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Integrating Writing to Enhance Mathematical
Skills at the Elementary Level

by

Kendra J. Kupp

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The recommendations of the National Council of Teachers of Mathematics and the Washington State Commission on Student Learning Essential Academic Requirements are addressed. The benefits of integrating mathematics and writing are studied. Integrated activities and materials for a first and second grade mathematics curriculum are developed. Recommendations for implementing the project are given.

CHAPTER ONE

BACKGROUND OF THE PROJECT

Introduction

The National Council of Teachers of Mathematics (NCTM) recommendations and the goals developed by the Washington State Commission on Student Learning are greatly impacting the way that mathematics is being taught in the state of Washington. The NCTM stresses that at the elementary level mathematics should include various opportunities for communication so that students can-

- relate physical materials, pictures and diagrams to mathematical ideas;
- reflect on and clarify their thinking about mathematical ideas and situations;
- relate their 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. (NCTM, 1989, P. 26)

Because writing is a key communication skill used too infrequently in mathematics, the NCTM stresses the

importance of making connections by addressing the curriculum standards as one integrated whole rather than as separate, independent content areas (NCTM, 1989).

Purpose of the Project

The purpose of this project is to integrate writing activities in an elementary mathematics curriculum. The project will focus on connecting the Essential Academic Learning Requirements (EALRs) for writing and math to meet state requirements.

Significance of the Project

According to Mendez and Taube (1997), writing in mathematics classes not only improves students' understanding of mathematics, but it helps instructors assess that understanding. Countryman (1992), believes that the use of writing in mathematics helps students reflect on and clarify their thinking about mathematical ideas and skills. Many experts agree that connecting writing with math not only enhances mathematical skills, but enables students to communicate and relate ideas about

their lives, and the world around them (Bell & Bell, 1985; NCTM, 1989; Pugalee, 1994).

Limitations of the Project

Although the research for this project focuses on the elementary levels, only first and second grade and their areas of content will be addressed in the project. The project also is limited to one area of communication, writing. Although it will include connections between the math and writing content areas of the EALRs, it will not contain all of the components for those areas.

Definition of Terms

The terms used in this project are to clarify the author's meaning.

Integration: To bring together as a whole. The inclusion of writing in the process of mathematics.

Math Journal: A journal used to record pictures, strategies and explanations of how math problems are solved.

Multiple Entry Log: A systematic way for students to record their thoughts and reflections on specific mathematical problems.

Story Problem: A math problem presented in written story form.

Overview of the Remainder of the Project

Chapter Two is a review of the current literature available regarding the integration of writing in mathematics. Chapter Three describes the procedures used to develop the project. Chapter Four consists of the project itself. It contains strategies for integrating writing into a mathematics curriculum. Chapter Five is a summary of the project by the author. The author's conclusions as well as personal recommendations on integration of writing into mathematics will also be addressed.

CHAPTER TWO
REVIEW OF LITERATURE

Introduction

According to the National Council of Teachers of Mathematics (NCTM, 1989), representing, talking, listening, writing, and reading are key communication skills that students need to practice, and they should play a significant role in any mathematics curriculum. The NCTM claims that writing has been overlooked far too often in mathematics, and that it is a useful tool which helps students express understanding. Bell and Bell (1985) agree that writing should be encouraged as an important part of the mathematics curriculum intended to assist students in understanding mathematical ideas.

The Commission on Student Learning(1994)states that writing is a "powerful tool that connects us to each other and empowers us to explain, create, discover, and communicate in the world around us" (p.31). Pugalee (1997) supports that view and believes the "power of writing as an instrument in the mathematical curriculum was realized during the 1980s as a part of the writing-across-the-curriculum movement" (p. 308).

The current reform in mathematics education calls for experiences that encourage and enable students to value mathematics, gain confidence in their own mathematical ability, become mathematical problem solvers, communicate mathematically, and reason mathematically. (Pugalee, 1997, p.308)

The NCTM, researchers and recognized educators agree that the integration of writing and mathematics can be a positive learning tool for students. Further evidence is supported in this chapter to justify the integration of the use of writing strategies in the instruction of mathematics in the following areas: NCTM recommendations, state requirements and components, the practice of using writing in mathematics, and assessment.

National Council of Teachers of Mathematics

The Curriculum and Evaluation Standards for School Mathematics specifically address mathematics as communication (NCTM, 1989). Recommendations include that students have opportunities to write mathematics. The NCTM stress that writing about a problem and how it was solved

builds a deeper understanding, and clarifies the students own thinking. The NCTM feels that writing and reading in mathematics involve children actively by helping them to explore, investigate, describe and explain mathematical ideas.

State Requirements and Components

The Washington State Commission on Student Learning has developed the Essential Academic Learning Requirements (EALRs) as part of a statewide educational reform in Washington state. The writing process is included in the requirements as an important part of teaching writing. According to Mendez and Taube (1997), "The steps of the writing process are similar to the steps in solving a mathematical problem" (p. 108). The following are a list of the Washington state requirements and components for writing and mathematics.

Writing

1) The student writes clearly and effectively.

To meet this standard the student will:

1.1 develop concept and design

1.2 use style appropriate to the audience and purpose

1.3 apply writing conventions

2) The student writes in a variety of forms for different audiences and purposes.

To meet this standard the student will:

2.1 write for different audiences

2.2 write for different purposes

2.3 write in a variety of forms

2.4 write for career applications

3) To meet this standard the student will:

3.1 prewrite

3.2 draft

3.3 revise

3.4 edit

3.5 publish

4) The student analyzes and evaluates the effectiveness of written work.

