

The Math/Literature Connection:

'Adding' to the Number Experience



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Words and numbers
are of equal value,
for, in the cloak of knowledge,
one is warp and the other woof.
It is no more important
to count the sands

than it is
to name the stars."

(The Phantom Tollbooth, p. 67)

Purpose of the Review

As educators continue to search for the most effective approach to teaching mathematics, they face the monumental challenge of meeting the national call for reform. The rapid advances in knowledge and technology and the need for a better means of preparing children for today's challenging world have led educators to examine new ways of actively engaging students in their mathematics learning, primarily through its integration with literature. By providing a context through which students can construct meaning, it is the goal of educators to subsequently foster and develop students mathematical thinking and reasoning using what they have learned to solve problems both in school and in real-world contexts. The purpose of this current review is to critically examine and discuss recent literature and research concerning the integration of mathematics and literature at the elementary school level, as a way of exploring and investigating mathematical concepts, providing the reader with a sense of how this literature reflects the current views on this topic. For while there continues to be changes in the most effective ways of providing students with meaningful mathematical instruction; no one disputes the significance of providing learning environments in which all students have the opportunity to learn, grow, and reach their maximum potential.

The History of Mathematics Education

While the study of mathematics as a process for communicating data and examining pattern and order, has existed for as long as recorded history, its scope has changed over the centuries, progressing from a static field of study to its current dynamic status of universal applicability (O'Banion, 1997). In the past, the mathematics curriculum was isolated from all other disciplines and was designed to provide basic computational skills, emphasizing the rote memorization of rules and procedures. Students mastered these skills using paper and pencil drill, textbooks, and the memorization of addition, subtraction, multiplication, and division facts. In mathematics, opinions on how and what should be learned shifted rapidly, from an emphasis on basic skills mastered through precision and rigor, to a process-driven hands-on approach using manipulatives, and then back to the basics attitude, with "basics" never precisely defined

or agreed upon. A valid concern about the basic skills and knowledge of our students and the adjustments necessary in mathematics education has led to the current shift toward a broader view of mathematical instruction reflected in the National Council of Teachers of Mathematics (NCTM) Standards for the elementary school level (Gailey, 1993).

The complexity of today's society requires all citizens of different cultures and backgrounds to be well prepared in the area of mathematics, a need that far exceeds basic computational skills. Although the rote learning of math facts and processes do not adequately prepare students for life in today's world, these computational skills are still valuable tools for understanding our number system and providing a necessary and efficient method to perform computational functions.

The Need for Reform

In an effort to keep up with students in other advanced nations and to help students see connections between mathematics and their world, educators must seek new and creative methods to motivate students and provide them with real-life applications of mathematical concepts. With the publication of the National Council of Teachers of Mathematics (NCTM) Standards, many mathematics teachers and educators have become especially interested in making mathematical connections, such as those found between math and children's literature (Leitze, 1997). This logical union between math and literature provides a natural way for teachers to allow students to see mathematics in everyday society, to give it meaning, and to make it come alive. Similarly, it provides students the opportunity to observe the interaction of mathematics with other disciplines and with daily life. The overarching goal of these standards is the integration of mathematics into contexts that give its symbols and processes practical meaning (Leitze, 1997).

The inclusion of literature in mathematics is one of the changes recommended by the National Council of Teachers of Mathematics, which enables a more authentic approach to math. These standards underscore the constructive nature of mathematical understanding and stress the need for students to communicate mathematical ideas. According to curriculum standards, communication helps students "construct links between their informal, intuitive notions and the abstract language and symbolism of mathematics; it also plays a key role in helping children make important connections among physical, pictorial, graphic, symbolic, verbal, and mental representations of mathematical ideas (Lewis, Long, & MacKay, 1993). The message of

NCTM's teaching standards is that "computational algorithms, manipulation of equations, and paper-pencil drill must no longer dominate school mathematics. In mathematical reasoning, problem solving, communication, and connections are central" (Lewis et al., 1993). A critical look at the abundance of research which supports the integration of math and literature examines the opportunities provided by children's books to develop mathematical power in a natural and meaningful way.

