gain a new and deeper knowledge of the math concepts being taught when they can make a text-to-self connection with a book or story that introduces the same concept they are learning. At first glance, readers may wonder how literature invites interaction with math. Sometimes the interaction is more natural than what is expected (Giorgis & Johnson, 2001). Whitin and Wilde (1992) compliment Giorgis and Johnson advocating that children's literature can be the vehicle for providing a meaningful context for learning in mathematics as it helps learners value mathematics, encourages learners to be mathematical problem solvers, provides a meaningful context for children to communicate mathematically, supports learners in reasoning mathematically, and explores a variety of mathematical topics (Whitin & Wilde, 1992).

With all of the testing requirements placed on teachers by the enactment of the "No Child Left Behind" policy in the United States of America, mathematical literacy will prove to be beneficial to both teachers and students in the elementary classroom (Byrd & Kinniburgh, 2008). Children's literature can show children that mathematics is not an isolated subject that is done at a certain time of the school day, but that it is an important part of everyday life (Franz & Pope, 2005). Parallel strides are being made in Canada with the EQAO tests which seek to evaluate students' performance in mathematics and literacy. The assessments present literacy and mathematics gaps which the Ontario Education Ministry can then address in the schooling system (Toronto District School Board 2014). This strengthens my research because if students are given frequent exposure to mathematics they will engage more in the subject and should over time experience less math anxiety.

I endorse the argument postulated by these writers. The research shows that integrating children's literature, regarding problem solving, into mathematics lessons provides a framework for expanding the students' understanding. When students' understanding is increased, they are more likely to develop more confidence in mathematics and experience less anxiety.

However there are limitations associated with using children's literature to teach mathematics. Based on my observations, the children's book in which the teacher requires for a specific lesson may not be available at the schools, and the ones that are provided often do not have the math terminology that the teacher want to bring to the classroom. I have also noticed that teachers are faced with many time constrains and do not welcome the idea to search for the book elsewhere.

Using children's literature to teach math

Children's literature provides a powerful opportunity to understand the world (Diakiw, 1990).The author argues that literature is created to amuse or educate, this mass of printed material for young people is becoming much more prevalent as a means of instruction in the classroom. Literature encompasses both narrative and expository trade books, books that are found in a library or bookstore, as well as songs and poems. They are different from textbooks, books used specifically for learning in school, and, therefore, have different strengths and weaknesses. Many students benefit vastly from the integration of literature into the math curriculum (Diakiw, 1990). This author validates my research because we can see that the use of literature to learn mathematics is accessible.

Shatzer (2008) suggests that in addition to picture books captivating children's interest in mathematics, picture books also helps them make mathematical connections because it provides visualizations of mathematical concepts in the form of illustrations. The writer explains that research has demonstrated that children are better at explaining their reasoning and strategies, enjoyed mathematics more, showed greater overall persistence on difficult tasks, and experienced a level of success. It also indicates that when children's literature and numeracy are connected in an interactive and meaningful way, students will understand the mathematics concepts readily and will sustain the knowledge that is disseminated to them by their teachers. The article cites examples where students were motivated and more confident to participate in mathematical activities after engaging in the reading of children's literature. For example, students were very enthused to graph their favorite hundredth day foods following the sharing of this story.

Students are more involved in their academics when they are motivated to learn and they exercise self-efficacy. (Tobias,2003; & Murr, 2001) . Books are an excellent way for students to get excited about learning mathematics. Children's books also help students make connections to real life mathematical situations in everyday life. Books give kids another way to comprehend math problems helping them make the leap to understanding how such problems are expressed in mathematical terms (Murphy, 1999). This researcher affirms my thinking that children's literature gives students a deeper understanding of the concepts taught in the classrooms and should be utilized in teaching mathematic concepts.

Research has shown that the use of children's literature can reduce student's anxiety in mathematics (Pomykal Franz & Pope, 2005). The writers posit that activities which are easily

integrated into the lesson provide teachers with a framework to expand the students' understanding of essential concepts and bridge mathematics with the real world. Additionally, Research promote the use of children's literature to develop integrated units with other academic subjects as it clearly shows the student's enthusiasm and excitement about learning mathematics to the stories that are included in the instructions that are given (Pomykal Franz & Pope, 2005).

Pomykal Franz and Pope (2005) further explain that this method helped students to use mathematics to connect to their own lives each day. This they say can be reflected in activities such as buying groceries and calculating what time to get up. Teachers are able to link these activities to fractions and decimals in class activities. Elementary teachers use a variety of books to deepen students' understanding or make important connections. Close examination of these same books reveals underlying themes that can also be used to introduce many complex mathematical concepts or build connections to the real world (Pomykal Franz & Pope, 2005).

Marzano's Dimensions of Learning Model (1992) is based on that students must have a good attitude and perception towards learning before real learning can occur. If a student feels good about learning as a person then learning math will be less challenging for them. If the students understand the math concepts then they will be more likely to develop confidence when learning math.

It has been found that many school administrators believe that once a teacher possesses a basic knowledge of mathematics and a relatively clear memory of how it was taught, that person is capable of teaching mathematics (Darling- Hammond, 2006). With this said, it is therefore worth investigating the attitudes and beliefs of teachers to determine how the attitudes of secondary mathematics teachers compare with those of elementary school teachers. There are a variety of strategies that teachers can exercise in the teaching of mathematics in the elementary

classroom. Elementary teachers have been encouraged to explore differentiated methods of instruction in mathematics pedagogy (Darling- Hammond, 2006). I believe that this is important because it changes the monotony in the classroom and exposes students to different ways of learning mathematics.

