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Integrating children's literature and mathematics in the early childhood classroom

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Integrating children's literature and mathematics in the early childhood classroom

Abstract

"Historically there have been three reasons for groups to formally adopt a set of standards: (1) to ensure quality, (2) to indicate goals, and (3) to promote change. For NCTM, all three reasons are of equal importance" (The National Council of Teachers of Mathematics, 1989, p. 2).

Now, more than any other time in history, mathematical reform is essential in our school systems. The traditional mathematics curriculum was designed to prepare shopkeepers, farmers, and factory workers for occupations in the early 1900s. Some of those skills are still useful in today's society. However, as the new millennium approaches, our future citizens require an education in mathematics that goes far beyond basic computational skills. Research has revealed that although students can perform arithmetic computations adequately, they are not able to use their skills to solve problems (Burns, 1992). All students must "deepen their understanding of mathematical concepts and processes, and develop their problem solving, reasoning, and communication abilities while using mathematics to make sense of, and to solve, compelling problems" (NCTM, 1996a).

Integrating Children's Literature and Mathematics
in the Early Childhood Classroom

A Graduate Project
Submitted to the
Division of Reading Education
Department of Curriculum and Instruction
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Education
UNIVERSITY OF NORTHERN IOWA

by

Jamie M. Christensen

November 24, 1998

This Project by: Jamie M. Christensen

Titled: Integrating Children's Literature and Mathematics in the Early Childhood

Classroom

has been approved as meeting the research requirement of the Degree of Master of Arts
in Education.

Dec. 16, 1998

Date Approved

Deborah L. Tidwell

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and Instruction

Introduction

“Historically there have been three reasons for groups to formally adopt a set of standards: (1) to ensure quality, (2) to indicate goals, and (3) to promote change. For NCTM, all three reasons are of equal importance” (The National Council of Teachers of Mathematics, 1989, p. 2).

Now, more than any other time in history, mathematical reform is essential in our school systems. The traditional mathematics curriculum was designed to prepare shopkeepers, farmers, and factory workers for occupations in the early 1900s. Some of those skills are still useful in today’s society. However, as the new millennium approaches, our future citizens require an education in mathematics that goes far beyond basic computational skills. Research has revealed that although students can perform arithmetic computations adequately, they are not able to use their skills to solve problems (Burns, 1992). All students must “deepen their understanding of mathematical concepts and processes, and develop their problem solving, reasoning, and communication abilities while using mathematics to make sense of, and to solve, compelling problems” (NCTM, 1996a).

In response to society’s need for mathematical reform, The National Council of Teachers of Mathematics created a document called Curriculum and Evaluation Standards For School Mathematics (1989). The *Standards* define the mathematics content that all students should know and be able to do at each specified grade level, K-12. The *Standards* document was written by a team that consisted of classroom teachers, supervisors, educational researchers, teacher educators, and mathematicians. Thousands of others, both NCTM members and nonmembers

including parents and business leaders, reviewed and critiqued the document in draft form, so that the final edition represented a broad consensus. The entire document is divided into three sections; K-4, 5-8, and 9-12, with each level having twelve to fourteen standards. These standards identify the basic skills that students should obtain in numbers and number theory, geometry, measurement, probability and statistics, patterns and functions, discrete mathematics, algebra and beyond. The standards also emphasize that students need to “learn how to solve problems, reason, communicate mathematically, and connect their studies to other areas of mathematics, other disciplines, and the real world” (NCTM, 1996a, p. 2).

Table 1 indicates the presence or absence of each of the standards according to three current textbooks. The first textbook “SBG” is Silver Burdett & Ginn Mathematics (Fennell, Ferrini-Mundy, Ginsburg, Greenes, Murphy, & Tate, 1998). The second textbook “SF” is Scott Foresman Exploring Mathematics (Bolster et al., 1991). The third textbook “H” is Heath Mathematics Connections (Manfre, Moser, Lobato, & Morrow, 1996). The table of contents, and scope and sequence models of each textbook were used as the source of information in determining whether the textbook included each NCTM standard.

Table 1
Usage of standards in three current mathematics textbooks

	Kindergarten			First			Second			Third		
	SBG	SF	H	SBG	SF	H	SBG	SF	H	SBG	SF	H
Problem Solving	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Communication	N	N	Y	N	N	Y	N	N	Y	N	N	Y
Reasoning	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Connections	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Estimation	N	Y	N	N	Y	N	Y	Y	N	Y	Y	Y
Number Sense	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Whole Number Operations	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Whole Number Computation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Geometry	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Measurement	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stats/ Probability	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fraction/Decimal	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Patterns	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y=Yes N=No

SBG=Silver Burdett Ginn

SF=Scott Foresman

H=Heath

The *Standards* advocate a very different approach to teaching mathematics, in comparison with how a majority of textbooks are written. Most textbooks include the basic concepts that NCTM suggests. However, current literature about the standards reflects that most textbooks' methods of teaching these concepts are drastically different from what NCTM envisions. Many textbooks still suggest teaching rote learning of basic mathematics facts, and they fail to show connections between mathematical processes to the real world (Braddon, Hall, & Taylor, 1993). NCTM recommends five specific approaches for effectively teaching the NCTM standards (Braddon, Hall, & Taylor, 1993).

1. Emphasis on application of mathematics rather than computation.
2. Allowing more time for problem solving activities compared to rote drill skills.
3. Appropriate daily use of computers and calculators.
4. Viewing mathematics as an integrated whole rather than a group of unrelated topics.
5. Learning the meaning of operations, not just the skills.

Using these five approaches as criteria, the three textbooks (Silver Burdett & Ginn, Scott Foresman, and Heath) were reviewed for the quality of teaching suggestions and student activities. Table 2 illustrates how well the lessons for each standard within the textbooks met the five NCTM criteria for good teaching. The textbooks were evaluated on a scale of 1-3, 1 representing low use of criteria, 2 representing moderate use of criteria, and 3 representing high use of criteria. The scores were determined based on the number of criteria that the lessons in each textbook included. Standards six through thirteen were reviewed first, using the table of contents as the

reference in locating the corresponding lessons for these specific standards. A score of 1 meant that the textbook only used one or two ideas presented in the criteria, a score of 2 meant that the textbook used three ideas presented in the criteria, and a 3 meant that the lessons used either four or all five of the criteria suggested by NCTM. Standards one through five were evaluated based on the overall viewing of the entire textbook since these standards should be included in every mathematics lesson.

Table 2
Evaluation of textbooks according to NCTM standards

	Kindergarten			First			Second			Third		
	SBG	SF	H	SBG	SF	H	SBG	SF	H	SBG	SF	H
Problem Solving	1	1	1	1	2	2	1	2	1	1	2	2
Communication	-	-	1	-	-	1	-	-	1	-	-	1
Reasoning	1	1	1	1	1	1	1	1	1	1	2	1
Connections	1	1	1	1	1	1	1	1	1	1	1	2
Estimation	-	1	-	-	1	-	1	1	-	1	2	2
Number Sense	1	1	2	1	1	2	1	1	2	1	2	2
Whole Number Operations	1	1	1	1	1	1	1	1	1	1	2	2
Whole Number Computation	1	1	1	1	1	1	1	1	1	1	2	2
Geometry	1	1	2	1	1	2	1	1	2	1	2	1
Measurement	1	1	2	1	1	2	1	1	2	1	2	2
Stats/Probability	-	1	1	1	1	1	1	1	1	1	2	1
Fraction/Decimal	1	1	1	1	1	1	1	1	2	1	2	1
Patterns	1	1	1	1	1	1	1	1	1	1	1	1

1=Low 2=Medium 3=High

SBG=Silver Burdett Ginn
 SF=Scott Foresman
 H=Heath

The Curriculum and Evaluation Standards For School Mathematics (1989) is the latest research in mathematical reform, and is an excellent resource for teachers to utilize in their curriculum. However, this is not a step-by-step “how to do it “ book (NCTM, 1996b). The *Standards* creates a set of goals that teachers should work toward, but many teachers will ask “How do I make these changes in my classroom?” There are many methods that can be used in striving to attain these goals. Most importantly children need to be actively involved in real mathematical tasks. Manipulatives such as interlocking cubes, base-ten blocks, geoboards, dot paper, and even household objects can be concrete examples of mathematics that children can visualize and construct. Calculators, computers, and other sources of technology are also important methods in exploring mathematics. The use of technology allows children to investigate number patterns and enables children to focus on problem-solving processes rather than computational procedures (NCTM, 1996a). Another excellent method to achieving these goals is the use of children’s literature.

Literature provides real, purposeful reading for students (Bosma & Goth, 1995). Every child loves to tell stories and listen to stories. Storytelling is a natural part of life. “Children need stories and they need to story, they view stories as a source of comfort, a means of connecting all aspects of life, and an opportunity to live experiences rather than merely know about them” (Sorensen & Lehman, 1995, p. 58). Research also supports the benefits of using children’s literature in the classroom. “Experiences with literature during the school years promote interest in reading, language development, reading achievement, and growth in writing abilities” (Freeman & Person, 1998, p. 3). Teachers and librarians have long observed that

students learn best when they: “are personally involved with the material they read, become engaged in a topic, and have a context and framework for understanding facts” (Cullinan, 1993, p. 1). These conditions prevail when children are read to or read children’s literature (Cullinan, 1993).

Children’s literature is a powerful tool that can be used with any content area. However, the integration of mathematics and children’s literature is a dynamic pairing of subject areas. Most elementary students who love good literature are often the same children who dislike completing worksheets filled with math problems. With increased support of the whole language philosophy and literature-based language arts, it became apparent that integrating math and literature would be not only exciting, but also a logical union (Braddon, Hall, & Taylor, 1993). “In children’s literature mathematics is viewed as a process, not merely an event: it is part of a larger experience and can only be understood in its total context” (Whitin, Mills, & O’Keefe, 1990, p. 69).

There are numerous benefits to integrating children’s literature and mathematics. First, and most important, literature has an aesthetic and universal appeal to both adults and children. “Good children’s books are a form of art and like all art have an infinite capacity to delight and move us, to touch the emotions and perceptions that make us truly human” (Hickman & Cullinan, 1989, p. 4). Mathematics is not simply a body of knowledge that is separate from human actions, but it is a consequence of social interaction (Whitin & Wilde, 1995). Children’s literature provides a human perspective to mathematics that causes it to become more personal and realistic to the child.