The Benefits

The benefits of the math-literature link are rooted in its inherent connection, integrating the learning of mathematical concepts into contexts that are meaningful to children (Raymond, 1995). According to Raymond (1995), children's literature provides a stepping stone to mathematical understanding. Its ability to motivate students to learn mathematics illustrates the notion that it does not have to be learned "in isolation" from other subject areas. By eliminating the barriers created by the constraints of time and formal math instruction, both students and teachers benefit, provided with more time and the smooth, gradual flow of interdisciplinary activities (Lightsey, 1996). Trade books portray mathematics in a different light, as an everyday human activity, rather than as the rules and procedures that children "have to learn" which do not seem applicable to life situations. Through the math-literature connection, "it is hoped that...students begin to view mathematics...as a natural part of everyday life" (Raymond, 1995).

In a study conducted by Jennings, Jennings, Richey, and Dixon-Krauss (1992), it was found that the use of children's literature to teach mathematics concepts to kindergarten children improved math achievement test scores, and increased both their interest in mathematics, and the number of times they used mathematical vocabulary during free play. Research conducted supported the idea that using children's literature to teach math provides teachers with the opportunity for creativity, a vital component of successful teaching, while resulting in increased student interest and achievement in the area of mathematics. The Jennings et al.(1992) study examines the importance of providing meaningful experiences that actively involve children in their learning. The benefits of these developmentally appropriate activities lie in their ability to act as prerequisites for the eventual application of concepts and principles to real-life problems, the motivation for both teachers and students provided through the integration of real-life problem solving situations, and the facilitation of discussion fostered by these activities, a necessary part of understanding and applying mathematics to new situations.

The challenge of providing experiences that are meaningful for each individual student faces educators everyday, as they strive to meet the needs of a diverse group of students. The integration of math and literature provides the ideal opportunity for tapping into the talents of all students no matter what their ability levels may be. As stated by Thrailkill (1994), “the line between ‘good’ readers and ‘good’ mathematicians begins to blur and children are more likely to build their confidence in each area focusing less upon what they see as their strengths and weaknesses in school subjects.”

Trade books, especially picture books, can be integrated into any lesson because of their short format. Presenting similar information as textbooks, children’s literature provides a more interesting format as well as issues and themes that are of interest to various age levels. They act as vehicles that help children to apply the information they learn to their own lives as opposed to textbooks which often include activities that are based on things that kids don’t do, can’t do, or don’t want to do (Murphy, 1999). In a society inundated with visuals, picture books provide a more meaningful avenue for understanding difficult concepts. Books portray specific concepts through diagrams and illustrations, which, for visual learners, can be much more meaningful than purely verbal or numerical explorations. In picture books by Mitsumasa Anno, for example, math concepts become clear without the use of a single word (Murphy, 1999). They can be used to introduce a specific concept, develop interest, provide background information and expand understanding of a lesson (Goerss, 1998). The problem solving process of both literature and mathematics provides a dual opportunity for enhancing thinking both in comprehending a piece of children’s literature and in the broader, more meaningful assessment of student’s thinking in mathematics, which is more powerful than assessing either reading comprehension or mathematical understanding separately (Thiessen, 1996).

The use of children’s books in mathematics enriches overall learning. Mathematics and language skills develop together as students listen, read, write, and talk about mathematical ideas. While enhancing mathematics learning, children’s books also enhance reading skills, providing students more opportunities to experience literature as it pertains to different content areas (Gailey, 1993).

The Challenge: Make it Work!

The greatest risk in integrating literature with math; in fact, the greatest risk in integrating any areas of the curriculum is inappropriately doing so. What is meant by “appropriate” is not

specifically defined but basically means that the literature used has a specific purpose and is not used as a means of teaching a specific skill. The best books are obviously those related to the math being taught, the ones with which extensions can be made, such as to other areas of the curriculum (i.e. dramatic arts), and those that motivate children to subsequently explore with the books themselves.

“Appropriate” also means that the developmental levels and previous literacy experiences of children must be considered when using children’s literature to teach mathematics. Listening to children’s responses to a story and incorporating these into teacher planning are absolutely crucial for developing understanding, interest, and motivation in mathematics (Jennings, Richey, & Dixon-Krauss, 1997). When teachers fail to learn from their students, their students fail to learn.

When children are guided in learning, and subsequently allowed to make their own investigations and decisions, the math and literature connection will equal learning. Ultimately, Jacobs and Rak (1997) state, “mathematics should flow from and be a natural part of the book.”