One such strategy recommended by McDuffie, Young, Terrell (2003) is the use of mathematical discourse. Students who are not accustomed to talking about mathematics may be uncomfortable with or reluctant to participate in discussions, because discourse in mathematics involves expressing and justifying mathematical thinking and ideas. Researchers emphasize that the primary purposes of facilitating mathematical discourse are to help students become aware of others' perspectives and strategies. The discourse recognizes the need to help students analyze and develop their own thinking and approaches which can improve their confidence and reduce math anxiety. Mathematics instruction has received considerable attention since the standards were first published; however, prompting mathematical discussions and providing an environment that encourages discourse may present challenging tasks for teachers (McDuffie, Young, Terrell, 2003). Callan adds that children can learn many problem-solving strategies from fictional books that address mathematical concepts. Integrating different mathematical topics after discussing books can also help children make the connection to mathematics in their daily lives (Callan, 2004). These studies illustrate the idea that students sharing their thoughts in a comfortable way, with fellow classmates, is a healthy practice and it may help students to experience less math anxiety and gain confidence in the subject.

This addresses the idea that students' reflecting on their mathematical discourse is essential for reducing mathematics anxiety. I think that when students reflect on a mathematical concept they will be better able to understand and retain the concepts taught to them. I agree with

Callan (2004) and McDuffie, Young, Terrell (2003) that mathematical discourse creates a healthy environment for students to clarify misconceptions, and it often reinforces what students are taught. It is the existence of these shared elements that I recommend the use of literature in a very dynamic way in the teaching of mathematics. This aspect of mathematics is very relevant to my research because students are less likely to experience math anxiety when they are given the opportunity to explain their ideas of mathematical concepts.

To maintain the integrity of both subjects, math and the literature, teachers are to show responsibility towards their duty to cover the curriculum when engaging in positive discourse. According to Phyllis and Whitin (2004) teachers should follow specific criteria and observe key principles when selecting books for mathematics instruction and these are: mathematical integrity, potential for varied response and ethnic, gender and cultural inclusiveness. Different books will be more appropriate for certain lessons and children. Literature shared in the mathematics classroom taps into the natural process of communication, not only improving students' language skills but adding dimension and understanding to their mathematics skills. With so much literature available to incorporate into mathematics lessons, criteria for selecting the right books are invaluable tools. Once the right books have been selected, there are many ways in which this union of literature and mathematics benefit students (Phyllis, Whitin, 2004). These findings attend to the research problem of math anxious teachers selecting books based on their personal feelings towards the subject.

Mathematics engagement to reduce math anxiety

In her book, "How to Use Children's Literature to Teach Mathematics" (1992), Rosamond Welchman-Tischler suggests ways to use literature in the mathematics classroom to enhance students' learning experiences and these are:

- To provide a context or model for an activity with mathematical content
- To introduce manipulatives that will be used in varied ways (not necessarily as in the story)
- To inspire a creative mathematics experience for children
- To pose an interesting problem
- To prepare for a mathematics concept or skill
- To develop or explain a mathematics concept or skill
- To review a mathematics concept or skill

These ways suggest the promise of improved performance and demonstration of skills in the classroom. If the child can make a connection to mathematics content in a story, the literature can make mathematics more interesting, engaging and applicable to real-life situations.

Communication is one of the National Council of Teachers of Mathematics' (NCTM) process skills emphasized in mathematics education (2000). Literature naturally brings a more complex mode of communication to mathematics instruction because it presents mathematical concepts in words rather than in numbers. After incorporating literature into mathematics' lessons, many teachers report that their students showed increased comfort levels in talking about their understanding of mathematics concepts. In addition, teachers are able to identify many misunderstandings during the course of this subject combination dialogue.

Making connections is another process skill identified by NCTM (2000). Children who find the relevance of mathematics after reading (or listening to) a book are learning to recognize mathematics used in the world around them. After exposure to numerous books incorporated into mathematics' lessons, students often connect the concept from one book to similar mathematics concepts in other books that they have discussed.

This study explores the questions: a) “How is a sample of teachers using children’s literature to teach mathematics and what perceived impact it has in their classroom?” b) “What is the range of challenges teachers experience using children’s literature to teach mathematics?” and c) “What is the range of benefits teachers have observed from incorporating children’s literature in the teaching of mathematics?”

Given the research reviewed herein, I hold that it is important that more teachers integrate children’s literature as an instructional strategy for teaching mathematics, because it can potentially reduce students’ experiences with math anxiety.

Chapter 3: Methodology

Procedure

The purpose of this qualitative study is to learn from a sample of elementary school teachers how they are integrating children's literature in their mathematics lessons and the impact of this method of integration in their classrooms. The research was conducted through an in-depth literature review of what research has been done on the topic. I looked at previous research to learn about findings from past researchers.

The data represents the views and practices of experienced teachers who have been using this method of instruction for at least two years. This study will be important to the education community because it will contribute a range of instructional strategies in the teaching of mathematics that may have the potential to reduce math anxiety and improve students' confidence in mathematics, and may ultimately influence improvement in mathematics' scores.

I obtained data for this research by conducting face-to-face interviews with three teachers. These teachers had to meet the criteria of being elementary school teachers who are, or who have actively integrated children's literature in their math instruction for at least two years.

Instruments of Data Collection

Semi-structured interviews were used as the instrument of data collection. The primary purpose of an interview is to gain information on a particular topic or a particular area to be researched. Kvale (1983 p.174) defines the qualitative research interview as "an interview, whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena." For this qualitative research I used

open-ended questions to conduct my interviews. Research supports the use of open-ended questions to conduct interviews, to probe deeper into the initial responses of the respondent to gain a more detailed answer to the question (Wimmer and Dominick, 1997, p. 156).

Interview as a method of data collection has many benefits which include: a) hearing about first-hand experience from the interviewee, b) reveals interesting information because of the open ended nature of an interview c) good approach to gather in depth attitudes, beliefs and anecdotal data from individuals, d) provides excellent opportunity to probe and explore questions, as well as, e) permits interviewers to observe the body language of the interviewee and facial expressions during face –to- face interviews (Collins,1970; Joan & Fisher 2005).