To meet this standard the student will:

4.1 assess own strengths and needs for improvement

4.2 seek and offer feedback

Mathematics

1) The student understands and applies the concepts and procedures of mathematics.

To meet this standard the student will:

1.1 understand and apply concepts and procedures from number sense

1.2 understand and apply concepts and procedures from measurement

1.3 understand and apply concepts and procedures from geometric sense

1.4 understand and apply concepts and procedures from probability and statistics

1.5 understand and apply concepts and procedure from algebraic sense

2) The student uses mathematics to define and solve problems.

To meet this standard the student will:

2.1 investigate situations

2.2 formulate questions and define the problem

2.3 construct solutions

3) The student uses mathematical reasoning.

To meet this standard the student will:

3.1 analyze information

3.2 predict results and make inferences

3.3 draw conclusions and verify results

4) The student communicates knowledge and understanding

in both everyday and mathematical language.

To meet this standard the student will:

4.1 Gather information

4.2 organize and interpret information

4.3 represent and share information

5) The student understands how mathematical ideas connect within mathematics, to other subject areas, and to real-life situations

To meet this standard the student will:

5.1 relate concepts and procedures within mathematics

5.2 relate mathematical concepts and procedures to other disciplines

5.3 relate mathematical concepts and procedures to real life situations (Comission on Student Learning, 1994,P.22)

The Practice of Using Writing in Mathematics

Countryman (1992) states that to understand mathematics is to accomplish mathematics. She feels that situations need to be constructed so that students can be active, creative, and responsive to the world they live in. Countryman believes that to learn mathematics, students

must build an understanding for it for themselves. She concludes that "They can only do that by exploring, justifying, representing, discussing, using, describing, investigating, predicting, in short by being active in the world. Writing is an ideal activity for such processes" (Countryman, 1992, p. 2).

Countryman (1992) advocates several strategies for integrating writing and mathematics. Some of those strategies include learning logs, which are personal accounts of the work done in class; freewrites, which include students' attitudes and feelings; finishing sentences, commenting on assignments, finding definitions, writing comparisons of different procedures, and autobiographies, and word problems.

Other researchers agree that writing practices help students' learning in mathematics. According to Powell (1997), writing activities such as multiple log entries help students reflect critically on their mathematical experiences, situations and questions that are personal and of their own choosing. A multiple log entry is defined by Powell as an activity where a piece of paper is divided into three equal columns. The left-hand column is used to write a story problem (this can be taken from a text, or

any other course material). In the middle column, students reflect on the problem by writing their thoughts about this problem and how to solve it. The right hand column is reserved for students to reflect again on their thoughts about the problem, and to revise, reconsider, or refine their previous reflections.

Helton (1995), feels that writing practical word problems can be helpful to students as early as first grade, because it helps them to understand the significance of mathematics. Pugalee (1997), concurs that math journals can be a wonderful method for developing dialogue between the student and teacher and can also create a comfortable environment for discussion and one on one instruction.

Powell (1997) agrees:

When students write about their feelings and thoughts concerning particular mathematical ideas, their prose offers a vehicle for us and for them to examine, reflect deeply on, and respond to their mathematical thinking. Writing not only captures mathematical thinking but also facilitates learning in powerful ways. (Powell, 1997, p.1)

Mendez and Taube (1997) support writing in mathematics classes to refine students' comprehension of mathematics and help instructors assess their students' knowledge of the subject. Smith (1995), feels that students should be immersed with opportunities for writing, reading, and solving problems in mathematics to prepare them for the mathematics skills required for daily living.

Some researchers believe that discretion should be used in the area of integrated subjects. Shanahan (1997) cautions that integration does not automatically lead to learning. He feels that when using integration one must first consider whether the instruction is actually accomplishing the purpose of meeting educational outcomes. Shanahan concludes that "successful integration requires a great deal of attention to the separate disciplines" (Shanahan, 1997, p. 17). His research verifies that benefits of integration results only if both areas of study receive instructional attention.

Assessment

Blackwell, Chambless, Oswalt, and Redding (1998), conducted a two-week project based on child-centered, problem-solving approaches to connecting literature

and writing with mathematics, and found that the students' process of "collecting, recording, interpreting, and analyzing data gave the instructional team authentic ways of observing students' ability to construct and apply their own knowledge of mathematics" (p. 450). Assessment of this knowledge was accomplished in several different ways, as recommended in the Assessment Standards for School Mathematics (NCTM, 1995). Researchers observed the children at work and made notes of their abilities to share ideas, make predictions and analyze data. Researchers also noted positive changes in attitudes, such as interest enthusiasm, curiosity, and confidence.

Quinn and Wilson (1997) conducted a study to determine current teacher beliefs and practices regarding the use of writing in the teaching of mathematics. They found that teachers at all levels considered writing in mathematics to be extremely important for assessment. Elementary teachers who were part of the study agreed on the importance of writing to assess, and felt that writing logs helped them to see the students' thinking process. They also stated that "without writing, misconceptions may go unnoticed" (Quinn & Wilson, 1997,p.18).

Mitchell and Stemple (1991) point out that new evaluation standards from the National Council of Teachers of Mathematics stress the use of "multiple assessment techniques, including written, oral, and demonstration formats." They state that "performance assessments in math class call for writing as well as formulas and diagrams" (p. 40).