Secondly, literature provides a meaningful context and illustrates real-life application of mathematics. Many children view mathematics as being isolated from the rest of their lives. It cannot be assumed that children will perceive and internalize connections between math and the real world (Griffiths & Clyne, 1994). Math is part of everyday life; therefore its understanding is essential to functioning in the real world (Lightsey, 1996). Literature provides this context because children learn how real-life people use mathematics in their own lives. "Children's literature restores a meaningful context to the use of numbers because mathematical concepts are naturally embedded in stories" (Whitin & Wilde, 1992).

The third benefit of integrating children's literature and mathematics is that literature easily integrates mathematics into other curriculum areas. Teachers can become frustrated by the lack of time in which they are expected to cover a very broad curriculum. By combining math with children's literature, valuable classroom instruction time can be used to focus on other curriculum areas. However, an interdisciplinary approach not only saves time, but also enhances children's insights into all curriculum areas, "the whole is greater than the sum of the parts" (Welchman-Tischler, 1992, p. 1). An integrated curriculum provides a base that children can use to make connections between content areas and the real world.

The fourth benefit is that the familiarity of a book or story provides a structure in which children will enjoy exploring mathematics. "Stories are natural invitations for learners to enter and explore the mathematics of their own lives and lives of others." (Whitin & Wilde, 1992, p. xii). The familiarity of a book or story provides

a structure with which children can manipulate and develop mathematical concepts (Griffiths & Clyne, 1988).

The fifth benefit is that literature can relieve “math anxiety” and provide a non-threatening experience toward mathematics. Much has been written about “math anxiety” and the effects that occur on the attitudes and literacy development of learners. Children’s literature can help to alleviate some of that anxiety (Whitin & Wilde, 1992). Most children, and even adults, want to listen to stories because it is a comforting and enjoyable experience. “With literature, a teacher is able to convey a mathematical concept in an easy, relaxed manner and follow the story with a discussion.” (Lightsey, 1996, p. 416).

The last benefit is that literature can enhance motivation toward mathematics and reading. Children must feel that mathematical experiences are interesting if they are to achieve their full mathematical potential; using literature as a springboard is one way to capture their interest (Lightsey, 1996). As students work on projects that integrate math and literature, they learn about both of these essential content areas. Through the integration of literature and mathematics children will learn to see the purpose of mathematics in a meaningful way, and they will discover that the mathematical perspective can enhance their enjoyment and understanding of literature (Kliman, 1993).

Mathematical ideas and concepts are present in all kinds of literature. Many children’s books relate to mathematics in some aspect. Some are explicitly about mathematics such as counting books, books about shapes, and other books that focus on one specific aspect of mathematics. These books are written to explain and

illustrate one area of math, such as Time, by Henry A. Pluckrose. This book was designed and written specifically to teach children about the concept of time in their own lives. Other children's books involve mathematics in slightly more subtle methods. These books might not be called "math books" by teachers or students, but they suggest rich possibilities for more in depth mathematical investigations (Welchman-Tischler, 1992). The Grouchy Lady Bug, by Eric Carle, was probably not written to be a book about the concept of time. However, because of the sequential format of this book it can be an excellent example in helping children visualize time. See Table 3 for examples of both explicit and subtle math in early childhood literature.

Table 3

An example of children's literature that contains both explicit math and subtle math

	Explicit Math	Subtle Math
Number Sense And Numeration	<u>1,2,3</u> by Tana Hoban	<u>Ten Black Dots</u> by Donald Crews
Whole Number Operations And Whole Number Computation	<u>Multiplication</u> by David Stienecker	<u>One Hundred Hungry Ants</u> by Elinor J. Pinczes
Geometry And Spatial Sense	<u>Shapes</u> by Ivan Bulloch	<u>The Village of Round and Square Houses</u> by Ann Grifalconi
Measurement	<u>Time</u> By Henry A. Pluckrose	<u>The Grouchy Ladybug</u> by Eric Carle
Statistics And Probability	<u>Statistics</u> by Jane Jonas Srivastava	<u>Moira's Birthday</u> by Robert Munsch
Fractions And Decimals	<u>Fractions Are Parts of Things</u> by J. Richard Dennis	<u>Gator Pie</u> by Louise Mathews
Patterns And Relationships	<u>Patterns</u> by Ivan Bulloch	<u>Brown Bear, Brown Bear, What Do You See?</u> by Bill Martin

This project is a series of nine workshops. The purpose of these workshops is to inform the early childhood classroom teacher about the use of children's literature to teach mathematics. I first became interested in this topic during my undergraduate study. I majored in elementary education and acquired a minor in mathematics. I was introduced to the concept of integrating children's literature with mathematics while attending the UNI Mathematics Conference. However, I did not realize how successful it could be as a teaching method.

As I began my graduate study in reading education I learned more about the power of children's literature in an integrated curriculum, especially through a class called "Language Arts Across the Curriculum." Part of the requirement for this course was to create a presentation about the integration of content areas, especially language arts. Since I already had a math background, I decided to investigate the integration of mathematics and children's literature. I knew that there were several children's books that related to math, but I had not examined them in great detail. I was surprised not only at how many children's books that I found, but also at the number of resources I found. I located several books that gave examples of quality children's books, and suggested various lessons/activities to use with that specific book.

As I contemplated the topic for my graduate paper I thought back to this project that I had constructed, and I decided that I wanted to investigate it further. I wanted to learn more about the benefits of integrating children's literature with mathematics and try to determine why more teachers do not use this teaching method. After completing my research I can only conclude that either most teachers have

never been informed of this method of integration, or they are uncertain of how they could implement this strategy into their existing curriculum. I have chosen a project format for my research because I want to help elementary teachers learn about integrating literature and mathematics, and aid them in using this teaching strategy in their own classrooms.

Methodology

I began my research for this project by searching the UNISTAR system at the UNI library. I wanted to find all of the books that connected children's literature and mathematics. I found these books by entering the key words mathematics and literature. This produced several valuable resources. One specific book that I found especially helpful was called Math Through Children's Literature: Making the NCTM Standards Come Alive. This book gave many examples of books (K-6) that aid in teaching the thirteen standards. The authors of this book did not create complete lesson plans for each of the books, but they gave several brief activities on which the teacher could elaborate. I also found useful information in Math and Literature, Books You Can Count On, It's the Story That Counts, and Read Any Good Math Lately?. All four of these books talked about the benefits of integrating children's literature and mathematics, and offered several suggestions in implementing this technique into the classroom.

In addition to the resources that I found, I also wanted to find some journal articles about the integration of children's literature and mathematics. I found these articles by using an ERIC search with the same key words, mathematics and literature. Most of the articles that I found were written by an elementary teacher, and the content consisted of suggestions about particular books that he/she had used in their own classroom. Two articles that I found very interesting were "Integrating Mathematics and Literature in the Elementary Classroom" and "Using Literature to Build First Grade Math Concepts." Both of these articles provided narrative text about integration as well as examples that worked well for them.

Next I thought that I needed some type of format to organize the data that I had collected. I used the book Math Through Children's Literature: Making the NCTM Standards Come Alive. I also reflected on the knowledge that I had attained about the *Standards* in my undergraduate math courses. I decided to use the thirteen standards as a guide because I thought that they would be an excellent framework to help me create my workshops, and I felt that the information that NCTM wrote was very important. I continued my research by reviewing the Curriculum and Evaluation Standards For School Mathematics. I also found two other pamphlets published by NCTM called Mathematics An Introduction to the NCTM Standards and Mathematics Making a Living, Making a Life. I had received both of these resources during my undergraduate study, but I had not examined them thoroughly. I also found information about teaching mathematics in the books Living and Learning Mathematics, Math Makes Sense, and IDEAS: NCTM Standards-Based Instruction. The information from these books gave me knowledge and support for teaching mathematics in context, and gave me an understanding of real-life application of mathematics.

At this point in my research I felt that I had a good background knowledge about integrating children's literature and mathematics, and about the need for a project that proposed mathematical reform. However, I didn't feel that I had the research to prove why I felt that literature was the most important method in making instructional changes in the mathematics curriculum. I found resources about the importance of literature and using literature to integrate content areas by searching the subject interdisciplinary approaches. This produced resources such as Connecting

Informational Children's Books With Content Area Learning, Fact and Fiction: Literature Across the Curriculum, and Children's Literature in an Integrated Curriculum. These books gave me the explanation and quotes that helped me build my case for the use of literature to teach the content area of mathematics.

I had now completed my review of literature and felt very confident in the information I had attained. After writing my introduction I decided to create my workshops based on the standards. With each workshop I wanted to include an annotated bibliography of books that corresponded with that standard(s). I also wanted to present a lesson using one of the books from the bibliography. This lesson would integrate a children's book with the particular standard(s) that was presented at the workshop. Before I began writing about my workshops I wanted to compile all of the books that I would use, and sketch rough drafts of the lessons that I planned to teach. I found most of the books through UNISTAR searches. I would enter each particular standard under the category subject. Then I would limit my search by asking for only the books that were located in the youth collection. I also found many children's books in the resources that I mentioned earlier that integrated children's literature and mathematics. I found several books in magazine/journal articles, and from a book called The Wonderful World of Mathematics. After I had created piles, one for each workshop, I reviewed each pile and choose the book that I wanted to use for my lesson. Some of the books that I choose were recommended in the sources that I found , and activities were provided to use with the books. I used some of these ideas and I also created my own to construct the lessons that I felt would be most effective.

The Project

This project is designed to be a series of workshops for early childhood educators. I will use the NCTM standards as a framework to teach how mathematics can be enlightened by the integration of literature. I will introduce several books that are both explicitly about math and portray math more subtly. Each workshop will introduce and explain the importance of one or more standards. Then an annotated bibliography of corresponding children's literature will be provided with a presentation of one book that relates to the specific standard. Every session will conclude with professional development time for the teachers to reflect on their own teaching techniques and create personal goals for integrating children's literature and math based on the standard(s) that they have learned.

This project consists of nine sessions (See Table 4). The initial and final workshops involve a ninety-minute time block, while the other seven require sixty minutes. The initial session will contain an introduction for the project and the first five standards will be examined. The final session will conclude with several suggestions for integrating children's literature and mathematics, and each teacher will be given time to present a lesson that he/she has used in their own classroom. The remaining sessions will provide an in-depth overview of either one or two standards per workshop. It is recommended that these workshops be distributed throughout one entire school year, one workshop per month. This year-long format will be more beneficial for the teachers that participate because it will give them time to implement new ideas into their curriculum and to monitor their own progress in making instructional change in their classroom.