“Quadraliterature”

The “language” of mathematics can be divided into four categories of children’s books: counting books, storybooks, number books, and concept books. While not limited to these categories, Gailey (1993) offers these to teachers to better classify that which the books are intended to teach.

Counting books, as their name implies, reinforce number concepts and can be used to teach any of the arithmetic functions of addition, subtraction, multiplication, and division. Widely used in first grade to review the numerals from 1-10, counting books actively engage students in learning. Moja Means One: Swahili Counting Book, by Marjorie Feelings, uses African people in native dress to illustrate the numerals from one to ten. As a multi-cultural extension, it also teaches children the Swahili word for each numeral. Teachers can use the book with children to count such things in the classroom as boys, girls, children wearing red, etc. Thus the children while learning to count, subsequently learn to classify sets of objects and different representations of numbers.

Number books, as their name implies, reinforce a particular number. Examples include My Six Book, by Jane Moncure, and Jeffrey Moss’s Five People in My Family. This math-literature connection is vital in teaching beginning readers the importance of labeling. Students

will soon strengthen understanding that “6” is the same as “six” is the same as “a picture of six cows.” Lightsey (1996) recommends several songs and rhymes to accompany number books, aiding in their understanding of specific numbers. The song “This Old Man” lends itself to this goal, as children learn and can even act it out. The students have fun and are motivated to learn more, subsequently establishing stronger connections.

To introduce or reinforce mathematical concepts, storybooks can also be used. Fairy tales, folk tales, or any other stories in which the author touches on a mathematical concept can be used. Two Ways to Count to Ten, by Dee may be used as a way to introduce alternative counting methods. In the story, King Lear holds a spear-throwing contest to find an heir to his throne. The first animal to count to ten before his spear hits the ground wins. Finally, an antelope discusses counting by even numbers is quicker and he is made heir to the throne. Students will also come up with other ways such as counting by 5’s, laying the foundation for basic discussion. A Remainder of One (see attached lesson) is one of my favorites. In the story, poor Joe is always being left out of his squadron of twenty-five ants as they rearrange themselves into lines of two by twelve, three by eight, and four by six. This story illustrates multiplication and division using different arrangements of ants, which can later be reinforced, with the creation of fact families.

Lastly, concept books (informational books) are useful in exploring specific mathematical concepts such as money, time, “a million”, and fractions. They usually have interesting formats and convey excitement in exploring various mathematical ideas. Schwartz’s How Much is a Million is popular in classrooms to teach the concept of large numbers. When teaching basic place value and then introducing this book, students are motivated to discuss this “imaginary” number and what exactly it is. One Grain of Rice (see attached lesson) by Demi provides the basis for a lesson on place value as a review of the tens, hundreds, ones, tenths, and hundredths places of a multi-digit numeral. Eating Fractions, by Bruce McMillan is similarly motivating to students when introducing the concept of fractions. McMillan shows real children manipulating food to show different fractions. Since the text is simple, emergent readers will enjoy reading and re-reading the book. Similarly students love to make their own food fractions, sharing, and counting them with their classmates.

This presents an overview of how children’s books fit into categories, better assisting the teacher in making this appropriate integration. While it is not necessary to categorize every

book, it is imperative that these books are appropriately used within a mathematics curriculum to ensure student understanding.

Personal Commentary: Review of Literature, Observations, and Opinions

As a future elementary/special educator, I found this analysis of past and current literature on the math-literature connection to be an extremely rewarding experience that has helped me to see just how valuable the integration of children's literature with mathematical concepts can be, especially at a time where elementary testing does not blur their distinction. Each of the articles addressed key issues surrounding math and literature in a clear and concise manner, with the author making his/her purpose known to the reader in the introduction. The remainder of each article followed wholly and essentially from the introductory paragraph providing the reader with distinct sections and issues to compare and contrast as well as examples of activities involving math and literature. Research findings indicate both the benefits and the challenges of creating meaningful and effective math-literature connections. For only when this teaching strategy is used appropriately, can it be a positive experience for the entire community of learners.