Summary

It is apparent when reviewing the research and literature on connecting writing to mathematics, that researchers and educators alike feel that writing can and should be used as a means to enhance students' learning in mathematics. Not only do writing practices " help build thinking skills for mathematics" (Pugalee, 1997, p. 308), but they are tools for educators to use in assessment, as they work towards meeting the Washington state EALRs.

CHAPTER THREE PROCEDURES OF THE PROJECT

The procedure for this project consisted of several steps. First, the author attended a workshop, which inspired the study. The workshop, entitled "Box It or Bag It", was taught by Bonnie Isom in the summer of 1997. It focused on mathematical strategies for elementary students, and provided insight on current thoughts and practices in mathematics.

Second, recommendations of the National Council of Teachers of Mathematics and the Essential Academic Learning Requirements of Washington State Commission on Student Learning were considered.

Third, research was gathered and reviewed by the author to determine the legitimacy of using writing to enhance mathematics instruction in the elementary classroom.

Fourth, strategies for integrating writing in mathematics were considered. Activities and worksheets were developed based on research and recommendations from the author's review of the literature.

Finally, project-based activities to integrate math and writing were implemented by the author in a first grade classroom.

CHAPTER FOUR

THE PROJECT

The project provides strategies for integrating writing into a first and second grade mathematics curriculum. The author used research and personal experience to develop activities to use in the classroom and aligned each activity to the Essential Academic Learning Requirements. There are seven math concepts that are addressed. They include, Fractions, Geometry, Logic, Measurement, Money, Number Sense, Operation Sense, and Time. At least two lessons for each concept are provided. Worksheet and supplemental materials are included with some lessons.

Fractions

The Cake Fraction

Objective: Students will become familiar with the terms whole, halves and fourths.

Activity: Hand out a square piece of paper to each student. Ask the student to fold the paper in half. Then have the students fold it in half again. Then have the students cut the square into fourths by cutting on the folded lines of their square. Ask the students to place the pieces on their desk so that they form the large square again. Then ask the students to imagine that their square is a cake. Explain that they are looking at the whole cake when all of the pieces are together. Then have them hold up the pieces that they think would show half of their cake. Then ask them to show $\frac{1}{4}$ of their cake. Ask the students to write a sentence that tells how much of the cake they would like to eat using the terms whole, half, three fourths, and one fourth. Tell them to be sure and explain why they feel the way they do. Then ask the students to share their sentences with a partner.

EALR's:

Mathematics 1.1, 2.1, 2.2, 2.3, 3.1, 4.2, 4.3, 5.3

Writing 1.3, 2.2

Quilts

Objective: The students will design quilts and write what part of their quilt each print makes up.

Activity: Review the fractions $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{3}{4}$. Have each student choose twelve 6-inch squares of patterned fabric. Limit students to three different patterns. Tell them that they are going to design a mini quilt. After they have arranged their fabric have them glue the pieces down to a piece of construction paper. Ask the students to look at their quilts and count the squares in each pattern. Ask the students to write a sentence to tell how many squares they have in each pattern, and then challenge them to write the fraction that each pattern makes up within their quilt.

EALR's

Mathematics 2.1, 2.2, 2.3, 3.1, 4.1, 4.2, 5.3

Writing 1.3, 2.2

Geometry

Shapes and Words

* The following activity was adapted from Writing Math by Sharon Z.

Draznin.

Objective: The students will create a shape picture and write sentences to describe their pictures.

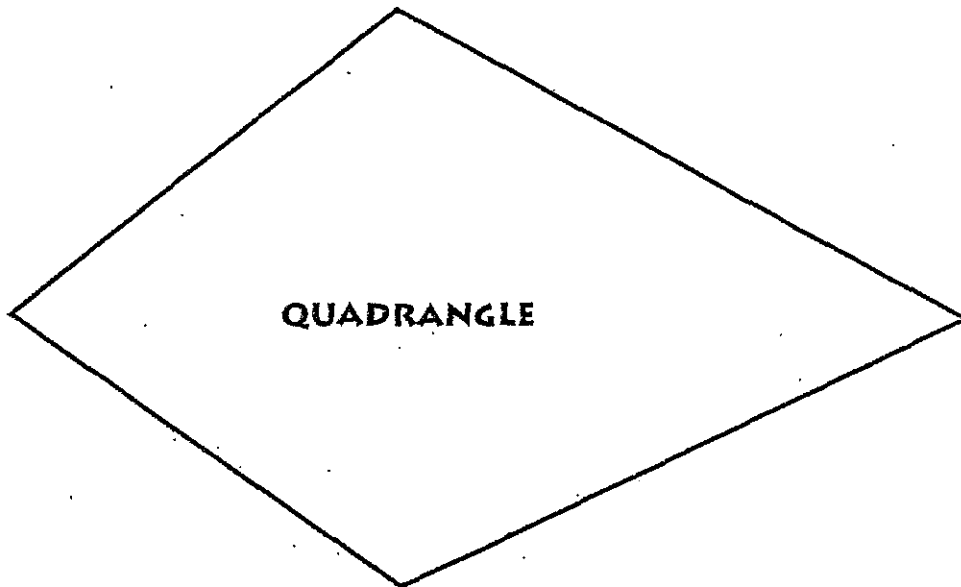
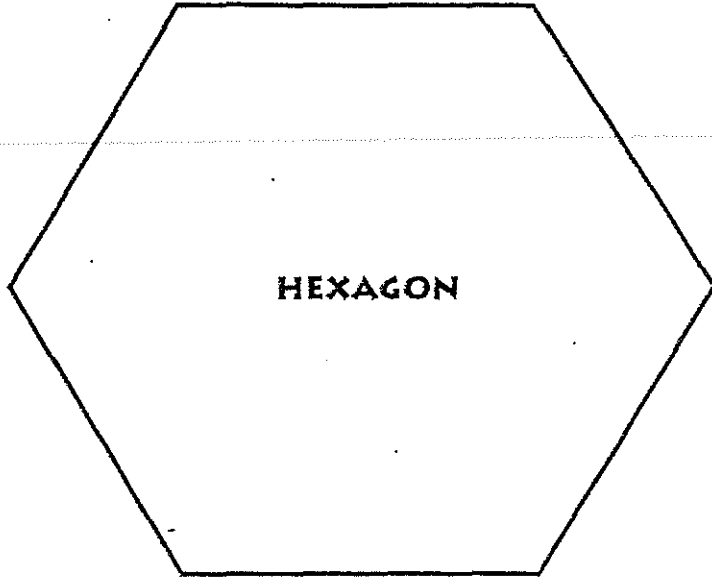
Activity: Tell students they will be creating a picture using black construction paper as background and various colored shapes for to form the picture. Shapes for tracing can be found on the following pages. After students have cut out and placed their shapes to create a picture, have the students brainstorm a list of descriptive words and list them on the chalkboard. Distribute writing paper. Ask the students to include as many descriptive words as they can in sentences they write to describe the shape picture they have just created. After the students have completed the writing process, display pictures and writings around the room.