It is the existence of these elements that makes interviews an ideal instrument for my research. I believe that the unique characteristic of interviewing will help me to gain answers to my research questions and much insight into my research topic. There are however limitations to interviews including: a) required staff time and quiet area needed to conduct interviews and the need for special equipment to record and translate interview (Joan & Fisher 2005).

Participants

I conducted semi-structured interviews with a total of three elementary teachers. I emailed the interview questions to each participant in advance to get them acquainted with the questions before the day of the interview. I selected elementary school teachers who have used teaching strategies that included integrating children's literature in mathematics instruction for at least two years, because they would have had experience integrating children's literature in their mathematics lesson, and they would have been able to observe the impact this integration has on their students. I recruited these teachers for my research by asking the teachers from my

practicums, and referrals made by my fellow classmates. I conducted pilot interviews with two teachers to see what their responses would be before I conducted my official interviews.

Conducting pilot interviews can be an effective strategy for getting a sense of how participants may respond to questions and help guide revision of the interview protocol. "It may throw a completely different light on an issue that the interviewer had previously never considered."

(Wimmer & Dominick 1997, p. 139).

Data Collection and Analysis

I began analyzing the data by transcribing the interview verbatim and recording the information on my personal computer. I read and reviewed the transcribed interview data, focusing on my research questions. I made notes to myself as I went along. I performed a cross comparison of my three interviews to identify common trends. This included identifying key phrases from the responses to the same question in a separate document. These responses were organized to identify common and overlapping themes. I coded using different coloured highlighter markers to highlight the important quotes and insights in the interview data. I coded a few times to identify eight themes and sub themes that emerged. These themes and sub-themes were then consolidated into four main themes. Once these themes were identified key quotes and phrases were organized beneath each. Chapter four was then written to discuss the findings of the study with reference made to each participant's response.

Ethical Review Procedures

For my research, I followed the ethical review approval procedures for the Master of Teaching program. Before conducting the interviews, all the participants were informed about the research. They were informally interviewed over the phone to identify if they met the criteria for the study. On the day of the interview, they were given a consent letter explaining the purpose of the study and the option to withdraw from the study at any point. All participants remain anonymous to maintain confidentiality. I recorded and then transcribed the data from the interviews.

Limitations

As with all research there are limitations to this study. The findings will only reflect how a small sample of students in a specific school(s) is responding to the use of children's literature to teach mathematics because the study is conducted in a specific region. Therefore the findings cannot be generalized to all students in the province of Ontario. A specific time was given to conduct this research and as a result the findings may not be as in-depth and comprehensive as it could have been if more time was given to conduct the research.

Another limitation is that only a small sample of teachers was interviewed. For this study only three teachers were interviewed. The findings could have reflected the data differently if more teachers were interviewed. More information could have been gleaned and other perspectives revealed.

Only one method of data collection was used to obtain information. The interviews that were conducted to obtain information for this study were proven effective. However, if I had included other methods of data collection along with the

interviews the findings of this research could have been more comprehensive. If I were able to observe firsthand how the teachers integrated children's literature in their mathematics curriculum, I would have been able to get a more extensive understanding of how effective the integration of children's literature is to the elementary classroom.

Chapter Four

Introduction

In Chapter Four, I detail the findings of my research study, sharing the teachers' thoughts, ideas and observations, by identifying emergent and sub-themes across all data as they relate to the use of children's literature to teach mathematics. I have organized my data around various themes and sub-themes, and shared my interpretation, personal thoughts and reflections surrounding the topics that emerged. I have shared practical examples of how teachers have integrated children's literature in their math curriculum. Included are direct quotations from the research participants to communicate a stronger emotional sense of each participant and to allow the reader themselves to form their own conclusions based on their interpretation of what was said. My findings were also appropriately connected to the literature. I was able to develop my personal perspectives and response to situations and experiences as they were shared by my participants.

Emergent Themes

Similar themes that emerged from my interviews and interpretation of my data are outlined below, along with subthemes gathered from my data. What follows the outline is a discussion and overview of my findings within each theme and sub theme.

Theme One: Impact of using Children's literature to teach math

- *Improves students understanding of math*
- *Children's literature appeals to different learning styles*

Theme Two: Fosters integration and help students to better connect to math.

Theme Three: Reduce math anxiety and increase comfort level in mathematics

Theme Four: Challenges experienced by teachers who integrate children's literature in their mathematics curriculum

Theme One: Impact of using Children's literature to teach math

Improves students understanding of math

All of my interview participants shared a tremendous love for children's literature; they expressed a sincere liking for including picture books in their math curriculum. Anna, Rose, Lili and Kerry (pseudonyms) described their early years of being introduced to math as being very "traditional." Anna and Kerry explained that their success in math was not attributed to their love for the subject, but they simply learned math out of fear. It was taught to them in a structured "traditional teacher" centered way. Kerry explained that she did not like the subject because she did not have good math teachers to make the math lessons interesting. These university graduates have been teaching between seven and eighteen years. They recall learning math only by rote. Children's literature provides a powerful opportunity to understand the world. They all expressed a desire to teach their students using a visual approach because their math teachers did not provide that opportunity for them. They believe that picture books will help to improve their student's understanding of mathematics, because it visually connects real life situations. Literature is created to amuse or educate, this printed material for young people is becoming much more prevalent as a means of instruction in the classroom (Diakiw, 1990).