Table 4
A sample schedule for project

Integration of Children's Literature and Mathematics

In the Early Childhood Classroom

Jamie M. Christensen

Session	Topic	Time
One	Problem Solving, Communication, Reasoning, Connections, and Estimation (Standards 1-5)	90 minutes
Two	Number Sense and Numeration (Standard 6)	60 minutes
Three	Whole Number Operations and Computations (Standards 7-8)	60 minutes
Four	Geometry and Spatial Sense (Standard 9)	60 minutes
Five	Measurement (Standard 10)	60 minutes
Six	Statistics and Probability (Standard 11)	60 minutes
Seven	Fractions and Decimals (Standard 12)	60 minutes
Eight	Patterns and Relationships (Standard 13)	60 minutes
Nine	Conclusions and Recommendations	90 minutes

Workshop 1

Workshop 1

I will begin my first workshop by introducing myself and providing an overview of the nine workshops that I plan to present. I will place an overhead of Table 4 (See Appendix A) on the projector and read it aloud to my participants. Then I will briefly discuss the NCTM standards and explain why I choose to use them as my guide in presenting the integration of children's literature and mathematics. I will proceed by stating that the NCTM standards are the most current research in mathematics study. They are the goals and the foundation on which teachers should construct their mathematics curriculum.

In the next part of my workshop I will discuss standards one through five in depth. I will explain that the first five standards are different from the remaining eight because there should be an attempt to incorporate these standards into every math lesson. Then I will ask my audience if anyone can name the first standard. If no one replies I will define it as "Mathematics as Problem Solving" and have everyone write down on a piece of paper what they think this phrase means. After sufficient time has been given for everyone to respond I will ask for volunteers to read some of their definitions or descriptors of the first standard. Then I will place an overhead of standard 1 (See Appendix B) on the projector and read the goals for standard 1 that NCTM has created.

I will use the same format for standard two. First I will ask if anyone knows the second standard. If no one responds I will define it as "Mathematics as Communication" and have everyone write what they think this phrase means. After some people have shared their ideas I will place an overhead of standard 2

(See Appendix C) on the projector and read the goals that NCTM has formed for that standard. I will use this same format for standard 3 (Appendix D), standard 4 (Appendix E), and standard 5 (Appendix F).

Next I will discuss the benefits of integrating children's literature and mathematics. I will place an overhead of the benefits (See Appendix G) on the overhead and I will discuss each one individually. Then I will present a lesson using the book The Three Little Pigs. After reading the story aloud to the teachers I will have them participate in acting out the lesson. First they will choose what materials they would use if they were going to build their own house (reasoning), like the pigs in the story. Then they will have the opportunity to construct model houses out of the materials of their choice (problem solving). They will guess how far they think their house can travel in three puffs of air (estimation). Then they will test their house for durability with wind power, like the wolf used to blow down the pigs' houses. At the end of the lesson they will write a paragraph about their results (written communication). They will also make connections between mathematical skills and real-life skills of building safe houses (mathematical connections). (For a complete description of this lesson see Workshop 1 Lesson.)

Then I will distribute a general list of quality children's literature that contain mathematical concepts (See Lesson 1 Annotated Bibliography.) I will also pass out several examples of books that are listed on the bibliography so that my participants can examine them. I will give them time to review the books and to think about how they could integrate the first five standards (problem solving, communication, reasoning, connections, and estimation with those books. I will remind them that this

is a small sample of possibilities and encourage them to use other books of their choice to teach these five concepts in their own classrooms.

The last part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving problem solving, communication, reasoning, connections, and estimation) that they will attempt to achieve before the scheduled date of workshop 2. Each of these goals needs to be related to the content of this workshop and attainable in one month.

Workshop 1 Agenda

- Introduce project and NCTM Standards
- Importance of Standards 1-5 [Taken from NCTM Standards (1989)]
 1. Mathematics as Problem Solving (Standard 1)
 - Use problem-solving approaches to investigate and understand mathematical content.
 - Formulate problems from everyday and mathematical situations.
 - Develop and apply strategies to solve a wide variety of problems.
 - Acquire confidence in using mathematics meaningfully.
 2. Mathematics as Communication (Standard 2)
 - Relate physical materials, pictures, and diagrams to mathematical ideas.
 - Reflect on and clarify thinking about mathematical ideas and situations.
 - Relate everyday language to mathematical language and symbols.
 - Realize that representing, discussing, reading, writing, and listening to mathematics are a vital part of learning and using mathematics.
 3. Mathematics as Reasoning (Standard 3)
 - Draw logical conclusions about mathematics.
 - Use models, known facts, properties, and relationships to explain their thinking.
 - Justify their answers and solution processes.
 - Use patterns and relationships to analyze mathematical situations.
 - Believe that mathematics makes sense.

4. Mathematical Connections (Standard 4)

-Relate various representations of concepts or procedures to one another.

-Recognize relationships among different topics in mathematics

-Use mathematics in other curriculum areas.

-Use mathematics in daily life.

5. Estimation (Standard 5)

-Explore estimation strategies.

-Recognize when an estimate is appropriate.

-Determine the reasonableness of results.

-Apply estimation in working with quantities, measurement, computation, and problem solving.

□ Benefits of integrating children's literature and mathematics

1. Literature has an aesthetic and universal appeal to both adults and children.

2. Literature provides a meaningful context and illustrates real-life application of mathematics.

3. Literature easily integrates mathematics into other curriculum areas.

4. The familiarity of a book or story provides a structure which children will enjoy exploring mathematics.

5. Literature can relieve "math anxiety" and provide a non-threatening experience.

6. Literature can enhance motivation toward mathematics and reading.

□ Lesson-The Three Little Pigs

□ Professional goals and reflections

Workshop 1 Annotated Bibliography

Aker, S. (1990). What comes in 2's, 3's, and 4's? New York: Simon and Schuster.

Explains groups of numbers by illustrating how they occur in every day life. Such as two eyes or four seasons.

Holtzman, C. (1995). A quarter from the Tooth Fairy. New York: Scholastic.

A boy gets a quarter from the tooth fairy and he can't decide how to spend it.

Hulme, J. (1996). Sea Sums. New York: Hyperion Books.

An underwater setting is an inviting atmosphere for children to perform number games.

Lasky, K. (1994). The librarian who measured the earth. Boston, MA: Little, Brown.

Describes how a Greek geographer measured the circumference of the earth.

Long, L. (1996). Domino addition. Watertown, MA: Charlesbridge.

This book illustrates basic addition through the use of dominoes.

Merriam, E. (1993). 12 ways to get to 11. New York: Simon & Schuster.

Everyday experiences are used to illustrate twelve combinations of numbers that add up to eleven.

Neuschwander, C. (1997). Sir Cumference and the first round table.

Watertown, MA. Charlesbridge.

Sir Cumference and King Arthur find the perfect shape for his table.

Paul, A. (1991). Eight hands round: a patchwork alphabet. New York:

Harpercollins.

This book introduces the letters of the alphabet with names of early American patchwork quilt patterns and explains their origins.

Reid, M. (1990). The button box. New York: Dutton.

A child looks at all of the different shapes and sizes of the buttons in Grandma's button box.

Schuett, S. (1995). Somewhere in the world right now. New York: Knopf.

This book describes what is happening at many different places around the world at one particular time.

Walton, R. How many, how many, how many. Cambridge, MA:

Candlewick.

Playful rhymes help the reader in counting from one to twelve.

Workshop 1 Lesson

Objectives

Students will-

- Use multiple problem solving strategies
- Develop skills of oral and written communication
- Enhance reasoning skills by creating Venn Diagrams
- Make connections between mathematical skills and real-life skills.
- Estimate distance.

Materials

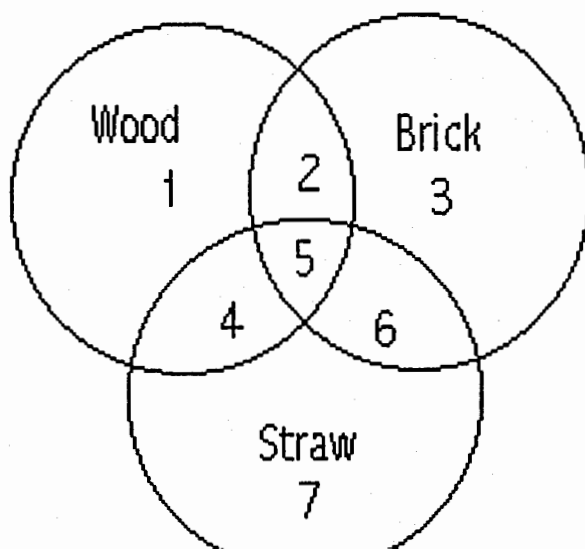
- Three Little Pigs
- Three twenty-foot pieces of yarn
- Scissors
- Tape
- Paper
- Pencil
- Various materials (construction paper, interlocking cubes, straws, etc.)
- Measuring tape

The Three Little Pigs (Synopsis)

Three little pigs each choose different materials to build their own house to protect themselves from the big bad wolf. The wolf goes to each house and says “Little pig, little pig let me in or I’ll huff and I’ll puff and I’ll blow your house in.”

Procedure

- Read The Three Little Pigs.
- Ask children to choose which materials they would use-straw, wood, brick, or any combination of the three-if they were going to build their own house. Have them write down their answer on a piece of paper.
- On the floor form three large intersecting loops of yarn to make a Venn Diagram. Then label the circles by placing cards on each one that say straw, wood, or brick.



- Discuss all six regions of the Venn diagram and talk about what it means to stand in each region. For example standing in region 4 would mean that you choose to make your house out of straw and wood.
- In step 2 the children reasoned which materials they would use to make their own house. Now have the children physically stand inside the loop or loops that he/she chose so that the entire class can visualize the various choices that their classmates made.
- Designate a class recorder to tabulate the number of people in each region.
- Talk about the results of the students' choices and the number of people in each region. If there was a region that no one choose, ask for a volunteer that would change to that region. Then the class will have at least one representative for each region.
- Provide time for each child to construct a house using similar materials as the ones that they choose for the Venn diagram.
- After everyone is finished remind them that in the story the big bad wolf blew the pigs' houses. Have each child estimate how far they think the big bad wolf could blow their house in three puffs. Ask children to write their estimate on the same piece of paper that they used in step 2.
- Have all of the children who choose the same region get together into groups.
- Allow time for each child to blow their house using only three puffs of air, and then measure the distance.
- When each group is finished help them compute the average distance for their region by adding all of their measurements together and then dividing that number by the number of people in their group.
- As a whole class have a representative from each group record their average result on the chalkboard.
- Discuss the results of each group and talk about the durability of each of the materials that were used.
- Have each child rank the scores in order of greatest to least on their own paper. Then have them write a paragraph about which houses traveled the longest distance and the shortest distance. In this description they need to include how much further the first house traveled than the second, and why they think it did.