Harris Hill Elementary School in Penfield, NY holds a firm belief in the need to actively involve students in meaningful, hands-on, real-life experiences involving a variety of learning modalities. In an observation of Mrs. Wostl's second grade classroom, I was fortunate enough to be able to watch an amazing teacher connect mathematics and literature using the class's very own garden to create the interest, motivation, inquiry, and excitement, which facilitate true learning. With the class garden right outside the door of the classroom in the school's courtyard, Mrs. Wostl's class had the responsibilities of planting seeds and watering the plants, while also graphing the locations of the different plants/vegetables, and their continuous growth. The students saw the results of their efforts as they watched seeds bloom into flowers and plants grow into vegetables, which eventually became a part of their afternoon snack. Using Ehlert's book, Planting a Rainbow, Mrs. Wostl complemented the mathematics involved in the students' gardening experience with literature, nurturing the students' enthusiasm prior to the actual planting experience. In the children's gardening, mental math, numbers and operations, and measurements were involved in mathematical ideas such as the number of seeds in each package, how many flowers bloomed on each plant, the size of the garden needed to plant a given number of plants, the number of days each group of flowers takes to bloom (compare groups), the size of

the plants, the length of the rows, and the area of the garden. By appropriately connecting math and literature and even science, Mrs. Wostl was able to use children's books and a garden as avenues to explore the mathematical linkages offered, motivating her students with real-world experiences, and fostering meaningful connections.

In my work at Hillside Elementary School in Niskayuna, NY, I have observed the integration of math and literature using the story, The Doorbell Rang by Pat Hutchins. As an introduction to fractions, this first grade teacher provided students with "paper cookies" which could be used to perform math as the book was read aloud. In the story, a mother has made twelve cookies for two children, but the doorbell keeps ringing. As the number of children grows, the number of cookies per child diminishes. Performing the math with manipulatives during the story, the students were able to visualize how $\frac{1}{2}$ of $12=6$ (cookies per child), $\frac{1}{3}$ of $12=4$, $\frac{1}{4}$ of $12=3$, $\frac{1}{6}$ of $12=2$, and $\frac{1}{12}$ of $12=1$. At the end, the doorbell rings one more time and it is Grandma with more cookies.

This book could also be used with other activities to introduce fractions, such as having students role-play the story, write their own stories, or to work out in different ways how many cookies each child would have for various different numbers of children and cookies. Regardless of the method used, these activities use the story as an appealing and meaningful context in which students can develop skills and an understanding of the concept and process of division and fractions. By creating their own similar stories, students are encouraged to both be creative and to communicate about mathematics.

I firmly believe that it is time to stop punishing children with math instruction that involves hours spent on worksheets, flash cards, timed tests, and never-ending algebraic equations. We need to exchange the sweaty palms, the tears, and the attempting of problems over and over again without knowing the meaning or understanding why, for the meaningful, real-world math experiences involving children's literature, journal writing, cooperative learning, hands-on discoveries, and the creation of their own word problems. With the proper knowledge and skills, we as teachers can put an end to the nightmares that children have experienced with math in the past, providing them with the motivation and tools necessary for success. As educators, we must begin to focus on the individual learner and their special needs, ensuring success for all students. The many alternatives available are necessary and sufficient to meet the needs of a diverse student population and have been proven effective in many educational

environments. In an era of such high standards, we must prepare students for the complexity of today's society, which requires all citizens to be well prepared in the area of mathematics. We must see each individual student as a person of value, able to learn and succeed when provided with the appropriate learning environment and activities. When we gamble with math-literature connections without direction, everyone loses. However, when we provide students with motivation, real-world experiences, and meaningful connections, the chances and benefits of success are in everyone's favor.

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A REMAINDER OF ONE

Name Kristen Jenne

Date April 21, 2000

Content Area Language Arts/Mathematics

Unit Topic The Math/Lit. Connection

Today's Lesson A Remainder of One

Grade Level 3rd

LESSON RATIONALE

New York State Learning Standards

Language Arts

Standard 1: Students will listen, speak, read, and write for information and understanding.

Standard 2: Students will read, write, listen, and speak for literary response and expression.

Key Idea 2- Speaking and writing for literary response involves presenting interpretations, analyses, and reactions to the content and language of a text. Speaking and writing for literary expression involves producing imaginative texts that use language and text structures that are inventive and often multilayered.

Standard 4- Students will listen, speak, read, and write for social interaction.

Key Idea 1- Oral communication in formal and informal settings requires the ability to talk with people of different ages, genders, and cultures, to adapt presentations to different audiences, and to reflect on how talk varies in different situations.

Mathematics

Standard 3: Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea 3- Students use mathematical operations and relationships among them to understand mathematics.

Key Idea 4- Students use mathematical modeling/multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships.