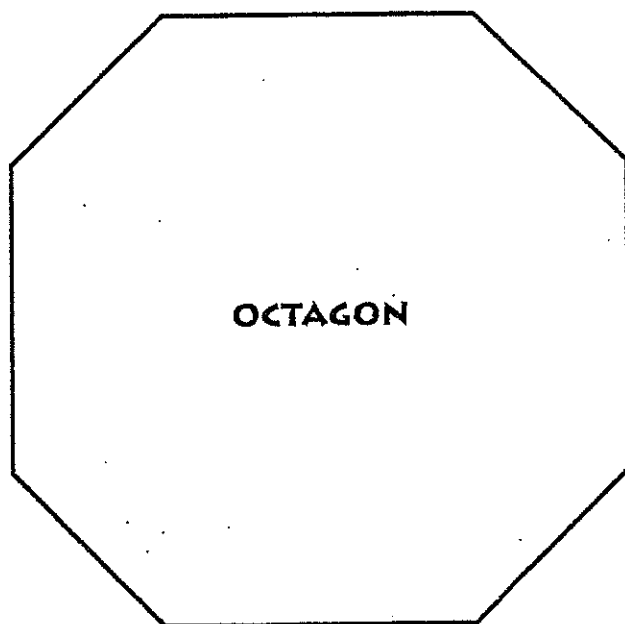
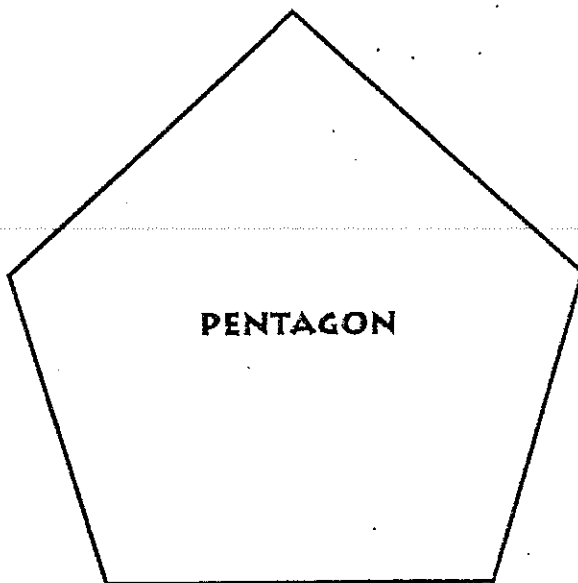
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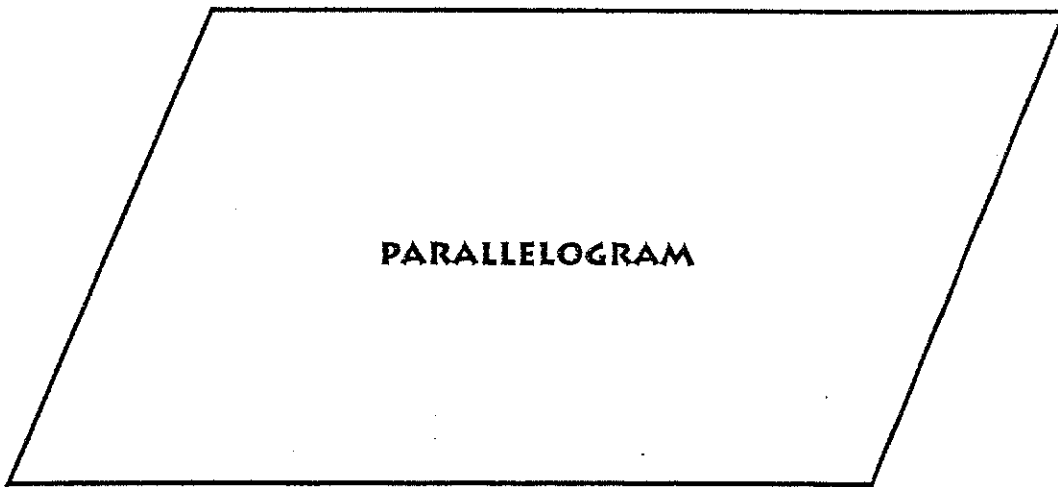
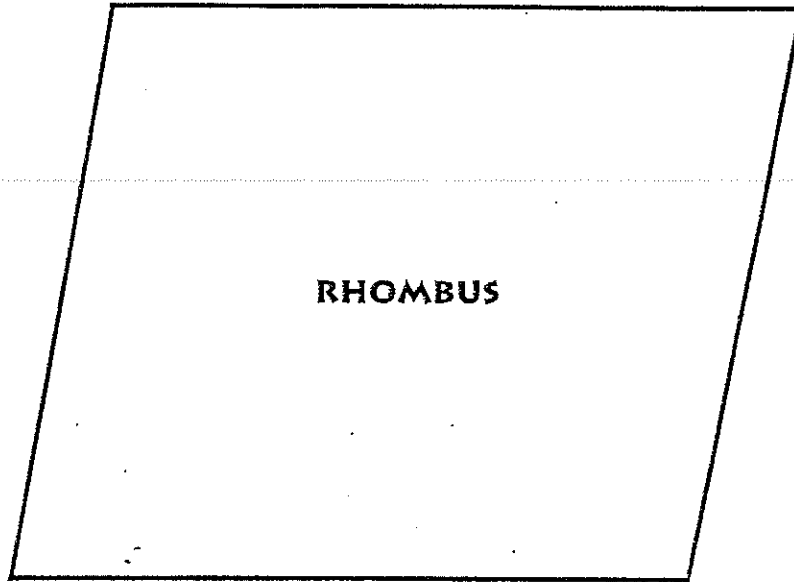
Mathematics 1.3, 2.1, 3.1, 4.1, 4.2, 4.3, 5.2