Extension

Select two different versions of the three little pig stories to compare. After both stories have been read have children vote for their favorite. Illustrate the results in a two circle Venn diagram. Remember that the children can choose to vote for both stories, these votes would be placed in the intersecting region of the two circles. Then allow time for the students to write their own version of the three little pigs, changing the characters, setting, plot, etc. in any way that they choose.

Resources

Pigging out. (September/1996). Teaching Children Mathematics. Reston: VA: National Council of Teachers of Mathematics.

Galdone, P. (1970). The three little pigs. New York: Clarion.

Workshop 2

Workshop 2

I will begin workshop two by asking my participants to seat in the same groups that they formed at the end of workshop one (by similar grade levels). Then I will allow time for them to talk with their colleagues about the progress they have made on their individual goals. After about ten minutes I will ask for volunteers to share some ideas or lessons that have been successful in their classroom.

Next I will discuss the importance of numeration and number sense. I will explain that numbers should be an integral component of mathematics instruction in the primary grades. Numbers are used for various reasons such as to describe quantities, compare quantities, and measure. Developing number sense is crucial for students understanding of numerical information and relationships. I will ask my participants to write down their definition of numeration and number sense. Then I will ask for volunteers to share some of their own definitions, or examples of how they use this standard in their classroom. Next I will place an overhead of standard 6 (See Appendix H) on the projector and explain each of goals that NCTM created for numeration and number sense.

At this time I will pass out an annotated bibliography of books that relate to standard 6 (See Workshop 2 Annotated Bibliography). I will also distribute the books that are included on the bibliography and allow time for the teachers to look through them and examine the bibliography in detail. Then I will present a lesson using one of the books from the bibliography, Frog and Toad are Friends, by Arnold Lobel. For this lesson I will distribute several different buttons to each teacher, one being the correct button (a large, thick, white, round button that has four holes). I will ask each

teacher to estimate how many buttons they think are in the bag and then count them (numeration.). Then as I read the story they will have to sort and classify their buttons (number sense), and try to figure out which button Toad has lost. Then I will have them pick a button and write a series of five or six descriptors. When everyone is done they will read their description a loud and have the other teachers try to guess what button they choose. (For a complete description of this lesson see Workshop 2 Lesson.)

The last part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. They will also reflect on the changes that they have incorporated in their own classroom thus far. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving numeration and number sense) that they will attempt to achieve before the scheduled date of workshop 3. Each of these goals needs to be related to the content of this workshop and attainable in one month.

Workshop 2 Agenda

- Discussion in small groups
- Importance of Numeration and Number Sense (Standard 6)

[Taken from NCTM Standards (1989)]

-Construct number meanings through real-world experiences and the use of physical materials.

-Understand our numeration system by relating counting, grouping, and place-value concepts.

-Develop number sense.

-Interpret the multiple uses of numbers encountered in the real world.

- Annotated bibliography
- Lesson-The Lost Button
- Professional goals and reflections

Workshop 2 Annotated Bibliography

Counting 1-10

Anno, M. (1982). Anno's counting house. New York: Philomel Books.
One by one, ten children move all of their possessions from their old house into their new house.

Archambault, J. (1989). Counting sheep. New York: Henry Holt.
A child begins to count other imaginative animals because she's tired of counting sheep to help her fall asleep.

Carle, E. (1968). 1, 2, 3 to the zoo. Cleveland, OH: World.
Each car on the train holds different zoo animals from one elephant to ten birds.

Crews, D. (1986). Ten black dots. New York: Greenwillow.
This counting book shows what black dots can make, one can make a sun, two can make fox's eyes, etc.

Hoban, T. (1985). 1, 2, 3. New York: Greenwillow.
Several familiar objects are counted such as shoes, fingers, and toes.

Lobel, A. (1983). A lost button. Frog and Toad are friends. New York: Harper.
Toad has lost his button and Frog tries to help him find it by using Toad's clues.

Large Numbers

Grover, M. (1995). Amazing and incredible counting stories. San Diego, CA: Browndeer.
A collection of hypothetical newspaper headlines that help introduce the concept of counting.

Modell, F. (1981). One zillion valentines. New York: Greenwillow.
Two boys, Marvin and Milton, decide to make valentines for everyone in their neighborhood.

Reiss, J. (1971). Numbers. Scarsdale, NY: Bradbury Press.
In this counting book various animals represent different numbers such as a starfish with five arms illustrates the number five.

Schwartz, D. (1985). How much is a million? New York: Lothrop, Lee, & Shepard.
Colorful pictures illustrate large numbers such as a million, a trillion, and a billion.

Workshop 2 Lesson

Objectives

Students will-

- Utilize reasoning and estimation skills
- Sort and classify buttons
- Count buttons

Materials

- The Lost Button
- A large quantity of buttons (black, white, large, small, thick, thin, square, round, two-hole, and four-hole).

The Lost Button (Synopsis)

Toad has lost his button and Frog tries to help him find it. While they are searching Frog finds several buttons, but each time Toad says “No, that is not my button. My button is ____.” Finally they decide to go home, and Toad finds his button on the floor.

Procedure

- Read The Lost Button aloud to the entire class.
- Divide children into pairs or groups of three.
- Distribute bags of buttons, one of which fits the description of Toad’s button (It is a large, thick, white, round button that has four holes).
- Have each student estimate how many buttons they think are in the bag. Then have them empty the bag and count to see who had the closest guess.
- Tell students to spread their buttons out onto their desk so that they can see all of them.
- Reread the story, stopping after each of Toad’s descriptions. Allow time for students to eliminate the buttons that could not belong to Toad.
- At the end only one button should remain. Ask volunteers to give one characteristic of their remaining button. Then have every group raise their button high in the air so you can check to see if they have the right one.

Extension

Have each student pick their favorite button without letting anyone else see it. Then have them write a series of five or six descriptions about their button. After everyone is finished they can take turns reading their descriptions for the class and having them try to guess what the mystery button looks like.

Resources

Hynes, M. (1995). IDEAS: NCTM standards-based instruction. Reston, VA: National Council of Teachers of Mathematics.

Lobel, A. (1983). The lost button. New York: Harper.

Workshop 3

Workshop 3

Workshop three will begin by having each participant draw a number. They will then find the other teachers with that same number, each group should have a representative from each grade level. They will then be allowed sufficient time to discuss various activities and lessons that they have experimented with in their classroom. My ultimate goal in having them switch groups is for my participants to realize that their ideas are not specific to only one grade level.

Next I will discuss the importance of whole number operations and whole number computations. These two standards, seven and eight, include the mathematical processes of addition, subtraction, multiplication, and division. These four methods should be illustrated as real-life problem solving skills, not isolated algorithms. Children need to understand the importance and the practical use of these strategies by making connections with their own experiences. I will ask my participants to write down their definition of whole number operations and computations. Then I will ask for volunteers to share their descriptors or definition of these standards. Next I will place an overhead of standards 7 and 8 (See Appendix I) on the projector and discuss each of the goals that NCTM created for these two standards.

Then I will hand out the corresponding annotated bibliography and several books that are included in the bibliography (See Workshop 3 Annotated Bibliography). I will allow time for my participants to review the materials and discuss the bibliography with their colleagues. Then I will present a lesson using one of the books from the bibliography, The Doorbell Rang, by Pat Hutchins to teach the

computational skill of division. For this lesson each teacher will be supplied with miniature chocolate chip cookies. Then as I read the story they will use their manipulatives to visually represent their thinking for every part of the story. The doorbell rings several times and the children in the story have to decide how they could share (divide) their cookies equally with their new guests. (For a complete description of this lesson see Workshop 3 Lesson.)

The last part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. They will also reflect on the changes that they have incorporated in their own classroom thus far. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving whole number operations and computations) that they will attempt to achieve before the scheduled date of workshop 4. Each of these goals needs to be related to the content of this workshop and attainable in one month.

Workshop 3 Agenda

- Discussion in small groups
- Importance of Whole Number Operations and Computations (Standards 7 and 8)

[Taken from NCTM Standards (1989)]

-Develop meaning for the operations by modeling and discussing a rich variety of problem situations.

-Relate the mathematical language and symbolism of operations to problem situations and informal language.

-Recognize that a wide variety of problem structures can be represented by a single operation.

-Develop operation sense.

-Model, explain, and develop reasonable proficiency with basic facts and algorithms.

-Use a wide variety of mental computation and estimation techniques.

-Use calculators in appropriate computational situations.

-Select and use computational techniques appropriate to specific problems and determine whether the results are reasonable.

- Annotated bibliography
- Lesson-The Doorbell Rang
- Professional goals and reflections

Workshop 3 Annotated Bibliography

Addition and Subtraction

Christelow, E. (1989). Five little monkeys jumping on the bed. New York: Clarion.

This book counts backwards as five little monkeys fall off of the bed one by one.

Gackenbach, D. (1983). A bag full of pups. New York: Ticknor & Fields. Mr. Mullins has to find homes for twelve pups, he gives them away one by one.

Owen, A. (1988). Annie's one to ten. New York: Alfred A. Knopf. The illustrations of this book show all of the different combinations of objects that can be grouped together to equal ten.

Walsh, E. (1991). Mouse count. San Diego, CA: Harcourt Brace Jovanovich.

Ten mice decide to outsmart a hungry snake.

Wells, A. Subtraction. (1996). Tarrytown, NY: Benchmark. Subtraction is introduced through the use of story problems.

Multiplication and Division

Anno, M. (1983). Anno's mysterious multiplying jar. New York: Philomel Books.

Easy text and colorful pictures introduce the mathematical concept of factorials.

Hutchins, P. (1986). The doorbell rang. New York: Greenwillow. Concept of division is presented each time the doorbell rings and the children have to decide how they can share their cookies equally with their new guests.

Mathews, L. (1978). Bunches and bunches of bunnies. New York: Dodd, Mead.

Through rhyming text and colorful pictures several busy bunnies demonstrate multiplication facts from 1×1 to 12×12 .

Pinczes, E. (1993). One hundred hungry ants. Boston, MA: Houghton Mifflin.

One hundred hungry ants march toward a picnic, but stop several times to change their line formation, illustrating various divisions of one hundred.

Pinczes, E. (1995). A remainder of one. Boston, MA: Houghton Mifflin. The queen bug demands that her army march in even lines so they change formations.