The Arts

Standard 1- Students will actively engage in the processes that constitute creation and performance in the arts (dance, music, theatre, and visual arts) and participate in various roles in the arts.

Key Idea 1 (Theatre)- Students will create and perform theatre pieces as well as improvisational drama. They will understand and use the basic elements of theatre in their characterizations, improvisations, and play writing. Students will engage in individual and group theatrical and theatre-related tasks, and will describe the various roles and means of creating, performing, and producing theatre.

Instructional Objectives:

- Students will answer assigned multiplication and division problems recalling material they previously learned. [knowledge]
- Students will give examples, in writing, of the grammar, vocabulary, and spelling concepts that reflect what they are to understand in this segment of Language Arts [comprehension]
- Students will give examples, in writing, of the multiplication and division problems from A Remainder of One. [comprehension]
- Students will create and act out a play using the story and props, demonstrating their knowledge of the math problems represented. [comprehension/synthesis] (Theatre Integration)

- Students will create, for extra credit, a story similar to A Remainder of One. Again, they will include the grammar, vocabulary, and spelling covered in this unit. [comprehension/synthesis]

Adaptations:

- Teacher assists seven students with documented needs in the class.
- Use an audio voice enhancer (FM system) for five hearing impaired students.

Materials:

Silver Burdett and Ginn Mathematics Teacher's Edition 4, overhead projector, small plastic ants (25), antennae (25 pair), A Remainder of One, index cards for lines, apple tree background, queen's crown, throne, ceptor, honeybee stinger, Joe's hammock (use 2 chairs and a cloth), mosquito nose, dragonfly wings, Joe's badge, video camera.

LESSON OPENING [assigned seats]

Anticipatory Set [5 min.]:

“Who can tell me the times tables for 4? 7? [check for understanding (CFU)]
Today we are going to practice our multiplication and division skills with 1-digit numbers and act out a story using our skills.”

LESSON BODY [assigned seats] [60 min.]

1. Quick review of multiplication and division using 1-digit numbers.
 - a. Have problems on overhead. Students complete the problems and raise hand when done. First three to have all correct earn a reward [CFU].
 - b. When three have “won” do the problems on the board [guided practice].
 - c. Answer any questions throughout [CFU]
2. Read the story
 - a. Introduce the book. Identify the title/author/illustrator. Emphasize that this book has to do with multiplication and division just as we have been doing.

- b. Read the book through two times. First, have the students identify in writing any grammar, vocabulary, or spelling words covered in this unit. Then, have students pay attention to the math included in the story. The students will write down any math problems they can pick out as the story is being read.
 - c. Stop and show illustrations.
 - d. Allow students to give example of math problems from the book that they wrote down [CFU]. Write them on the overhead. Refer back to ones that were missed [guided practice].
 - e. Cover all of the multiplication and division problems and how multiplication and division relate by creating fact families as a class [guided practice].
3. Now Presenting: A Remainder of One (THEATRE INTEGRATION!)
- a. Ask volunteers to fill various roles in the story: narrator, 23 anonymous ants, Joe (the remainder ant), Sergeant Steven, extra insects watching the parade, one queen, honeybee, slender mosquito, dragonfly. (If not enough students in class, have some play 2 roles or better yet, combine classes to do this and have extra “extras.”)
 - b. Students will then put on their antennae and remain seated at their desk.
 - c. Script will be held up by the teacher and index cards will be given to the students with their lines on them.
 - d. Practice one time through (sitting).
 - e. The push desks to the side and set up the room. As the students act it out, I will use plastic ants on the overhead to model the different arrangements.
 - f. Stop and discuss the math problem represented by each arrangement [CFU].
 - g. VIDEOTAPE IT!

Closure:

Great Job! Did you all have fun with this activity today? Who can tell me one fact family that we talked about today? Who can come up here and put the ants in a 4 X 6 arrangement? [CFU]

For homework tonight, I would like each of you to write the mult. and div. fact family for (4, 6, 24); (5, 5, 25); (7, 3, 21); (8, 4, 32); and (9, 6, 54). For example: (do for [9, 10, 90]) [modeling]. Also, for extra credit for next Monday, you may write your own (multiplication and/or division) story like (not copying) the one we just read, and put it in a play form (script). We will discuss and act some out next week.