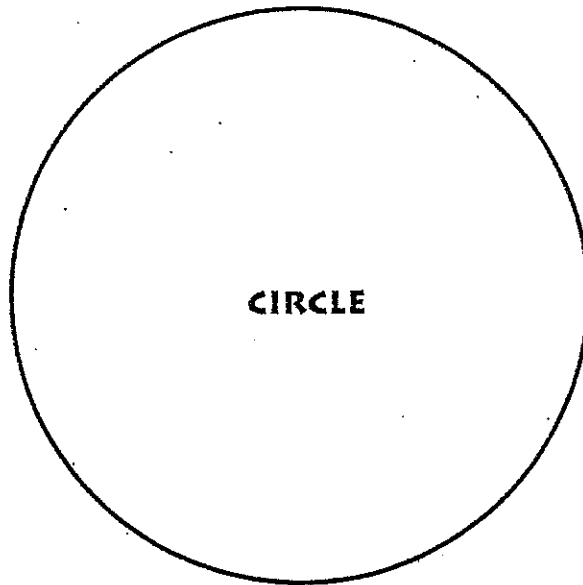
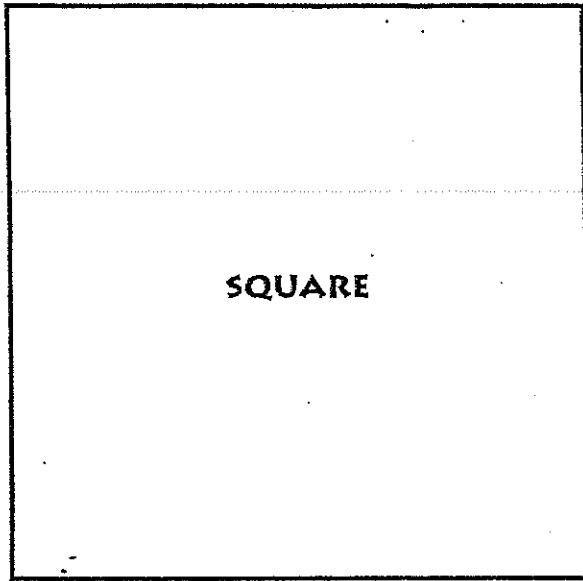
Writing 1.1, 1.2, 1.3, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5

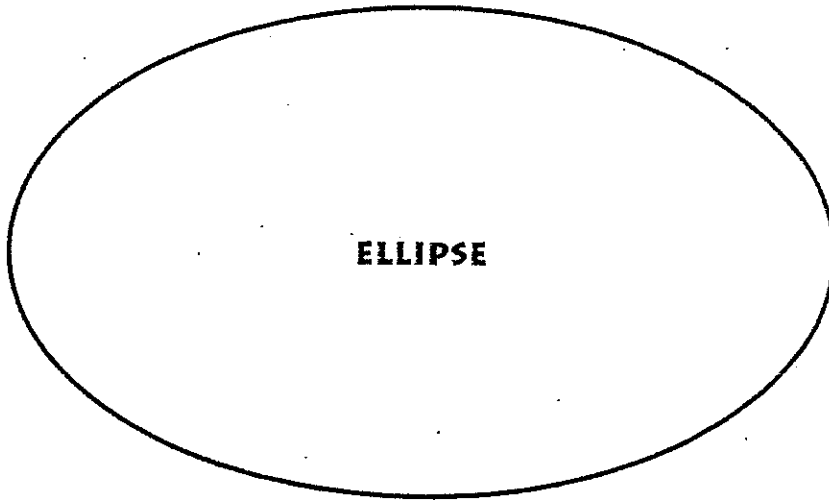
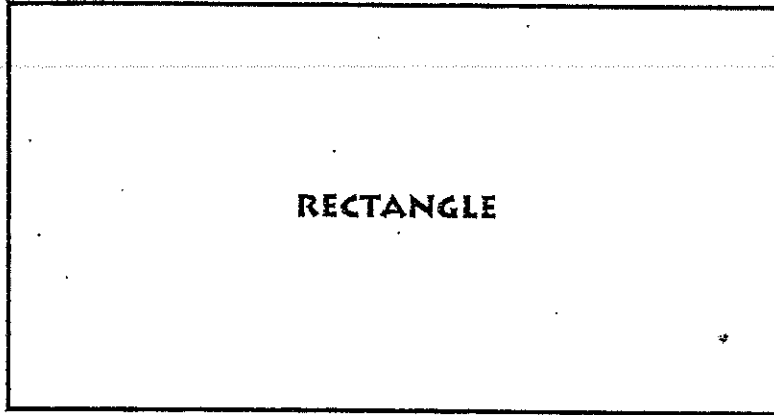
Shapes