Workshop 3 Lesson

Objectives

Students will-

- Make a connection between mathematical skill of division to real-life skill of sharing.
- Use manipulatives to visually represent thinking processes.

Materials

- The Doorbell Rang by Pat Hutchins
- Manipulatives (Miniature Chocolate Chip Cookies)
- Paper
- Pencil

The Doorbell Rang

Sam and Victoria's mother bakes them twelve cookies-six for each of them.

However, the doorbell continues to ring, bringing more and more guests. Each time Sam and Victoria have to decide how they can share their cookies equally. At the end grandma rings the doorbell, however she has a whole plate of cookies.

Procedure

- Introduce the activity and show students the book The Doorbell Rang.
- Supply each student with manipulatives (cookies), paper, and pencil. Encourage students to visually illustrate their thinking processes as they solve the problems.
- Read the first page of the book and ask students to determine how many cookies there are total, and how many cookies Sam and Victoria can each have. Then have them check their answer as page two is read.
- Read the third and fourth pages of the book and allow time for students to compute how many cookies each child can eat after the two neighbor kids arrive. Check answer as page five is read.
- Read the sixth and seventh pages and find out how many cookies each child can have now if they are shared equally with the guests. Check answer on page eight.
- Read pages nine, ten, and eleven. Then have the students decide how the cookies should be divided now. Check answer on page twelve.
- Read the next three pages and ask the students: "If twelve more kids are at the door what would we do?"
- Read the final three pages.
- Ask the question: "If grandma has five dozen cookies on her tray, how many more cookies will each of the twelve children receive."

Resources

Griffiths, R., & Clyne, M. (1991). Books you can count on. Portsmouth, NH: Heinemann.

Hutchins, P. (1986). The doorbell rang. New York: Greenwillow.

Workshop 4

Workshop 4

Workshop four will begin by having each teacher share an anecdote about a book that they have used in their classroom. I will ask each teacher to give us the title of the book, the standard(s) to which it relates, and their students' response to the book. After the teacher has had time to share his/her story the other teachers will be allowed to ask questions or offer any suggestions that they may have.

Next I will discuss the importance of geometry and spatial sense. Many children have had experience with geometry through shapes and blocks before they even enter school. This exploration should be continued and encouraged in all mathematical programs, regardless of age. These kinds of explorations help students in understanding the practical, real-life application of both geometry and spatial sense. Most people utilize their spatial ability on a daily basis when figuring quantities for projects like wallpapering, painting, carpeting, or sewing. I will ask my participants to write down their definition of geometry and spatial sense. Then I will ask for volunteers to share their definition of this standard. Next I will place an overhead of standard 9 (See Appendix J) on the projector and discuss each of goals that NCTM established for this standard.

Next I will distribute the annotated bibliography (See Workshop 4 Annotated Bibliography) and the books that are included in the bibliography. I will allow time for the teachers to view the books and discuss the bibliography with their colleagues. Then I will present a lesson using the poem "Shapes" from the book A Light in the Attic, by Shel Silverstein. I will read the poem aloud to the teachers and then I will distribute attribute blocks to each teacher. I will call the shapes (square, circle,

triangle, and rectangle) aloud and ask my participants to hold the shape high into the air. This step will allow me to see if everyone understands shapes (geometry) and to see if everyone has the necessary materials. As I reread the poem I will ask my participants to arrange the blocks according to what they hear as I read the poem (spatial sense). After I'm done reading I will have them draw their creation on a piece of paper that will be shared with the rest of the class. (For a complete description of this lesson see Workshop 4 Lesson.)

The last part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. They will also reflect on the changes that they have incorporated in their own classroom thus far. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving geometry and spatial sense) that they will attempt to achieve before the scheduled date of workshop 5. Each of these goals needs to be related to the content of this workshop and attainable in one month.

Workshop 4 Agenda

- Discussion in small groups
- Importance of Geometry and Spatial Sense (Standard 9)

[Taken from NCTM Standards (1989)]

-Describe, model, draw, and classify shapes.

-Investigate and predict the results of combining, subdividing, and changing shapes.

-Develop spatial sense.

-Relate geometric ideas to number and measurement ideas.

-Recognize and appreciate geometry in their world.

- Annotated bibliography
- Lesson-Shapes Art
- Professional goals and reflections

Workshop 4 Annotated Bibliography

Anno, M. (1979). Anno's medieval world. New York: W. Collins.
A journey through the medieval ages explains how threatened the people of this age felt with new scientific thought.

Bulloch, I. (1997). Shapes. Chicago, IL: World Book.
This book illustrates two-dimensional and three-dimensional objects.

Ehlert, L. (1990). Color farm. New York: Lippincott.
Various farm animals are made of colorful shapes such as circles, squares, triangles, and rectangles.

Emberley, E. (1961). The wing on a flea; a book about shapes. Boston, MA: Little, Brown.
This book contains pictures that show how different shapes look when found in familiar objects like a ferris wheel or a box.

Froman, R. (1975). Angles are easy as pie. New York: Crowell.
Angles of different shapes such as triangles, quadrangles, polygons, and circles are illustrated.

Grifalconi, A. (1986). The village of round and square houses. Boston, MA: Little, Brown.
A grandmother explains why the men in a village live in square houses, and the women live in round houses.

Grover, M. (1996). Circles and squares everywhere. San Diego, CA: Harcourt Brace.
Geometric shapes are introduced through simple objects such as boxes, tires, and windows.

Rogers, P. (1989). The shapes game. New York: Henry Holt.
Colorful illustrations and rhyming text are used to introduce circles, triangles, squares, rectangles, ovals, spirals, crescents, diamonds, and stars.

Silverstein, S. (1981). Shapes. A light in the attic. New York: Harper & Row. This book is a collection of poems.

Sitomer, M. (1971). Circles. New York: Crowell.
Simple experiments show the characteristics of a circle.

Snape, J., & Snape, C. The boy with square eyes. New York: Prentice-Hall.
Charlie watches so much TV that his eyes become the shapes of squares, and everything appears to be the shape of a square.

Workshop 4 Lesson

Objectives

Students will-

- Recognize, draw, and describe geometric figures.
- Interpret positional words and understand what they mean.

Materials

- A Light in the Attic
- Attribute blocks (squares, rectangles, triangles, and circles).
- Overhead of page 77 from A Light in the Attic
- Overhead projector
- Paper
- Pencil

Shapes (Synopsis)

A square was sitting quietly
 Outside his rectangular shack
 When a triangle came down-kerplunk!-
 And struck him in the back.
 "I must go to the hospital,"
 Cried the wounded square,
 So a passing rolling circle
 Picked him up and took him there.

Procedure

- Read the entire poem aloud.
- Distribute attribute blocks to each student (make sure that each student had at least one of every shape).
- Reread the poem and ask the students to arrange the blocks in a picture according to what they hear in the poem.
- Give each student a blank piece of paper so they can draw their formation of shapes onto the paper.
- When everyone is done place the transparency of page 77 on the overhead projector.
- Have students compare their illustration with Shel Silversteins illustration.
- Ask students to write answers to the following questions.
 1. "Why do you think the illustration in the book looks like yours?"
 2. "How are they different?"
 3. "What part of the poem is missing in Silverstein's illustration?"
 4. "Why do you think he chose not to include it?"
 5. Allow time for students to share their illustrations with the class and verbally answer some of the above questions.

Extension

Supply students with several attribute shapes and ask them to write their own poem about shapes. Then have them switch papers with another student so that he/she can illustrate the poem. All of the poems can be bound into a class book.

Resources

Hynes, M. (1995). IDEAS: NCTM standards-based instruction. Reston, VA: NCTM.

Silverstein, S. (1981). Shapes. A light in the attic. New York: Harper & Row.

Workshop 5

Workshop 5

I will begin workshop five by asking my participants to sit in their grade-level groups. Then I will allow time for them to talk with their colleagues about the progress they have made on their individual goals. After about ten minutes I will ask for volunteers to share some ideas or suggestions that have been successful in their classroom over the past month.

Next I will discuss the importance of measurement. I will explain how children learn measurement most effectively through hands-on practice. Measuring is a skill that is used often in everyday life. All children need to practice and become familiar with using measuring tools such as rulers, scales, thermometers, clocks, etc. I will ask my participants to write down their definition of measurement. Then I will ask for volunteers to share some of their own definitions, or examples of how they would teach this standard in their own classroom. Next I will place an overhead of standard 10 (See Appendix K) on the projector and explain the goals that NCTM created for measurement.

At this time I will pass out an annotated bibliography of books that relate to standard 10 (See Workshop 5 Annotated Bibliography). I will also distribute the books that are listed on the bibliography so that the teachers can examine them with their colleagues. Then I will present a lesson using one of the books from the bibliography, Who Sank the Boat?, by Pamela Allen. This book explains the concept of capacity as several animals try to get into a boat that eventually capsizes because of the total weight. For this lesson I will read the story aloud to the teachers. Then I will divide them into small groups of three or four members per group. I will provide

each group with a container of water, a boat, and a variety of materials. Each group will choose five materials (of varying weight and size) and use those materials to test the capacity of their boat (measurement). They will have the opportunity to perform several trials of putting the same five materials into the boat, but in a different order each time. (For a complete description of this lesson see Workshop 5 Lesson.)

The last part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. They will also reflect on the changes that they have incorporated in their own classroom thus far. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving measurement) that they will attempt to achieve before the scheduled date of workshop 6. Each of these goals needs to be related to the content of this workshop and attainable in one month.

Workshop 5 Agenda

- Discussion in small groups
- Importance of Measurement (Standard 10)

[Taken from NCTM Standards (1989)]

-Understand the attributes of length, capacity, weight, mass, area, volume, time, temperature, and angle.

-Develop the process of measuring and concepts related to units of measurement.

-Make and use estimates of measurement

-Make and use measurements in problem and everyday situations.

- Annotated bibliography
- Lesson-Who Sank the Boat?
- Professional goals and reflections

Workshop 5 Annotated Bibliography

Linear

Bulloch, I. (1994). Measure. New York: Thompson Learning.
This book demonstrates simple measuring techniques such as estimating, counting, and sorting.

Hightower, S. (1997). Twelve snails to one lizard: a tale of mischief and measurement. New York: Simon & Schuster.
The concepts on inches, feet, and yards are explained as Bubba the bullfrog helps Milo the beaver build a dam.

Myler, R. (1990). How big is a foot?. New York: Dell.
An apprentice discovers a more accurate method of measuring size after he is thrown in jail for making a bed for the Queen that was too small.