LESSON FOLLOW-UP

Independent practice: Students will complete the five assigned fact families and for extra credit, may write a story similar to the one we did in class.

Evaluation:

(a) What did you want the students to learn?

- Students will answer assigned multiplication and division problems recalling material they previously learned.
- Students will give examples, in writing, of the multiplication and division problems from A Remainder of One.
- Students will create and act out a play using the story and props, demonstrating their knowledge of the math problems represented. (Theatre Integration)

(b) How will you know that they learned it?

- Observing students during the “contest” at the beginning of class. Did they all answer the questions by the end of the time given? Do they understand how they arrived at their answers?
- Listening to students identify the math problems/fact families covered in the story.
- Observing the students’ participation in the play. Did they all assume a part? Did they all understand the math problems that were represented? Did they all have fun in some way?☺

LESSON RESOURCES

References for student use: Silver Burdett and Ginn Mathematics Book, A Remainder of One.

References for teacher use: Teacher’s Manual to text book, A Remainder of One [Pinczes, E.J. (1995)].

Name: Kristen Jenne

Content Area: Mathematics

Today’s Lesson: “Human Place Value”

Date: February 13, 2000

Unit Topic: Place Value

Grade Level: Second

LESSON RATIONALE

New York State Learning Standards for Mathematics, Science, and Technology

Mathematics

Standard 1: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

Key Idea 2- Deductive and inductive reasoning are used to reach mathematical conclusions.

Key Idea 3- Critical thinking skills are used in the solution of mathematical problems.

Standard 3: Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea 2- Students use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.

Language Arts

Standard 1: Students will listen, speak, read, and write for information and understanding.

Instructional Objectives:

1. Students will identify the place value of each digit in a multi-digit numeral. [Knowledge]
2. Students will identify digits in the tens, hundreds, ones, tenths, and hundredths place. [Knowledge]
3. Students will, holding a paper plate with a number and place value, place their bodies in order to create the numbers dictated by the teacher. [Application]
4. Students will create the largest possible number using a game board and rolling a die. [Comprehension, Application]

Adaptations:

Hearing Disability: In order to accommodate the student's hearing disability, a microphone system will be used by the teacher.

Visual Disability: To accommodate a student with a visual disability, the teacher will use large print on the chalkboard and the visuals, and a magnifying device will be placed over the child's game board.

Materials: One Grain of Rice

- Dice, game board for each student labeled $_ _ _ _ . _ _$,
- 9 blue paper plates each labeled hundredths, each with a number 1-9,
- 9 red paper plates each labeled tenths, each with a number 1-9,
- 9 green paper plates each labeled ones, each with a number 1-9.

LESSON OPENING

Anticipatory Set:

“Does anybody remember talking about place value? Raise your hands. What do you think of when I say place value? (Call on 2 students) [Check for understanding] “Does anyone remember talking about hundreds, tens, and ones? What do they mean?” (Call on 3 different students) [Check for understanding]

“Today we are going to read the story called One Grain of Rice. Pay close attention during the story because I’m going to stop along the way and ask you questions, so be ready! If we get through the story, we can play a couple of place value games that I’m sure you’ll all like. So pay close attention and be a good audience so we don’t run out of time.”

LESSON BODY

Activities:

[Before the lesson:

- a. Create blue, red, and green paper plates labeled hundredths, tenths, and ones, each with a number 1-9.
 - b. Create game boards for each student labeled $_ _ _ _ \cdot _ _ _$
1. Read One Grain of Rice [15-20 mins]
Tell students: “Listen carefully to the number of grains of rice that the book mentions.”
 - a. Stop at various places and ask questions about the number values in the increasing amounts of rice. [Check for understanding]
 - Ex.) “On the ninth day, Rani was presented with 256 grains of rice.”
“I’d like you to write down the number, and underline the digit in the ones place.” (Ask students to put their thumb up if they underlined the “6”.)
[Check for understanding] (Write the number on the board. Underline the “6” and label it “ones”. Explain what the one’s place means.)
 - Ex.) “She had received 511 grains of rice, only enough for a handful.”
“This time I’d like you to write down the number and underline the digit in the tens place. What number did you underline? [Call on a few different students] Thumbs up if you underlined “1”. [Check for understanding] (Write the number on the board. Underline “1” and label it “tens”. Ask the students to define the tens place. Write it on the board next to the tens place.)