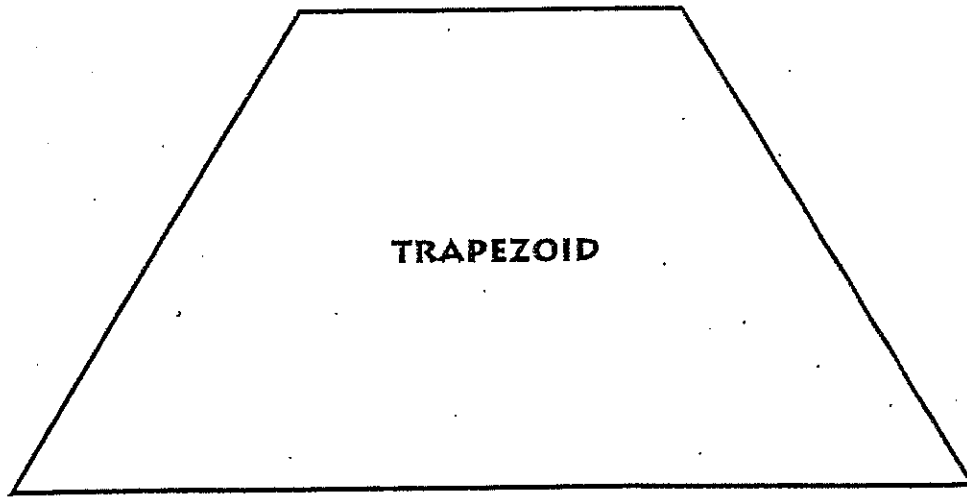
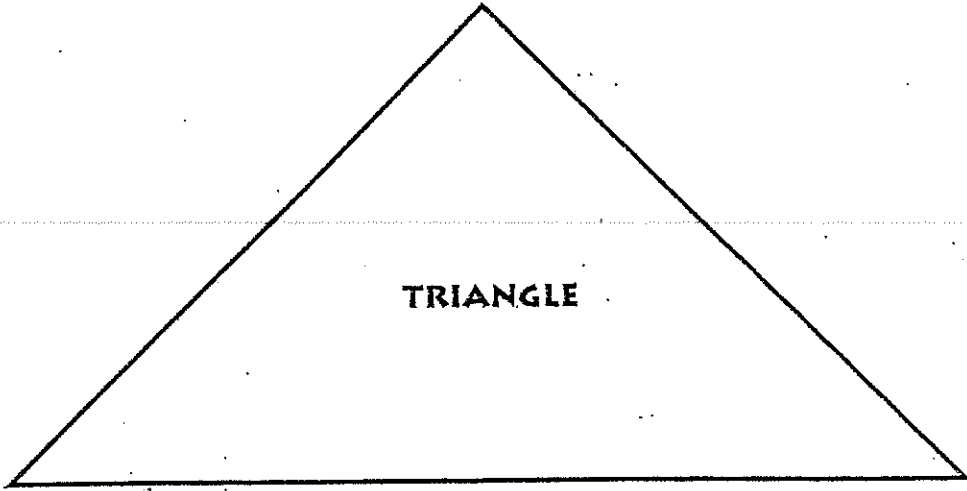












Shapes

* The following activity has been adapted from *Geometry and Language* by Lionel Pereira-Mendoza.

Objective: The students will write a narrative about what the world would be like without shapes.

Activity: Discuss with the students what the world might be like without shapes. For example, if there were no circles, how could we ride bikes? What would cars look like? Ask them to brainstorm all of the round objects that are important in our day to day lives. Discuss why these things must be round. Then ask students to write a story titled *What life would be like without _____*. Have them fill in the blank with the shape of their choice. After students have completed the writing process, ask them to share their stories with the class.

EALR's

Mathematics 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.3

Writing 1.2, 1.3, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5

Logic

Pattern Stories

Objective: The students will write a pattern story.

Activity: Reading and discuss the pattern story The Important Book

by Margaret Brown. Ask the students to explain how they know the story is in the pattern form. Then have the students create their own pattern story. Be sure to review the writing process prior to this activity. After each student has published his or her pattern story, have them share it with the rest of the class.

EALR's:

Math 4.1, 4.2, 4.3, 5.1, 5.2

Writing 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5, 4.2

Strategy Games

Objective: The students will write an explanation on how to play the game Tic Tac Toe.

Activity: After Playing the game Tic Tac Toe several times, ask students to write the directions for playing the game, including the rules of the game and any strategies they might know that will help to win the game. After completing the writing process, ask the students to share their explanations with a partner to see if it makes sense.