Time

Carle, E. (1977). The grouchy ladybug. New York: Tomas Y. Crowell.
A very grouchy ladybug illustrates the concept time in one day of her life.

Pluckrose, H. (1995). Time. Chicago, IL: Children's Press.
This book teaches time and mathematics in a child's world.

Money

Schwartz, D. (1989). If you made a million. New York: Lothrop, Lee, & Shepard.
Explains the various forms of money, coins, paper money, checks, etc.

Viorst, J. (1978). Alexander, who used to be rich last Sunday. New York: Atheneum.
Although Alexander has lost almost all of his money, he discovers that many things can be done with only one dollar.

Mass, Weight, and Volume

Allen, P. (1990). Who sank the boat?. White Plains, NY: Putnam
Five animal friends decide to go for a row in the bay, but every time someone gets in the boat it almost capsizes.

Walpole, B. (1995). Size. Milwaukee, WI: Gareth Stevens.
This book illustrates the elements of size such as height, weight, area, volume and mass.

Workshop 5 Lesson

Objectives

Students will-

1. Understand that the sum of weights affect capacity, not individual weights.
2. Learn the difference between weight and mass.

Materials

- Who Sank the Boat?
- Variety of objects to be used as boats
- Containers filled with water
- Various items of different sizes and weight
(Examples: corks, nails, bottle caps, rocks, etc.)
- Paper and Pencil

Who Sank the Boat? (Synopsis)

Five animal friends (a cow, a donkey, a sheep, a pig, and a tiny mouse) decide to go for a row in the bay. The animals get into the boat one at a time and each time the boat almost capsizes. The mouse is last to get in and finally sinks the boat.

Procedure

- Before reading the story introduce the five animal characters and ask the class for their prediction of who will sink the boat and why.
- Read the book aloud to the class. As the story is read draw attention to the change of water-line as the animals get into the boat. Also discuss where the animals are sitting and how their positions maintain balance.
- After the story discuss why the mouse sank the boat, ask children to explain their own theory to the class.
- Divide the class into small groups. Provide each group with a container of water, an object that can be used as a boat, and a variety of materials to choose from to use as passengers.
- Ask each group to choose five materials (to match the five animals in the story) that they would like to use to test their boat capacity. Encourage them to choose a materials that vary in shape and size (as the animals did).
- Allow time for the students to test their materials by placing them in the boat. Each time they should try to a different order and record their results.
- Come back together as a whole class and ask each group to report their results. Then go back to the book and relate the findings to the story. Some may still not understand that the mouse sank the boat because he was the last one in, and it is the sum of all of weights of all of animals that sank the boat (The boat has a certain capacity and mouse caused the total weight to become too much for the boat to handle).

Extension

Give each group five objects (each group should receive the same five objects). Ask the group to weigh the objects, write down the total weight, and then place them in

the boat. Then give each group five additional items that are larger in size, but weigh the same as the first five objects. Have the students weigh the objects and then place them in the boat. Talk about the results and discuss the differences between mass and weight.

Resources

Allen, P. (1990). Who sank the boat? White Plains, NY: Putnam.

Griffiths, R. & Clyne, M. (1991). Books you can count on. Portsmouth, NH: Heinemann.

Workshop 6

Workshop 6

I will begin workshop six by asking my participants to pair themselves with another teacher, not a teacher from their same grade level. They will have about ten minutes to talk about their progress of their personal goals, and share ideas that they have used in their classroom. Then we will get back together as a whole group. Each person will present an idea that they learned from their partner and add their own suggestions or comments.

Next I will discuss the importance of probability and statistics. Statistics involves collecting, sorting, compiling, analyzing, and interpreting data. However, there is always some uncertainty with data, this is measured by the method of probability. Recent advances in technology have caused a great increase in statistical information. In order to be successful in today's society our children need to learn how to understand probability and statistical information. I will ask my participants to write down their definition of probability and statistics. Then I will ask for volunteers to share their definition of this standard. Next I will place an overhead of standard 11 (See Appendix L) on the projector and discuss each of the goals that NCTM created for this standard.

Then I will hand out the corresponding annotated bibliography (See Workshop 6 Annotated Bibliography) and several books that are included in the bibliography. I will allow time for my participants to review the materials and discuss the bibliography with their colleagues. Then I will present a lesson using one of the books from the bibliography, Six Dinner Sid, by Inga Moore. Sid is a cat that has convinced six different owners on six different streets that each of them are his

owner, therefore he receives six meals every night. I will read the book aloud to my participants. Then I will ask each of them to figure out how many meals Sid eats in one month (statistics). After they have shared their answer and strategies I will pose the question "If Sid averages forty-two meals of tuna fish a month, what is the probability (or chance) that he will be offered this meal by one of owners. (For a complete description of this lesson see Workshop 6 Lesson.)

The last part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. They will also reflect on the changes that they have incorporated in their own classroom thus far. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving probability and statistics) that they will attempt to achieve before the scheduled date of workshop 7. Each of these goals needs to be related to the content of this workshop and attainable in one month.

Workshop 6 Agenda

- Discussion in small groups
- Importance of Statistics and Probability (Standard 11)

[Taken from NCTM Standards (1989)]

-Collect, organize, and describe data

-Construct, read, and interpret displays of data.

-Formulate and solve problems that involve collecting and analyzing data.

-Explore concepts of chance.

- Annotated bibliography
- Lesson-Six Dinner Sid
- Professional goals and reflections

Workshop 6 Annotated Bibliography

Barrett, J. (1978). Cloudy with a chance of meatballs. New York: Atheneum.

This book illustrates the concept of probability through weather.

Cushman, J. (1991). Do you wanna bet?. New York: Clarion.
Two boys, Danny and Brian, learn about chance and probability in many everyday activities such as coin tosses, baseball statistics, playing cards, weather forecasts, etc.

Linn, C. (1972). Probability. New York: Crowell.
The theory of probability is explained through simple experiments with ordinary materials.

MacGregor, E. & Pantell, D. (1994). Miss Pickerell and the weather satellite. New York: McGraw-Hill.

Miss Pickerell has to make a trip to the weather satellite because it is not predicting the weather correctly.

Moore, I. (1991). Six dinner Sid. White Plains, NY: Simon & Schuster.
Sid, the cat, has convinced six different people that he/she is his owner. Therefore he can go to six different houses and eat six different meals every night.

Munsch, R. (1989). Moira's birthday. Toronto, Canada: Annick.
Moira's parents are expecting six of her friends to arrive for the birthday party, but Moira invited two hundred people.

Nozaki, A. (1985). Anno's hat tricks. New York: Philomel Books.
This book is an introduction to probability through three children, Tom, Hannah, and Shadowchild, as they perform hat tricks.

Rockwell, T. (1990). How to get fabulously rich. New York: Franklin Watts.
A young boy named Billy wins \$410,000 from the lottery and has to share it with his friends.

Sach, M. (1981). Fleet-footed Florence. Garden City, NY: Doubleday.
A famous baseball hero's daughter, Florence, becomes the fastest runner ever and sets so many records they can't find a book big enough to hold all of them.

Spohn, K. (1989). Clementine's winter wardrobe. New York: Orchard.
Clementine has many different possibilities of outfits that she can wear.

Srivastava, J. (1973). Statistics. New York: Thomas Y. Crowell.
Introduces the concept of statistics through counting.

Workshop 6 Lesson

Objectives

Students will-

1. Use various problem-solving strategies.
2. Learn how to predict the probability, or chance, that an event will occur.

Materials

- Six Dinner Sid
- Paper and Pencil

Six Dinner Sid (Synopsis)

Sid is a very clever cat that has convinced six different people on six different streets that each of them are his owner. Therefore he can go to six different houses every night to get six different meals.

Procedure

- Before reading the book ask the students how many of them have pets at home. Then ask them how many times a day they feed their pet (answers may vary). Tell them that you are going to read them a story about a cat that eats a lot of meals in one day and their job is to keep track of the number of meals that he eats a day.
- Read the story aloud to the class.
- After the story ask for volunteers to tell you how many meals Sid ate in one day. If there are several different answers go back into the story and have the children count the number of possible owners aloud with you.
- Pair the students and ask them to figure out how many meals Sid eats in one week. Before they can begin working make sure that everyone understands that Sid has six possible owners and that there are seven days in a week.
- Circulate around the room and listen to various strategies that are being used.
- Have each group present to the class how they solved the problem. (The purpose is for the students to realize that the problem can be solved using a variety of different methods.)
- Then present the question "If Sid averages forty-two meals of tuna fish a month, what is the probability (or chance) that this will be one of his meals."

Extension

Form twelve groups of students and give each group a different month of the year. Have each group figure out how many meals Sid if offered in that month. Then combine the group data to determine how many meals Sid could eat in a year.

Resources

Moore, I. (1991). Six dinner Sid. White Plains, NY: Simon & Schuster.

Sheffield, S. (1995). Math and literature (K-3). White Plains, NY: Math Solutions.

Workshop 7

Workshop 7

Workshop seven will begin with time for teachers to group themselves by grade level. They will have the first ten minutes to discuss their goals and share books that they have used. Then each group will have to choose one book that was mentioned in their group and describe it to the whole group.

Next I will discuss the importance of fractions and decimals. Many students have had some experience with fractions before they enter school because they are very common in every day life and language. However, most children talk about fractions without truly understanding what they mean. For example a child may say “My half is bigger than your half.” However, in order to have a fractional half both parts must be exactly the same size. Teachers should build on children’s previous experience and clarify misinterpretations with manipulatives that visually represent equal fractions. Decimals are also an important part of this standard because they make it possible to write fractions according to our place-value system. I will ask my participants to write down their definition of fractions and decimals. Then I will ask for volunteers to share some of their definitions, or examples of how they would use this standard in their classroom. Next I will place an overhead of standard 12 (See Appendix M) on the projector and explain each of the goals that NCTM formed for fractions and decimals.

At this time I will pass out an annotated bibliography of books that relate to standard 12. I will also distribute some of the books that are included on the bibliography and allow time for the teachers to look through them. Then I will present a lesson using one of the books from the bibliography, Fractions are Parts of

Things, by J. Richard Dennis. For this lesson I will read the book aloud to my participants. Then I will divide the teachers into groups of five. I will give each group an apple that has been divided into five unequal pieces, and tell them to distribute the pieces so that each group member receives a slice. I will ask a series of questions about the pieces of the apple. Then they will use Hershey chocolate bars to distribute equal pieces to each group member (fractions) and write the fractions in decimal form (decimals). (For a complete description of this lesson see Workshop 7 Lesson.)