[Continue with numbers throughout the book.]
 2. Review the chart developed throughout the story. Give students additional numbers and ask place value questions. [10 mins]
 - a. Ask students specific place value questions and how much the digit is worth.
 - Ex.) “If I were to give you the number 12,965 (write this on the board) and ask you to underline the digit in the thousands place, you would underline “2” and below it write the value of that number (2000). [Modeling]
 - Ex.) “If I were to give you the number 36,470 (write this on the board) and ask you to underline the digit in the hundreds place, what would you underline? (Call on one student) What is the value of this number?” (Call on another student) [Check for understanding]
 - Ex.) “This one is tricky. Listen closely, if I were to give you the number 9.43, what number is in the tenths place? (Call on a student) [Check for understanding] (Explain the difference between tenths and tens. Continue this with thousandths and hundredths.)
 3. Play Human Place Value Game [20 mins] (Bodily Kinesthetic) (Visual)

Tell students: "Okay boys and girls. You did such a great job! Now I think we're ready for the game. I'm going to pass out a paper plate to each of you. Some plates are going to be blue and labeled hundredths, some will be red and labeled tenths, and some will be green and labeled ones. They will all have a number on them, 1-9. It doesn't matter which one you get. Everybody will get to play."

- a. Explain that we will all do a few practice problems so we can get the hang of it. [Guided practice]
 - Ex.) Ask the students with a red 7, a blue 3, and a green 9 to come to the front of the room. (Teacher will be the human decimal point.)

"How could we use these numbers to make the largest possible number?" (Call on a couple of students) [Check for understanding]
 - Ex.) "Change this number so there is a "4" in the tenths place." (Child with red "4" goes to the front of the room, child with red "7" sits down) [Guided practice] "Now, at the front of the room we have 9.43. Change this number so that there is an "8" in the hundredths place. Change this number so there is a "1" in the tenths place. Change this number so there is a "5" in ones place." [Guided practice]
- b. Begin the game [Check for understanding]
 - Ex.) Change the numbers in the different places. Change the number so that the number in the tenths place is the same as the number in the ones place. add addition and subtraction- This number plus "1".

4. Place Value Dice Game [20 mins] [Check for understanding]

- a. Students are asked to return to their seats.
- b. Collect paper plates and pass out game boards.
- c. Introduce the dice game.

"For this game, you will need a partner. Turn to the person on your right. This will be your partner. The object of the game is to make the largest number possible. You will take turns rolling the die. Each time a number comes up, every player writes it in one space on his or her game board. Once it is written, it cannot be moved. Who ever has the largest number at the end, wins.
- d. Teacher demonstrates this with a partner. [Modeling]
- e. Students play game. [Check for understanding] (Teacher circulates)

Closure:

"You did an excellent job! Who were the winners? Raise your hands."

"For homework tonight, I would like you to play the dice game with someone at home. Make sure that you explain the rules to them as well as discuss the meaning of each place of the number. Do you all understand? Please raise your hand now or come see me later if you have any questions." [Check for understanding]

"Tomorrow we will share the experiences we had at home with our games." [May have to adapt for teaching setting. Inner-city students may not have that ability to share at home.]

LESSON FOLLOW-UP

Independent Practice:

Students will bring the board game home and share it with someone. They will explain the rules of the game as well as discuss the meaning of each place in the number.

Evaluation:

What did I want the children to learn?

Students will identify the place value of each digit in a multi-digit numeral.

[Knowledge]

Students will identify digits in the tens, hundreds, ones, tenths, and hundredths place.

[Knowledge]

Students will, holding a paper plate with a number and place value, place their bodies in order to create the numbers dictated by the teacher. [Application]

Students will create the largest possible number using a game board and rolling a die.

[Comprehension, Application]

How will I know that they learned it?

Watching their performance during each of the games. (Were they able to identify the different places and their values? Did they understand how to make the largest number possible?)

Assessing their independent practice. (Did they play the game at home? Were they able to

explain the rules and the values of each of the places to their partner? Did they win the game?)

LESSON RESOURCES

References for student use:

- Demi, H. (1997). One grain of rice. New York: Scholastic, Inc.

References for teacher use:

- Burns, M. (1992). About teaching mathematics. Sausalito: Math Solutions Publications.
- Cooper, J.D. (2000). Literacy: Helping children construct meaning. 4th ed. Boston: Houghton Mifflin.
- NYS Learning Standards