All four participants agreed that children's literature has had a tremendous impact on their students developing a better understanding of math. Anna and Kerry explained that they very often use picture books in their math pedagogy, while Lili and Rose both said they often use them in their math curriculum. Anna explained that she uses picture books very often in her math curriculum because she sees where her students benefit from it. "I use two to three picture books

in each of my math units because the stories really help the students to connect to real life situations and they can better relate to the math terminologies.” Anna continued,

“I am happy with using picture books to teach math because it fosters integration, and it helps my students to make connection to language. I once had a child in my class who had a problem identifying tens and ones. I used manipulative to try and explain the concept to her but she still did not understand. After I read the book, “*One is a Snail Ten Is a Crab*” to her she was able to visually represent to me tens and ones by drawing ten legs on the crab and one on the snail. I was relieved when I saw the proud look on her face communicating that she got the understanding of the concept. This was one of my most memorable moments as a teacher.” Reading activities that are integrated into the lesson provide teachers with a framework to expand the students' understanding of essential concepts and bridge mathematics with the real world. (Pomykal Franz & Pope, 2005).

a) *Children's literature appeals to different learning styles*

Anna, Rose, Lili and Kerry shared how they included picture books in their math curriculum to cater to visual linguistic learners in their classroom. The teachers justified their reason for using picture books in their classroom by saying, they see themselves in many of their students, and they believe that picture books would have helped them develop a better appreciation for math. Anna explained, “I found that picture books helped me and many of my students who are visual learners to better understand many of the concepts in mathematics.” The teachers explained how using picture books set the stage for many of their math lessons. Rose, “I find that after I read the stories to my students, they become more interested in learning the math lesson I have prepared for them.” Elementary teachers have been encouraged to explore differentiated methods of instruction in mathematics pedagogy (Darling- Hammond, 2006).

Lili teaches students who are developmentally delayed and students with autism spectrum disorder. Over the past seven years, she finds picture books to be very helpful to her students. She found that she could use the books to modify her lessons to meet the different levels of the students in her classroom.” Picture books can be modified to meet the needs of so many different kids depending on their level. It is an easy way to have a common lesson and be able to modify it to meet the different needs that are present in my classroom.”

Theme Two: Fosters integration and help students to better connect to math.

Anna, Rose, Lili and Kerry expressed how easy it is to integrate children's literature in mathematics and other subjects in the curriculum. They particularly liked how picture books helped their students connect with real life situations. The teachers unanimously agreed that picture books can help students make connections to the world around them. They expressed that while using picture books to teach math, it can be integrated in any subject area. Children's literature has the potential to produce several outcomes: a) motivate students to learn by providing a meaningful context for math, b) celebrate math as a language, c) demonstrate that math develops out of human experiences, d) foster the development of number sense and e) integrate math into other curriculum areas (Whitin & Wilde, 1992). Collectively, they have used picture books to integrate math with the arts, language and science. Anna said, “I use two to three picture books in each of my math unit because the stories really help the students to connect to real life situations, and they can better relate to the math terminologies after I read the stories to them.”

Theme Three: Reduce Math Anxiety and Increase Comfort level in Mathematics

Anna, Rose and Kerry expressed that they became interested in using Children's literature to teach math because they did not like math as a child, and experienced some level of anxiety towards the subject. Lili explained that as a child she struggled with math anxiety and did not realize that math could be taught in a number of different ways until she went to teachers' college. She explained that she wanted to find creative ways to teach math to avoid projecting her anxiety towards her students. Teachers who had been identified as having math anxiety and low self-confidence in mathematics attributed this feeling to negative experiences they had with a teacher when they were students. (Relich, 1996) Anna added that because she has a literature background and a genuine love for books, she became interested in using picture books to help decrease her students' math anxiety level. "Picture books help to relieve anxiety and minimize the fear of math for my students. I find that my students feel more comfortable and express less fear when picture books are used."

Theme four: Challenges experienced by teachers who integrate children's literature in their mathematics curriculum

Throughout my research I was curious to discover if my participants experienced challenges when using children's literature to teach math. It has been noted that teachers often do not practice integration because they are concerned about their ability to effectively support each subject and not highlighting one over the other. Three of my four participants expressed the challenges they experienced when using children's literature to teach math. The teachers articulated that they sometimes get lost in the stories whilst sharing it with their students. They often alluded to the students and themselves finding the characters in the stories very funny and

this was often distracting. Anna said, "Sometimes I enjoy sharing the books so much with the students that I get lost in the story." Kerry on the other hand explained that she did not experience any challenges with integrating picture books in her math curriculum. "No challenges, they facilitate the teaching experience, don't provide challenges." Alberta Education notes that curriculum integration enables primary teachers to: identify the connections within and among the content of subject areas, provide a relevant context for learning based on the needs of students, assess students' skills and understandings in a variety of learning contexts and increase students' motivation and participation (2007).

Personal Reflection

All four of my participants integrated children's literature regularly in their math curriculum. The ladies beamed with excitement as they shared how they included picture books in their math curriculum. They practice this method of integration because they don't remember been taught math using visuals; they believe that picture books could help to make math more visible for their students. The research participants seemed to recognize that many of their students experienced similar anxieties to the kind they experienced in the past. With this in mind, they each seemed to be determined to teach mathematics in a 'better' way than they were taught the subject. The teachers explained that mathematics instruction should include: manipulatives, active learning, real-life problems, and using picture books as a stimulus for learning.

Listening to the teachers expressing the role that children's literature plays in their math curriculum made me recall my unpleasant days of learning mathematics, I don't think my teachers cared much if I liked the subject or not. They were more concerned about me learning math concepts by rote; a love for the subject was never encouraged. I remember my teachers

from kindergarten to grade eight being very dispassionate about mathematics. My teachers at grade five to eight taught math with very little manipulates. The visual component of math was only represented on charts that my teachers made and highlighted in the classroom. My teachers did not try to integrate any other subject with mathematics to minimize our fear of the subject. They did not include stories in their math pedagogy, I learned math out of fear and not from a desire to develop an appreciation for the relevance of the subject.

Chapter Five

Introduction

In this final chapter of my qualitative research that explored the use of children's literature to teach math, I revisit the over-arching research questions that guided my study. Additionally, I reflect on the significance of my research and the potential advancement it may provide to researchers in the field of education, teachers and all other stakeholders. I will close this chapter with suggestions for future research and final thoughts about my personal learning. This chapter includes discussion and analysis of the data obtained, as it relates to the literature findings outlined in Chapter Two of this thesis and my conclusions.