The last part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. They will also reflect on the changes that they have incorporated in their own classroom thus far. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving fractions and decimals) that they will attempt to achieve before the scheduled date of workshop 8. Each of these goals needs to be related to the content of this workshop and attainable in one month.

Workshop 7 Agenda

- Discussion in small groups
- Importance of Fractions and Decimals (Standard 12)

[Taken from NCTM Standards (1989)]

-Develop concepts of fractions, mixed numbers, and decimals.

-Develop number sense for fractions and decimals.

-Use models to relate fractions to decimals and to find equivalent fractions.

-Apply fractions and decimals to problem situations.

- Annotated bibliography
- Lesson-Fractions Are Parts of Things
- Professional goals and reflections

Workshop 7 Annotated Bibliography

Fractions

Dennis, J. (1971). Fractions are parts of things. New York: Crowell. Illustrations and activities explain simple fractions such as halves, thirds, and fourths.

Froman, R. (1975). Angles are easy as pie. New York: Crowell. This book explains the relationship between angles and shapes such as triangles, quadrangles, circles, and polygons.

Leedy, L. (1994). Fraction action. New York: Holiday House. Miss Prime and her animal students investigate fractions in the world around them.

Mathews, L. (1979). Gator pie. New York: Dodd, Mead. Two alligators want to share a pie so they consider dividing it into halves, thirds, fourths, etc.

McMillan, B. (1991). Eating fractions. New York: Scholastic. Various kinds of foods are illustrated in halves, thirds, and fourths to show how they make a whole piece.

Stienecker, D. (1996). Fractions. Tarrytown, NY: Benchmark Books. This book explains a variety of activities that can help teach fractions.

Decimals

Conford, E. (1988). A job for Jenny Archer. Boston, MA: Little, Brown. Jenny Archer uses decimals when she decides to make money by selling her house.

Dumleton, M. (1991). Dial-a-croc. New York: Orchard Books. Vanessa makes a lot of money by having a crocodile work for her.

Hoban, L. (1981). Arthur's funny money. New York, NY: Harper & Row. Violet has a number problem and Arthur doesn't have any money so they go into business together to solve both of their problems.

Maestro, B. (1988). Dollars and cents for Harriet. New York: Crown. Harriet learns about the value of coins when she saves five dollars to buy a new kite.

McNamara, L. (1972). Henry's pennies. New York: Franklin Watts. Henry is a little boy who likes to collect pennies. Then one day he decides to use his pennies to buy a new pet.

Workshop 7 Lesson

Objectives

Students will-

- Learn about simple fractions (halves, thirds, and fourths)
- Understand the differences between parts and fractional parts of a whole object.
- Write fractions in decimal form.

Materials

- Fractions Are Parts of Things
- Apples
- Hershey chocolate bars
- Paper and Pencil

Fractions Are Parts of Things (Synopsis)

This book uses illustrations and activities to explain simple fractions such as halves, thirds, and fourths.

Procedure

- Read the book out loud to the class and discuss the concept of fractions being parts of things. As you read stop at points in the book and ask your students to find objects in the room that represent the fractions that are illustrated.
- After the story divide your students into groups of five.
- Give each group an apple that has been divided into five unequal pieces and tell them to distribute the pieces to each group member.
- Ask the following questions:
 1. "Do the five fractional parts of the apple make a whole apple?"
 2. "Did every group member get one of the five pieces?"
 3. "Is everyone satisfied with the piece that they received."
- Discuss the concept of parts and equal parts. Tell your students that the parts need to be equal in order to be considered fractions of the whole.
- Give each group a Hershey bar and have them divide it equally between the five group members.
- Ask for a volunteer to tell which piece of food was easier to divide equally, the apple or the candy bar. Why? (The candy bar is already divided into equal parts).

Extension

Have the students practice forming different fractions with the pieces of chocolate. Then ask them to draw the pieces of chocolate that represent the specific fraction on their paper, and write the decimal form of the fraction next to the illustration.

Resources

Dennis, J. (1971). Fractions are parts of things. New York: Crowell.

Braddon, K., Hall, N. & Taylor, D. (1993). Math through children's literature. Englewood, CO: Teacher IDEAS Press.

Workshop 8

Workshop 8

This workshop will begin with ten to fifteen minutes of brainstorming time. Each grade-level group of teachers will need to make a list of several books that they have found beneficial or books that they would like to try in their classroom. Then they each need to choose one of these books from the list that they would like to present to the entire class during the concluding workshop.

Next I will discuss the importance of patterns and relationships. Patterns are the basic understanding of all concepts of math and the ability to recognize patterns is very important in understanding mathematics. Our number system is formed by the structure of patterns. Searching for patterns in numbers is essential in finding relationships, understanding logic, and making predictions in mathematics. I will ask my participants to write down their definition of patterns and relationships. Then I will ask for volunteers to share some of their ideas. Next I will place an overhead of standard 12 (See Appendix M) on the projector and explain each of the goals that NCTM created for patterns and relationships.

At this time I will pass out an annotated bibliography of books that correspond with standard 12 (See Workshop 12 Annotated Bibliography). I will also distribute the books that are listed on the bibliography so that my participants can examine in closer detail. Then I will present a lesson using one of the books from the bibliography, Sam Johnson and the Blue Ribbon Quilt, by Lisa Ernst. For this lesson I will display several different quilt patterns and have my participants vote for the one that they like the best (patterns). Then each teacher will use the chosen pattern to create a piece of our group quilt (relationships) on graph paper. They can use any

color combination, but they must use the correct pattern. Then they will examine a hundreds chart to find visual patterns in numbers as well as shapes. (For a complete description of this lesson see Workshop 8 Lesson.)

The next part of my workshop will involve time for the teachers to group by grade level to reflect on the information presented and discuss how they might integrate some of these new ideas into their existing mathematics curriculum. They will also reflect on the changes that they have incorporated in their own classroom thus far. After each of the groups have had time to collaborate I will ask each teacher to write down two personal professional goals (involving patterns and relationships) that they will attempt to achieve before the scheduled date of workshop 9. Each of these goals needs to be related to the content of this workshop and attainable in one month.

In conclusion I will offer another ten to fifteen minutes for the teachers to work on their presentation. I will remind them that their lesson must include a children's book. This book can be from one of the bibliographies that I have provided, but it cannot be a book that I have used to present a lesson.

Workshop 8 Agenda

- Discussion in small groups
- Importance of Patterns and Relationships (Standard 13)

[Taken from NCTM Standards (1989)]

-Recognize, describe, extend, and create a wide variety of patterns.

-Represent and describe mathematical relationships

-Explore the use of variables and open sentences to express relationships.

- Annotated bibliography
- Lesson-Sam Johnson and the Blue Ribbon Quilt
- Professional goals and reflections

Workshop 8 Annotated Bibliography

Bayer, J. (1984). A my name is Alice. New York, NY: Dial Books.
This is an alphabet book that has a rhyme for each letter.

Bulloch, I. (1997). Patterns. Chicago, IL: World Book.
This book teaches the skills of pattern recognition, sorting, and matching.

Charosh, M. (1974). Number ideas through pictures. New York: Crowell.
This book explains simple concepts like odd and even numbers, triangular numbers, and square numbers.

Emberly, B. (1967). Drummer Hoff. Englewood Cliffs, NJ: Prentice-Hall.
This is a cumulative folk song about seven soldiers building a cannon.

Ernst, L. (1983). Sam Johnson and the blue ribbon quilt. New York: Lothrop, Lee & Shepard Books.
Sam discovers a love for the art of quilting.

Friedman, A. (1994). A cloak for the dreamer. New York: Scholastic.
This story shows how tailors fit geometric shapes together.

Hutchins, P. (1976). Don't forget the bacon!. New York: Greenwillow Books.
A little boy tries really hard to remember his mothers instructions as he goes to the grocery store.

Kellogg, S. (1971). Can I keep him? New York: Dial Press.
Arnold brings home several pets and his mother says no to every one except the last one.

Martin, B. (1983). Brown bear, brown bear, what do you see?. New York: Holt, Rinehart, and Winton.
Each page is an animal that is a different color.

Rinkoff, B. (1971). The case of the stolen code book. New York: Crown.
Bob, a new kid, uses clues and codes to impress the members of the Secret Agents club so that he can become a member.

Shaw, C. (1994). It looked like spilt milk. New York, NY: HarperCollins.
Text and illustrations are used to show different shapes of clouds.

Zolotow, C. (1969). Some things go together. New York: Abelard-Schumam.
Illustrations and rhymes describe things that go together to form relationships.

Workshop 8 Lesson

Objectives

Students will:

- Create a paper quilt by connecting multiple copies of the same pattern.
- Recognize that patterns occur in numbers as well as shapes.

Materials

- Quilt patterns
- Graph paper
- Markers or colored pencils
- Hundreds charts
- Tape
- Markers
- Paper and pencil

Sam Johnson and the Blue Ribbon Quilt (Synopsis)

Sam Johnson is a farmer that decides to learn how to quilt while his wife is away. After she returns Sam tries to join her quilting club, but the women laugh at him. Sam creates the Rosedale Men's quilting club and both groups compete for the prize at the county fair. After problems arise for both clubs they end up working together to create a winning design.

Procedure

- Talk about different patterns in quilting and show examples of various patterns.
- Decide on one specific pattern by having the students vote for various choices.
- Tell the class that they are going to work together to create one enormous quilt, made out of paper, to hang on our classroom wall.
- Explain that the quilt needs to be made by using the same pattern, but tell them that the patterns can be different colors.
- Distribute graph paper and place a transparency of the pattern that the class chose as their favorite on the overhead.
- Allow time for the students to make their patterns. Encourage them to be colorful and accurate in their drawing.
- After everyone is finished connect the pieces of paper by taping them together and hanging the large quilt on the classroom wall.

Extension

Discuss the use of patterns. Explain that numbers can also make visual patterns, just like the shapes in the quilt. Pass out markers and a hundreds chart to each student. Have the students use the markers to cover all the numbers on their chart that contain a 4. Then have them try covering all of the two-digit numbers that contain the same number (11, 22, 33, etc.). Let them experiment and make conjectures. Then as a large group make a list of the patterns that they discovered from their hundreds chart.

Resources

Ernst, L. (1983). Sam Johnson and the blue ribbon quilt. New York: Lothrop, Lee & Shepard.

Braddon, K., Hall, N. & Taylor, D. (1993). Math through children's literature: making the NCTM standards come alive. Englewood, CO: Teacher IDEAS Press.