*As an extension to this activity students can make up their own strategy games and share them with the class.

EALR's

Mathematics 1.1, 1.4, 2.1, 3.1, 3.3, 4.1, 4.2, 4.3

Writing 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5, 4.2

Measurement

Using A Tape Measure

* Part of the following activity was adapted from Writing Math by Sharon Z. Draznin.

Objective: Students will use a tape measure to measure the girth, or widest part of an apple in inches and centimeters and then record their findings.

Activity: Discuss the characteristics of a tape measure, including the difference between inches and centimeters . Define the word girth for the students and help them to locate the girth of their apple. Working in pairs, have the students measure the girth of an apple and record the measurement in both inches and centimeters on their apple worksheets, which can be found on the following page. Ask students to share and compare their findings with the rest of the class. Students then need to write their reflections about what they learned about measurement as well as any questions they may have about the assignment. Students might also list other items that can be measured with a tape measure.

EALR's: Mathematics 1.1, 1.2, 2.1, 3.1, 3.3, 4.1, 4.2, 4.3, 5.1, 5.3

Writing 1.2, 1.3, 2.2, 4.2

Weight

Objective: The students will predict, weigh and record the weight of apples.

Activity: Break students into groups of 2 or 3. Give each group two apples, a balance scale, ceramic tiles, and a Weighing The Apples record sheet for each member of the group. After modeling how to predict and record answers, have each student complete the first part of the record sheet. Then have the students weigh one of their apples by placing it on one end of the scale and placing the ceramic tiles in the other.

Students need to record how many tiles it took to balance the scale. Then have students repeat the process with the second apple. After completing the rest of their record sheet, each group can share their results with the rest of the class.

EALR's:

Mathematics 1.1, 1.2, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 4.3, 4.3, 5.1, 5.3

Writing 1.2, 1.3, 2.1, 2.2,

Weighing The Apples

Prediction

We think the _____ apple will be the heaviest because

We think the _____ apple will be the lightest because

The number of tiles I think it will take to balance the first apple. _____

The number of tiles I think it will take to balance the second
apple. _____

After weighing my apples I found that the _____ apple was
the heaviest and the _____ apple was the lightest.

I was surprised that _____

I learned that _____

*On the back of this paper list some places you might use weight.

Money

Buying Supplies

Objective: The students will write a plan to buy items to decorate a cookie.

Activity: Give each student 25 pennies. Tell students that they are going to use the money to buy items to decorate their own cookie.

Display items with their prices. Items might include frosting, chocolate chips, M&M's, coconut, or licorice. Model the concept of writing a plan for buying the items needed for decoration. Then have students use Cookie worksheet to write their plan for decorating their cookie. After writing and illustrating their plan, have the students buy their ingredients and decorate their cookies. After they have completed their decorations have students answer the following questions on the back of their worksheets. Did you stick with your original plan? How much money did you spend all together? Would you do anything differently? If so what? Then have students eat their cookies.

EALR's:

Mathematics 1.1, 2.1, 2.2, 2.3, 3.2, 4.1, 4.2, 5.3

Writing 1.3, 2.2

The Cookie Worksheet

I plan to buy:

_____ chocolate chips which equals _____ cents.

_____ M&M's which equals _____ cents.

_____ scoops of frosting which equals _____ cents.

_____ pieces of licorice which equals _____ cents.

_____ scoops of coconut which equals _____ cents.

Total amount spent _____ cents.

My cookie will look like this:

For Sale

* This activity was adapted from Writing Math by Sharon Z. Draznin

Objective: Students will write advertisements to encourage others to

buy items they have for sale.

Activity: Ask students to bring a toy or book from home that is no longer used. If students do not have anything to bring tell them that they can make some things at home to sell. Examples of such items might include a bookmark, a picture, or a paper airplane. Send home the parent notice about the project. After students have brought their items to sell, conduct a short discussion to elicit appropriate prices for their items. Then tell students that they will be writing ads to try and get their classmates to purchase the items they have brought to school. Discuss the purpose of advertising and model some examples of ads on the board. Distribute the "Ad Sheet" and have students fill it out. After the students complete the writing process, display their ads around the room. Choose a day for the class sale, and divide the class into two groups. Distribute play money to each student. The first group can shop while the second group sell their objects. Have

groups switch after about 10 minutes. At the end of the second time period, gather the students together and discuss how the sale went.

EALR's

Mathematics 1.1, 2.1, 3.1, 4.1, 4.2, 4.3, 5.3

Writing 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5

Number Sense

A Mini Math Museum

*The following activity was adapted from Writing Math by Sharon Z. Draznin.

Objective: The students will become familiar with the importance of numbers in daily life.

Activity: Have students brainstorm ways that we use numbers in every day life. Prepare a bulletin board for display. Entitle the board "Room ___'s Miniature Math Museum". Ask students to bring items from home that can be displayed on the board. Examples might include pages from a phone book, a receipt, a menu, or a bill. Ask each student to write about the item that they bring including where they found it and why they think it is a good item for the museum. Then have each student share their writing.

EALR's:

Mathematics 1.1, 2.1, 3.1, 4.1, 4.2, 4.3, 5.3

Writing 1.3, 2.2,

The item I brought to put in the Miniature Math Museum is _____

I found it _____

I think it is an important item for the Museum because _____

I learned that _____

How Many Steps?

Objective: The students will write a procedural that tells how many steps it takes to get to the Music room from their desk.