Findings and discussion

My research revealed that integration is an effective way to connect subjects in the elementary curriculum. Integration is a combination of two or more subjects usually taught under the same instructor. It is a curriculum approach that purposefully draws together knowledge, skills, attitudes and values from within or across subject areas to develop a more powerful understanding of key ideas. (Drake, 1991) Educational researchers have described various interpretations of curriculum integration, referring to the curriculum as interwoven, connected, thematic, interdisciplinary, multidisciplinary, correlated, linked and holistic (Beane, 1997; Drake, 1991; Vars, 1991).

Integrating picture books in the elementary classroom is an effective way to engage students in mathematics. Children's literature can be the vehicle for providing a meaningful context for learning in mathematics as it helps learners value mathematics, encourages learners to be

mathematical problem solvers, provides a meaningful context for children to communicate mathematically, supports learners in reasoning mathematically, and explores a variety of mathematical topics (Whitin & Wilde, 1992).

It is for this reason I believe that the integration of children's will make a significant contribution through reading, writing, listening and speaking in the Math Curriculum. Teachers can easily help their students appreciate mathematics and its ability to connect to other subjects. Students should be given the opportunity to understand how mathematics relates to other subjects, particularly those that they enjoy and find less challenging. Through integration student will develop an appreciation for mathematics. I believe that if my teachers from as early as the elementary level had integrated math with other subjects, I would have developed a better appreciation for mathematics. If they had practice integration by including other subjects to present a holistic approach to the curriculum, by including stories to provide a meaningful context for learning in mathematics it would have encouraged me as a learner to develop my mathematical problem solving skills and to value mathematics as a subject. I would have been more engaged in my math classes and more motivated to develop my mathematics problem solving skills. I would have participated in mathematics discourse and learned how to communicate mathematically. I perhaps would have responded better to mathematics and would have been more successful.

Each of my participants integrated picture book with mathematics, the arts, language and science. Based on the discussion I had with the participants for my research, math anxiety amongst teachers and students is very common. The teachers having identified that they experienced math anxiety, were committed to using picture books to help decrease the level of mathematics anxiety observed in their students. Research has shown that teachers who

experience math anxiety tend to project a similar level of anxiety on their students. Many teachers are suffering from math anxiety and they tend to project this fear onto their students (Johnston, 2010; Perina, 2002; Wood, 1998; Williams 1988; Bush, 1989; Hembree, 1990). I recall several of my elementary and secondary school teachers experiencing math anxiety. I think that they did little to confront the anxiety they had for mathematics and did very little to alleviate this fear. My teachers believed that math was an essential subject and should be learned at any cost. They did not comprehend the need to create an environment that would make math; relevant, enjoyable or exciting for their students.

I know the significant role that teachers play in reducing math anxiety in their students. Based on the unfortunate experiences I had with mathematics, I know the type of teacher I endeavor to become. I want to be a teacher who caters to the diverse learning styles of her students. One way to do this is to practice integration in my classroom by including children's literature in my math curriculum, to help my students understand that math can be creatively woven into everything we do.

Children's literature has been proven to work in the elementary classroom to motivate students to learn and exercise self- efficacy in improving their involvement in their academics (Tobias,2003; & Murr, 2001). Books are an excellent way for students to get excited about learning mathematics. Children's books also help students make connections to real life mathematical situations in everyday life. It has been found to provide numerous benefits to both students and teachers. Amongst the list of benefits are:

- It reduces students anxiety in mathematics and improve their confidence in

the subject, because it lessens the tension, apprehension and fear students have towards performing mathematical tasks

- Children's literature can improve students' academic performance in mathematics because literature has the ability to communicate visual ideas in a non-threatening way to children
- Integrating children's literature in the math curriculum help students to develop a better understanding in mathematics, because it provides teachers with the latitude to implement a more holistic approach to learning in the elementary classroom as it encourages students' engagement and motivates their learning.
- I recommend that teachers use children literature in a very dynamic way in the teaching of mathematics. It can be used as vehicle to promote mathematics discourse as it creates a healthy environment for students to clarify misconceptions, and reinforce concepts taught in the math curriculum.

Initially, I could not make the connection that Lili was able to successfully use picture books to teach math to her students with autism spectrum disorder. I know that students who are diagnosed with ASD are visual learners. Using children's literature to expose them to mathematics is an effective way to practically helps them relate to real life stories. "Picture books can be modified to meet the needs of so many different kids depending on their level. It is an easy way to have a common lesson and be able to modify it to meet the different needs that are present in my classroom." Before interviewing Lili, I thought picture books could only be used in the "regular classroom." I did not imagine it being used in a classroom where students were developmental challenged or experience any other form of

exceptionality. Having had the opportunity to interview her, she has helped me to realize that picture books can be very effective in any classroom setting.

Limitations of the study

Though a considerable amount of information was collected during the compilation of this study, this paper does have its limitations. The number of literature sources examined and the sample size of the participants interviewed were limited due to the time constraint of this research. Another limitation is that only three teachers were interviewed for this study. The findings could have reflected the data differently if more teachers were interviewed. More information could have been gleaned and other perspectives revealed. A specific time frame was given to conduct this research and as a result the findings may not be as in-depth and complete as it could have been if more time was granted. In addition, interviews were conducted focusing on elementary teachers from a specific region in Ontario which limited the scope of the findings. Therefore the results cannot be generalized to all teachers and students in the province of Ontario. Examining the perspective responses and approaches from elementary teachers in other school boards would have added more insight to my research.

While one method of data collection was used to obtain information for this study; the interview techniques have been proven effective. However, if other methods of data collection were used in conjunction with the interviews, the findings of this research could have been more comprehensive. If I was able to observe firsthand how the teachers integrated children's literature in their mathematics curriculum, I would have been able to get a more extensive understanding of how effective the integration of children's literature is to the elementary classroom.