Workshop 9

Workshop 9

I will begin workshop nine by asking each teacher to share the progress that they have made in achieving their personal goals over the past several months. It will be time for them to share instructional changes, ideas, suggestions, and criticism about integrating children's literature and mathematics in the early childhood classroom.

Then each teacher will have time to present a lesson for a book of their choice. They will teach the lesson as if their colleagues were their own students. After each teacher has presented an informal question/answer session will follow.

In conclusion I will thank them for participating in the series of workshops. I will also offer several general suggestions for them to think about in their continuing their progress of integrating these two content areas (See Appendix O).

Conclusion

Mathematics has traditionally been a subject mastered by few. "No one wants to admit being unable to read, but it has been socially acceptable to admit mathematical illiteracy." (Thiessen & Matthias, 1992). This belief must change in order to produce competent, productive citizens for the next millennium. The National Council of Teachers of Mathematics created a set of standards that insist on reforming the mathematics curriculums across the nation. These curriculums can be reformed through the use of several different methods. However, one of the most effective, yet untapped resources available to teachers, is the integration of children's literature and mathematics. NCTM urged that we "capitalize on the inherent relationships between reading and mathematics in order to provide a more effective approach to our mutual problems of providing students with the skills that they must have in order to survive the computer age." (Dupuis & Merchant, 1984, p.74).

Through this project six benefits of integrating children's literature and mathematics have been identified and explained. First, children's literature has an aesthetic and universal appeal. Second, it provides a meaningful context and illustrates real-life application of mathematics. Third, literature easily integrates mathematics into other curriculum areas. Fourth, the familiarity of a book or story provides a structure in which children will enjoy exploring mathematics. Fifth, literature can relieve "math anxiety" and provide a non-threatening experience toward mathematics, and last it can enhance motivation toward mathematics and reading. An ample list of quality children's books, along with a sample lesson to use with each of the thirteen standards has also been provided. The information supplied through this

project should be an excellent resource for early childhood teachers that are willing to make instructional changes in their classrooms. The following is a guide containing four general suggestions for teachers to keep in mind when integrating children's literature and mathematics in their own classrooms.

First, enjoy the story! Don't always force mathematics by interrupting the story with mathematical questions as it is read aloud. Some stories may lend to asking questions while reading. However, most stories will lose their aesthetic appeal if they are disconnected by questioning when being read aloud. Mathematically rich books will elicit responses from students. Waiting until the story is completed will allow students to make connections and share their own observations. It is also important to keep the activity open-ended and encourage multiple responses. Children need to understand that math is not a predetermined set of questions that have one exact answer.

Second, always read the book aloud at least once if not several times. Listening to the story can relieve the stress of reading and allow students to focus on the content of the story. Repeated readings will cause students to attain multiple interpretations and extract more details from the story. The more times that a child reads or listens to a book the more familiar they will become with the characters, setting, plot, events, and conclusion. Understanding these key elements of the story will help the students with their reading skills, their comprehension of the text, and will also help them focus on the mathematical aspect of the story.

Third, teachers should choose books that are interesting to both themselves, and their students. Almost any book can become a springboard for a mathematical

activity, even if it doesn't contain numbers within the text. Teachers can take some of their students' favorite books and think about how they could use those books to teach a specific mathematical concept. This task can be very challenging, but also very rewarding because the interest level of the students will be high. Teachers should also use their own judgement when deciding what books would be appropriate in their classroom, not a predetermined grade-level index. Picture books can be a great resource for any age, and sections of more difficult books may be appropriate for younger children.

The last, and most important suggestion, is to integrate literature into themes when planning the curriculum. A holistic theme will help students make connections. Learning consists of searching for connections that can be made between the known and the new (Bosma & Guth, 1995). Children's literature can be the thread that ties all of the content areas together and gives meaning to the subject.

The two major components of any elementary curriculum are reading and mathematics. "Even a cursory examination of the historical development of these disciplines reveals an extraordinary number of examples that, if shared, could enhance the effectiveness of both groups." (Russell & Dunlap, 1977, p.10). Children's literature provides an authentic learning experience and promotes real-life application of mathematics. Bernice Cullinan proposes an insightful equation in her book, Fact and Fiction: Literature Across the Curriculum, that summarizes this entire project "Math + Literature = Success." (p. 59)

This paper has specifically described a project that consists of nine workshops for early childhood educators. However, there are possibilities for similar workshops.

It is highly recommended that the same format be used to inservice upper elementary, fourth-grade through sixth-grade, teachers about the integration of children's literature and mathematics. Many of the standards for the upper grades overlap with those formed for the early childhood standards. Therefore this project could be a very valuable resource in creating another project about this topic. Many of the same books and lessons from this project could also be applicable if modified for older students reading skills and critical-thinking abilities.

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Appendix A

Table 4

A sample schedule for project

Integration of Children's Literature and Mathematics

In the Early Childhood Classroom

Jamie M. Christensen

Session	Topic	Time
One	Problem Solving, Communication, Reasoning, Connections, and Estimation	90 minutes
Two	Number Sense and Numeration	60 minutes
Three	Whole Number Operations and Computations	60 minutes
Four	Geometry and Spatial Sense	60 minutes
Five	Measurement	60 minutes
Six	Statistics and Probability	60 minutes
Seven	Fractions and Decimals	60 minutes
Eight	Patterns and Relationships	60 minutes
Nine	Conclusions and Recommendations	90 minutes

Appendix B

1. Mathematics as Problem Solving (Standard 1)

[Taken from NCTM Standards (1989)]

- Use problem-solving approaches to investigate and understand mathematical content.
- Formulate problems from everyday and mathematical situations.
- Develop and apply strategies to solve a wide variety of problems.
- Acquire confidence in using mathematics meaningfully.

Appendix C

2. Mathematics as Communication (Standard 2)

[Taken from NCTM Standards (1989)]

- Relate physical materials, pictures, and diagrams to mathematical ideas.
- Reflect on and clarify thinking about mathematical ideas and situations.
- Relate everyday language to mathematical language and symbols.
- Realize that representing, discussing, reading, writing, and listening to mathematics are a vital part of learning and using mathematics.

Appendix D

3. Mathematics as Reasoning (Standard 3)

[Taken from NCTM Standards (1989)]

- Draw logical conclusions about mathematics.
- Use models, known facts, properties, and relationships to explain their thinking.
- Justify their answers and solution processes.
- Use patterns and relationships to analyze mathematical situations.
- Believe that mathematics makes sense.

Appendix E

4. Mathematical Connections (Standard 4)

[Taken from NCTM Standards (1989)]

- Relate various representations of concepts or procedures to one another.
- Recognize relationships among different topics in mathematics
- Use mathematics in other curriculum areas.
- Use mathematics in daily life.

Appendix F

5. Estimation (Standard 5)

[Taken from NCTM Standards (1989)]

- Explore estimation strategies.
- Recognize when an estimate is appropriate.
- Determine the reasonableness of results.
- Apply estimation in working with quantities, measurement, computation, and problem-solving.

Appendix G

Benefits of Integrating

Children's Literature and Mathematics

1. Literature has an aesthetic and universal appeal to both adults and children.
2. Literature provides a meaningful context and illustrates real-life application of mathematics.
3. Literature easily integrates mathematics into other curriculum areas.
4. The familiarity of a book or story provides a structure which children will enjoy exploring mathematics.
5. Literature can relieve “math anxiety” and provide a non-threatening experience.
6. Literature can enhance motivation toward mathematics and reading.

Appendix H

6. Numeration and Number Sense (Standard 6)

[Taken from NCTM Standards (1989)]

- Construct number meanings through real-world experiences and the use of physical materials.
- Understand our numeration system by relating counting, grouping, and place-value concepts.
- Develop number sense.
- Interpret the multiple uses of numbers encountered in the real world.

Appendix I

7. Whole Number Operations (Standard 7)

8. Whole Number Computations (Standard 8)

[Taken from NCTM Standards (1989)]

- Develop meaning for the operations by modeling and discussing a rich variety of problem situations.
- Relate the mathematical language and symbolism of operations to problem situations and informal language.
- Recognize that a wide variety of problem structures can be represented by a single operation.
- Develop operation sense.
- Model, explain, and develop reasonable proficiency with basic facts and algorithms.
- Use a wide variety of mental computation and estimation techniques.

- Use calculators in appropriate situations.
- Select and use computational techniques appropriate to specific problems and determine whether the results are reasonable.

Appendix J

9. Importance of Geometry and Spatial Sense

(Standard 9)

[Taken from NCTM Standards (1989)]

- Describe, model, draw, and classify shapes.
- Investigate and predict the results of combining, subdividing, and changing shapes.
- Develop spatial sense.
- Relate geometric ideas to number and measurement ideas.
- Recognize and appreciate geometry in their world.

Appendix K

10. Importance of Measurement (Standard 10)

[Taken from NCTM Standards (1989)]

- Understand the attributes of length, capacity, weight, mass, area, volume, time, temperature, and angle.
- Develop the process of measuring and concepts related to units of measurement.
- Make and use estimates of measurement
- Make and use measurements in problem and everyday situations.

Appendix L

11. Importance of Statistics and Probability

(Standard 11)

[Taken from NCTM Standards (1989)]

- Collect, organize, and describe data
- Construct, read, and interpret displays of data.
- Formulate and solve problems that involve collecting and analyzing data.
- Explore concepts of chance.

Appendix M

12. Importance of Fractions and Decimals (Standard 12)

[Taken from NCTM Standards (1989)]

- Develop concepts of fractions, mixed numbers, and decimals.
- Develop number sense for fractions and decimals.
- Use models to relate fractions to decimals and to find equivalent fractions.
- Apply fractions and decimals to problem situations.

Appendix N

13. Importance of Patterns and Relationships

(Standard 13)

[Taken from NCTM Standards (1989)]

- Recognize, describe, extend, and create a wide variety of patterns.
- Represent and describe mathematical relationships
- Explore the use of variables and open sentences to express relationships.

Appendix O

Suggestions for Integrating Children's Literature and Mathematics

1. Enjoy the story! Don't always force mathematics by interrupting the story with mathematical questions as it is read aloud.
2. Always read the book aloud at least once if not several times. Repeated reading will cause students to attain multiple interpretations and extract more details from the story.
3. Choose books that are interesting to both you and your students. Almost any book can become a springboard for a mathematical activity, even if it doesn't contain numbers within the text.
4. Integrate literature into themes when planning the curriculum. A holistic theme will help students make more connections. Children's literature can be the thread that ties all of the content areas together and gives meaning to the subject.