Activity: Review the process for writing a procedural with the students. Then ask each student to investigate and then write their own procedural telling how to get the Music room when starting from their desk. After each student has completed the writing process for their procedural, have them get into groups of two. Ask each student to take turns reading their procedural to their partner while their partner actually follows the directions. With the whole class ask for volunteers to share what they learned from this experience. How many steps did they take all together?

EALR's:

Mathematics: 1.1, 2.1, 2.3, 3.1, 3.3, 4.1, 4.2, 4.3, 5.3

Writing 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1

Operation Sense

Writing Number Stories

Objective: Students will write number stories using addition or subtraction, and place these stories in a context.

Activity: The teacher will model an example of an addition story as practice. For example: "One day five bear friends were out gathering berries in the woods. After awhile they ran into three more bear friends picking berries. How many bear friends were picking berries all together?" As students practice coming up with addition stories, other students try to solve them. Students should be encouraged to explain their thinking, what made them think of the answer, or if there might be another way to solve the problem. Each story must ask a question that can be answered by adding. Students should be encouraged to use correct punctuation and capitalization when writing addition stories. More than one number story can be written at a time. Stories can then be shared with the class, and bound into a class book. After a successful addition story has been written, students can try a subtraction number story.

EALR's: Mathematics 1.1, 2.2, 2.3, 3.1, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3

Writing 1.2, 1.3, 2.1, 2.2, 4.2

Math Journals

Objective: Students will write step by step procedures on how they solved any given math problem, as well as their personal thoughts.

Activity: Each student is given a math journal. Every day a specific or challenging math problem is given to the class or individual. The student works to solve the problem and then writes to explain how he or she solved it. This is a step by step explanation that also may include their predictions about and personal thoughts on the problem. Students should be encouraged to share their writing from their math journals to show that there are often different ways to solve a problem.

EALR's: Mathematics 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.3, 4.3, 5.1

Writing 1.2, 1.3, 2.1, 2.2, 4.1, 4.2

Time

How Much Time?

Objective: Students will make a list of all the things they could do in 30 minutes, and a list of things they could do in 15 minutes and compare the two.

Activity: Review time using an analog Judi clock. Discuss length of time. Tell the students that you will be setting a timer while they go about their regular activities so that they can feel the difference between 15 minutes, and 30 minutes. Set the timer for 15 minutes first letting the students know when you set it. When the timer goes off, tell the class that you are now setting the timer again. This time set the timer for 30 minutes. When the timer goes off discuss and compare the two periods of time with the students. Did one time period seem longer than the other? Which one? Then ask students to make a list of activities that they think they could do in 15 minutes. Remind them that this was the first time period that they experienced. Then have students list things that they think they could do in 30 minutes. As a group discuss and compare student's lists.

EALR's

Mathematics 1.1, 2.1, 2.3, 3.1, 3.3, 4.1, 4.2, 4.3, 5.3

Writing 2.2, 2.3, 4.2

Digital Versus Analog

Objective: The students will write an explanation of how a digital clock differs from an analog clock.

Activity: Display an analog clock as well as a digital clock. Discuss the differences and similarities with the class. Review what a paragraph should look like. Ask the students to write a paragraph comparing both types of clocks. Tell them to be sure to include their favorite kind of clock and why it is their favorite. After the students have completed the writing process, have them share their paragraphs with the class.

EALR's

Mathematics 1.1, 2.1, 3.1, 4.2, 4.3, 5.3

Writing 1.1, 1.2, 1.3, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The Washington State curriculum reform is changing the way that education is being taught. The author noticed several opportunities to meet the Washington State Commission on Student Learning's Essential Academic Learning Requirements by connecting subjects to help enhance understanding. This project was designed to provide lessons and activities to enhance the curriculum currently being used in the author's district. First, the author attended a workshop that provided current thoughts and practices in mathematics. Second, the National Council of Teachers of Mathematics recommendations and the Washington State Commission on Student Learning's Essential Academic Learning Requirements were considered. Third, research was gathered and reviewed by the author to determine the legitimacy of using writing to enhance mathematics instruction in the elementary classroom. Fourth, strategies for integrating mathematics were considered, and activities and worksheets were developed.

Finally, project-based activities to integrate math and writing were implemented by the author in a first grade classroom.

Conclusions

Most of the activities developed in the project have been used by the author in the classroom. The activities were used along with the school districts regular adopted mathematics curriculum. The author noticed that the students responded well to the activities that included writing. Students tended to inquire about and discuss mathematical concepts amongst themselves as a result of these activities.

The author observed the students using mathematics in other subject areas as well. Students started writing story problems during writing time, as well as finding mathematical concepts within literature being read in the classroom.

The author believes that because these activities were conducted within a first grade classroom, time was a significant issue for many students. Students with writing skills that are developmentally higher may not have as much of an issue with time for these activities. The author

found that due to varying ability levels in writing some students needed longer to complete the writing activities. When additional time was given, the author found that the writing activities proved to be highly valuable in the students' understanding of a mathematical concept, as well as practice in writing conventions.

Recommendations

The author suggests several recommendations for use of this project. The author feels that although writing and math can be connected to enhance mathematical understanding, there should also be individual instruction in these two subject areas. Using writing during math instruction should not take the place of writing instruction itself.

The author also suggests that students are allowed enough time to read and discuss their writing in mathematics. Through discussion different perspectives are open for critique and analysis by classmates and teacher. Though time consuming, it appears to be beneficial as well as an essential academic learning requirement for each student to share their work, and to seek and offer feedback.

Lastly, the author recommends the addition of literature and more writing components to these lessons.

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