Further reading and Study

The focus of this research paper is to examine how elementary teachers are using children's literature to teach mathematics. It is my intent to continue research on this topic, and to examine exactly how children's literature helps students at the elementary level develop a better approach to understanding mathematics. I would be curious to know if the themes presented in this paper from the research participants would be similar or vary significantly upon opening discussion opportunities with elementary students. I would be interested to know how elementary students who have develop an appreciation for math at the elementary level respond to the subject at the post elementary level. Additionally, the larger educational community may find it useful to review the detailed experiences that the research participants shared during the interview process.

Implications

For elementary teachers

It is fundamental for educators to understand that helping students to reduce their fear of mathematics is significant at the elementary level. Math anxiety usually comes from a lack of confidence when working in mathematical situations. This study provides relevant research that supports the use of children literature to improve student's confidence and reduce their anxiety in mathematics. Including children's literature in the curriculum can increase students' confidence in mathematics and reduce their anxiety level; potentially improving students' academic performance. Math anxiety has been associated with negative feelings surrounding Math and adverse outcomes on both Math performance and the confidence to learn Math (Bekdemir, 2010,

Chinn, 2009, Chiu and Henry, 1990, Hembree, 1990, Ho et al., 2000, Ma, 1999 and Rubinsten & Tannock, 2010).

Teachers who experience math anxiety can project their fear of mathematics to their students. To help alleviate this, teachers need to acknowledge that they are experiencing math anxiety and take the necessary step to resolve this issue to avoid projecting this fear onto their students.

Teachers can confidently practice integrating children's literature in their pedagogy; because children's literature has the ability to contribute significantly to student's involvement in mathematics, resulting in improved academic performance; by integrating children literature in the curriculum students develop a better understanding and appreciation for mathematics. Research has consistently shown that students in integrated programmes are more likely to demonstrate academic performance equivalent to, or superior than, students in discipline-based programmes. Additionally, students become more engaged in school, and are less prone to attendance and behaviour problems. (Drake & Reid, 2010)

As a future Teacher

Having done this research I am more confident as a future teacher to practice integrating children's literature in my elementary classroom. My research has proven that this is a very effective way to engage students at the elementary level to learn mathematics in a non-threatening way.

As I begin my practice as an elementary teacher the findings from this study has provided me with an alternative method to encourage my students to learn mathematics. This study sufficiently proves that integrating children literature in the math curriculum is an effective strategy that I can include in my pedagogy. I believe that as a teacher it is my responsibility to

include a variety of strategies in my pedagogy to improve students learning in mathematics.

Teachers at the Primary grades' cite a number of benefits to curriculum integration that includes: building on prior knowledge and experiences, allowing for flexibility, unifying the students' learning, reflecting the real world and matching the way students think (Giorgis & Johnson, 2001). When literature is interlaced in the mathematics curriculum it can produce a positive outcome in the elementary classroom.

The findings of my research has also revealed that teacher's attitude toward mathematics can influence their students attitude towards the subject and may potentially hinder their comprehension of the subject and ultimately their performance. Therefore as a beginning teacher I need to ensure that I exhibition a positive attitude towards the subject.

Conclusion

After listening to the teachers' commentary on the integration of children's literature in their math curriculum, I conclude that teachers can successfully practice integration. The process of integration will require significant effort on the teacher's part, however, when integration is done mindfully, it will be very rewarding in the teaching and learning process. As I reminisce on my early exposure to mathematics, I cannot recall my teachers practicing integration. I know that integration can be beneficial in the classroom; therefore, I will include the process in my math pedagogy. Cross curricular integration can be very helpful to bridge the gap between subjects. Integrating children's literature in the math curriculum can play a significant role in reducing students' anxiety level towards mathematics.

I have decreased my anxiety of mathematics by participating actively in all opportunities to develop my skills and competent level in mathematics. I have embraced opportunities to study how teachers are using various strategies to help students develop an appreciation for mathematics and I have attended personal development workshops to learn from the experts how to make math more realistic, less threatening and enjoyable to students.

REFERENCES

- Alberta Education (2007). Primary programmes framework for teaching and learning: Curriculum Integration: Making Connections. Canada: Alberta Education.
- Anderson, R. (2007). Being a mathematics learner: Four faces of identity, *The Mathematics Educator*, 17, 7-14.
- Arp, K. C. (1999). *The relationship of pre-service preparation to teachers' attitudes towards mathematics and teaching middle school mathematics*. Texas A & M University, Galveston, TX.
- Ashcraft, M., Krause, J. (2007) *Working memory, math performance, and math anxiety*, 14(2), 243-248.
- Bandura, A. (1986). *Social Foundations of Thoughts and Actions: A social Cognitive Theory*. Englewood Cliffs: NJ: Prentice-Hall.
- Bandura, A. (1997). Self-efficacy: The exercise of control. New York: W.H. Freeman.
- Bolhuis, S., & Voeten, J. M. (2004). Teacher's conceptions of student learning and own learning. *Teachers and Teaching: Theory and Practice*, 10(1), 77-98.
- Benbow, C., & Stanley, J. (1983). Academic precocity: Aspects of its development. Baltimore: Johns Hopkins University Press.
- Beane, J. (1997). *Curriculum integration. Designing the core of democratic education*. New York and London: Teachers College Press, Columbia University.
- Bennett-Armistead, Duke, N., Moses, A., & Snow, E. (2005). Literacy and the youngest learner: Best practices for educators of children from birth to 5. New York: Scholastic.
- Bekdemir, M. (2010). The pre-service teachers' mathematics anxiety related to depth of negative experiences in mathematics classroom while they were students. *Educational Studies in Mathematics*, 75 (3), 311-328.
- Byrd, K. & Kinniburgh, L. H. (2008). Ten Black Dots and September 11: Integrating Social Studies and Mathematics through Children's Literature. *The Social Studies*, 99(1), 33-36.
- Bush W.S (1989) Mathematics Anxiety in Upper Elementary School Teachers. *School, Science and Mathematics*, 89, 499-504.

Callan, R. (2004). Reading + Math= A Perfect Match. *Teaching K-8*, 34(4), 50-51.

Curtain-Phillips, M. (2003). Befriending the Math Monster! *Today's Catholic Teacher*, 37(2), 18. Retrieved March 30, 2004, from ProQuest database.

Chinn, S. (2009) Mathematics anxiety in secondary students in England

Chiu, L.H., Henry L.L (1990) Development and validation of the mathematics anxiety scale for children

Measurement and Evaluation in Counseling and Development, 23 (1990), pp. 121–127

Darling-Hammond, L. (2006). Constructing 21st-century teacher education. *Journal of Teacher Education*, 57(3), 300-314.

Diakiw, J. (1990). Children's literature and global education: Understanding the developing world. *The Reading Teacher*, 43(4), 296-300.

Drake, S. (1991). How our team dissolved the boundaries. *Educational Leadership*, 49(2), 20-22.

Dyslexia, 15 (2009), pp. 61–68 <http://dx.doi.org.myaccess.library.utoronto.ca/10.1002/dys.381>

Forgarty, R., (1991) Ten Ways to Integrate Curriculum

Frey, J.H & S.M.Oishi (1995): *How to Conduct Interviews by Telephone and in Person*. London: Sage.

Furner, J, M. & Berman, B, T. (2003). Math anxiety: Overcoming a major obstacle to help the improvement of student math performance. *Childhood Education*.
<http://www.findarticles.com>

Furner, J, M. & Duffy, M. (2002). Equity for all students in the new millennium: Disabling math anxiety. *Intervention in School and Clinic*.
<http://www.idonline.org>

Giorgis, C., & Johnson, N.J. (2001). Children's Books: Interacting with the Curriculum. *The Reading Teacher*, 55(2), 204-213.

(Grouws,DA.(Ed). (1992) Handbook of Research on Mathematics Teaching and Learning. (pp584-585).New York: MacMillan

Heroman, C. & Jones, C. (2004). *Literacy: The creative curriculum approach*. Delmar: Cengage Learning.

Hembree R. (1990) The nature, effects, and relief of mathematics anxiety

TDSB (2014) Achievement and EQAO RETRIEVED 13/10/2014 from
<http://www.tdsb.on.ca/aboutus/research/achievementeqao.aspx>

Journal for research in mathematics education, 12 (1990), pp.33-46

<http://dx.doi.org.myaccess.library.utoronto.ca/10.2307/749455>

H.-Z. Ho, D. Senturk, A.G. Lam, J.M. Zimmer, S. Hong, Y. Okamoto *et al.* The affective and cognitive dimensions of math anxiety: A cross-national study Journal for Research in Mathematics Education, 31 (2000), pp. 362–379

Jackson, E. (2008). Mathematics Anxiety in Student Teachers. *Practitioner Research in Higher Education*, 2(1), 36-42.

Jacobs, H. H. (1989). Design options for an integrated curriculum. In H. H. Jacobs (Ed.), *Interdisciplinary curriculum: Design and implementation* (pp. 13-24). Alexandria, VA: Association for Supervision and Curriculum Development.

Jenner, D., (2002) Experiencing and understanding mathematics in the midst of a story: Teaching Children Mathematics 9.3

Johnston, C. (2010) *Female teachers transmit math anxiety to female students.*

Kvale, Steinar (1983). The qualitative research interview: A phenomenological and a hermeneutical mode of understanding. *Journal of Phenomenological Psychology*, 14, 171-196.

Kotsopoulos, D. (2007). It's like hearing a foreign language. *Mathematics Teacher*, 101, 301-305.

Krpan 2013

Kloosterman, P. & Clapp, M. (1994). Students' beliefs about learning school mathematics. *The Elementary School Journal*, 94, 375-388.

Lancaster, Peter. (February. 7th, 2006). In *The Canadian Encyclopedia online*. Canadian Mathematics and Society. (Ed. December, 15th, 2013). Retrieved from Historica Canada.
<http://www.thecanadianencyclopedia.com/en/article/mathematics-and-society/>

Ma, X., & Xu, J. (2004). The causal ordering of mathematics anxiety and mathematics achievement: A Longitudinal panel analysis. *Journal of Adolescence*, 27(2), 165-179

Maker, C. J. (1982). Curriculum development for the gifted. Rockville, MD: Aspen.

McDuffie, R., Young, A., Terrell A (2003). Promoting mathematical discourse through children's literature: Teaching Children Mathematics 9.7

Midgeley, C., Feldlaufer, H., & Eccles, J. (1989). Change in teacher efficacy and student self- and task-related beliefs in mathematics during the transition to junior high school. *Journal of Educational Psychology*, 81(2), 247-258.

Marzano, J.R 1992

Mission College. (2009). *Overcoming Math Anxiety*. Santa Clara, CA. Retrieved from [http://salsa.missioncollege.org/mss/stories/storyReader\\$9](http://salsa.missioncollege.org/mss/stories/storyReader$9).

Murphy, S.J. (1999). *Spunky Monkeys on Parade*. New York: Harper Collins Publishers.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.

Neuman, S., Copple, C., Bredekamp, S., & the National Association for the Education of Young Child. (2000). *Learning to read and write: Developmentally appropriate practices for young children*. Washington, DC: National Association for the Education of Young Child.

Ministry of Education (2005). The Ontario Curriculum Grades 1-8 Mathematics REVISED ISBN 0-7794-8122-4 (Internet) Grade 3 (pp.53-63)
<http://www.edu.gov.on.ca/eng/curriculum/elementary/math18curr.pdf>

Plaisance, D.V. (2009). *A Teacher's Quick Guide to Understanding Mathematics Anxiety*. Louisiana

Association of Teachers of Mathematics Journal, 6(1). Retrieved from http://www.lamath.org/journal/vol6no1/anxiety_guide.pdf.

Pomykal Franz, D., Pope, M. (2005): Using Children's Stories in Secondary Mathematics, *American Secondary Education* 33.2

Perina, K. (2002). The sum of all fears: What makes people math phobic? *Education. Psychology Today*. <http://www.findarticles.com>

Rubinsten, R. Tannock

Mathematics anxiety in children with developmental dyscalculia

Behavioral and Brain Functions, 6 (2010), pp. 1–13

<http://dx.doi.org.myaccess.library.utoronto.ca/10.1186/1744-9081-6-46>

Rubenstein, R. N. (2007). Focused strategies for middle-grades mathematics vocabulary development. *Mathematics Teaching in the Middle School*, 13, 200-20

Relich, J. (1996). Gender, self-concept and teachers of mathematics: effects on attitudes to teaching and learning. *Educational Studies in Mathematics*, 30, 179-195.

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

Stanley, J., Keating, D., & Fox, L. (1974). *Mathematical talent*. Johns Hopkins University Press.

Tobias, Sheila. *Overcoming Math Anxiety*. New York: W. W. Norton & Co., 1978.

Tobias, S. (1976a). Math Anxiety: Why is a smart girl like you counting on your finger's? *Ms. May*, 56-59, 92.

Vars, G.F. (1991, October). Integrating Curriculum in Historical Perspective. *Educational Leadership*, 49(2), 14. Retrieved from Academic Research Library. (Document ID: 1624389).

Vukelich, C. & Christie, J. (2009). *Building a foundation for preschool literacy: Effective instruction for children's reading and writing development*. New Jersey: International Reading Association.

Whitin, D.J. & Wilde, S. (1992). *Read any good math lately? Children's books for mathematical learning, K-6*. Portsmouth, NH: Heiemann.

Woodard, T. (2004). *The Effects of Math Anxiety on Post-Secondary Development Students as Related to Achievement, Gender, and Age*. *Inquiry*, 9(1). ERIC Document Reproduction Service No. EJ876845.

Worley, Jeff. (2002). *Using Literature to Teach Math and Science*. Available from <http://www.rgs.uky.edu/odyssey/fall02/usingliterature.html>.

William, V. (1988). Answers to questions about math anxiety. *School Science and Mathematics* 88, 95-109

Joan, C. & Fisher, E. Karen (2005). *How Libraries and Librarians Help: A Guide to Identifying User-Centered Outcome*. Chicago : American Library Association

Wimmer, Roger D & Joseph .R. Dominick (1997): *Mass Media Research: An Introduction*. Belmont, MA: Wadsworth

John Wiley & Sons, Inc. (1999) A Literature Review of Science and Mathematics Integration onlinelibrary.wiley.com Vol. 99 Issue 8

Yara, P. O. (2009). Student's Attitude towards Mathematics and Academic Achievement in Some Selected Secondary Schools in Southwestern Nigeria, *European Journal of Scientific Research*, 36 (3), p.339.

Murr, K. A. (2001). Math Anxiety and How It Affects High School Students.

Ohio Journal of School Mathematics, 43, 43. Abstract retrieved March 30, 2004, from ERIC database.

APPENDICES

Appendix A: Letter of Consent for Interview



Date: _____

Dear _____,

I am a graduate student at OISE, University of Toronto, and I am currently enrolled as a Master of Teaching candidate. I am studying, “how a sample of elementary teachers are using children’s literature to teach mathematics and the perceive impact it has on students’ learning,” for the purposes of a investigating an educational topic as a major assignment for our program. I think that your knowledge and experience will provide insights into this topic.

I am writing a report on this study as a requirement of the Master of Teaching Program. My course instructor who is providing support for the process this year is Dr._____. My research supervisor is _____. The purpose of this requirement is to allow us to become familiar with a variety of ways to do research. My data collection consists of a 40 minute interview that will be tape-recorded. I would be grateful if you would allow me to interview you at a place and time convenient to you. I can conduct the interview at your office or workplace, in a public place, or anywhere else that you might prefer.

The contents of this interview will be used for my assignment, which will include a final paper, as well as informal presentations to my classmates and/or potentially at a conference or publication. I will not use your name or anything else that might identify you in my written work, oral presentations, or publications. This information remains confidential. The only people who will have access to my assignment work will be my research supervisor and my course instructor. You are free to change your mind at any time, and to withdraw even after you have consented to participate. You may decline to answer any specific questions. I will destroy the tape recording after the paper has been presented and/or published which may take up to five

years after the data has been collected. There are no known risks or benefits to you for assisting in the project, and I will share with you a copy of my notes to ensure accuracy.

Please sign the attached form, if you agree to be interviewed. The second copy is for your records. Thank you very much for your help.

Yours sincerely,

Researcher name: _____

Phone number, email: _____

Instructor's Name: _____

Phone number: _____ Email: _____

Research Supervisor's Name: _____

Phone #: _____ Email: _____

Consent Form

I acknowledge that the topic of this interview has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw at any time without penalty.

I have read the letter provided to me by _____ (name of researcher) and agree to participate in an interview for the purposes described.

Signature: _____

Name (printed): _____

Date: _____

Appendix B: Interview Questions***Background Information***

1. How long have you been teaching? Have you always taught at the elementary level?

What grade(s) do you teach?

2. What did you study in your post-secondary education? Do you have teachable subjects?

3. You are participating in this study because you use children's literature to teach

mathematics. First, can you tell me a bit about your interest in children's literature?

4. What is your own relationship to mathematics education? (as a student in K-12,

undergraduate studies, teachable subject...)

5. How would you describe your confidence in teaching mathematics?

6. Have you ever suffered from math anxiety? If so, did you overcome that anxiety? How?

7. Have you had students who suffer from math anxiety?

8. How do you identify students in your class who suffer from math anxiety? What indicators of

math anxiety do you observe?

Instruction – Using Children's Literature to Teach Math

9. When did you start using children's literature to teach math? What motivated you to do so?
10. Can you give me some examples of which books you use and how you use them to teach math?
11. How do you become aware of and access these books? What resources and factors support you to do this integration?
12. What impacts have you observed your integration of children's literature and math having on students?
13. How would you describe the benefits of using children's literature to teach math?
14. What would you say are the challenges?
15. How do you respond to those challenges?