

Children's Literature in the Elementary Mathematics Classroom

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Any elementary school teacher can tell you that children love to share in a good story. Although some students are stronger and more avid readers than others, all children seem to enjoy either reading a story or sharing in the experience of having a story read to them. Some of the most intimate and special times I remember sharing with my children involved our rocking chair and a good book, typically one that one of them selected. Times spent with a good book are inherently enjoyable and motivating. We can build on that sense of enjoyment and bring it into our primary mathematics classrooms by using good children's literature as a springboard to fun and challenging mathematics activities. In this article, several children's books will be introduced, accompanied by a few math activities related to each story.

The process whereby I selected the books was really quite simple. I asked my children's teachers what their favourite books were, I asked local librarians for titles of popular books and, most importantly, I asked my children which of our books they enjoyed the most. I have focused on children's books that are very motivating. They have a charming story or intriguing pictures, and some have both. I did not select books that were obviously geared toward teaching mathematics; that is, books in which the story is deliberately secondary to how the main character uses math in his or her life, such as books that tell the story of how a character learns to add or tell time. Although these publications also have their place, I was much more interested in books that emphasized storyline, character, plot, or a surprise or visual appeal—the books we most like to read.

As you peruse the activities that follow, you will notice that the stories serve mainly as context for the mathematical activities, and that the activities may take a variety of forms, including games, problems, manipulative explorations and so on. The books are not selected to teach a concept itself but to stimulate

the child's imagination and motivation—to get him or her dreaming about being chased by a monster or eating cookies with Grandma, or imagining how hard it would be to rise above the challenges of a truly rotten day.

Alexander and the Terrible, Horrible, No Good, Very Bad Day by Judith Viorst

Have you ever had a day as bad as Alexander's day? His day was so bad that he was thinking of just packing up and moving to Australia! From the first moment he rises in the morning, everything just starts to go wrong. Getting dressed turns out to be a disaster, breakfast is ruined because there is no toy in his cereal and travelling to school is uncomfortable, but school itself is absolutely awful. Alexander's day just gets worse and worse. He finds out that he is no longer Paul's best friend and discovers that his mother forgot to put the treat in his lunch, and then the dentist finds a cavity in his teeth. I can identify with Alexander. Can you?

Activity 1: Alexander's Game

Objective: Count orally by ones, twos, fives and tens to 100 (Number Concepts, Grade 1).

Part of Alexander's very bad day happens during counting time when he leaves out the number 16. Sometimes leaving out a number is good and even fun!

Play this simple game with a partner. Try skip-counting by twos all the way to 100. If you make it to 100 successfully, start over skip-counting by fives. To increase the challenge, skip-count by threes, starting at 11. In another version of the game, further increase the challenge by snapping your fingers instead of saying the number if it has a four in it (such as 14, 24, 34, 40, 42, 44 and so on). Adapt the games

by playing with several players. Any player who makes a mistake drops out of the game. The last person standing wins.

Activity 2: Horrible-Day Race Game

Objective: Explore faces, vertices and edges of 3-D objects (3-D Objects and 2-D Shapes, Grade 2).

Materials: 3-D solids, scrap paper

To play this game, the teacher must first prepare the object cards. Select 8–10 different objects or things that are mentioned in the story—examples include castle, tooth, paper bag and sweater—and write these words on separate index cards.

Players are divided into teams with two to six players, and one player is appointed as the first to draw. Each team needs several sheets of scrap paper and a collection of 3-D solids.

To start the game, each student drawing first for his or her team approaches the teacher, and the teacher reveals the object listed on the first index card to all of them. The players return to their groups and race to draw the object listed on the card. However, players may not draw freehand; instead they must trace around the edges of the faces on their 3-D solids. The player drawing may not speak or try to act out the word. Once another player in the group guesses the name of the object from the drawing, that player goes up to the teacher and whispers the name of the object to the teacher. If correct, the player is shown the object on the next index card. This player returns to the group and takes over the task of drawing for his or her team. In this way, the team races its way through the object cards. The first team to progress through the entire deck of object cards wins.

The True Story of the Three Little Pigs! by Jon Scieszka

We all know the story. You know, the one about the three little pigs and the big bad wolf? This book echoes the familiar tale in which the cruel wolf destroys the homes of the poor piglets and eats them up. But did it ever occur to you that the wolf might really be innocent? Perhaps the entire incident was the fault of the piglets. Maybe they drove him to it. This is the famous story with a new twist, told from the perspective of the wolf—and maybe he has a point!

Activity 3: House of Bricks

Objective: Place objects on a grid, using columns and rows (Transformations, Grade 4).

Materials: Centimetre grid paper

Try building your own house of bricks, where the bricks are locations on a piece of grid paper. Draw

your house by shading in squares on your grid paper. Each brick is one square. Make a list of all the ordered pairs representing the squares you shaded in. Try reading your list of ordered pairs to a partner and let him or her try to build a house just like yours from your instructions.

Activity 4: House of Sticks

Objective: Observe and build a given 3-D object (3-D Objects and 2-D Shapes, Grade 1).

Materials: Marshmallows and toothpicks

In the story, the three little pigs each build their own houses—one of straw, one of sticks and one of bricks. Try to build the frame for your own house using only marshmallows and toothpicks. How many marshmallows did you use? How many toothpicks did you use? Can you build a frame for a two-storey house using only 13 marshmallows? How many sticks (toothpicks) are needed for this house? Can you build a frame for a single-storey house using only 16 toothpicks? How many marshmallows are required?

Activity 5: Wolves and Pigs Problem

Objective: Communicate and apply positional language in oral, written or numerical form (Transformations, Grade 2).

Materials: Two-colour markers

There are three wolves and three pigs on the same side of a river and they would like to cross to the other side. They have one boat that can hold only two animals at a time. If, at any time, the wolves outnumber the pigs, the pigs will be eaten! How can all six animals cross the river safely?

The Monster Bed by Jeanne Willis (illustrated by Susan Varley)

“Never go down to the Withering Wood!”—you never know what you might find or what might happen. The Withering Wood is special, indeed, because it is home to a family of monsters who don’t believe in humans. The smallest monster is terribly afraid of humans, but his mother assures him that there is no such thing. Just to be safe, the smallest monster decides to sleep under his bed—after all, no humans would think to look for him there! Along comes a truant (human) boy who has found himself lost in the woods. He discovers the monster’s cave and bed and decides to lie down for a little nap. Just as he is about to drift off to sleep, it occurs to the boy to check under the bed for monsters.

Activity 6: Measure a Monster

Objective: Construct items of specific lengths (Measurement, Grade 2).

Materials: Six-sided die, ruler

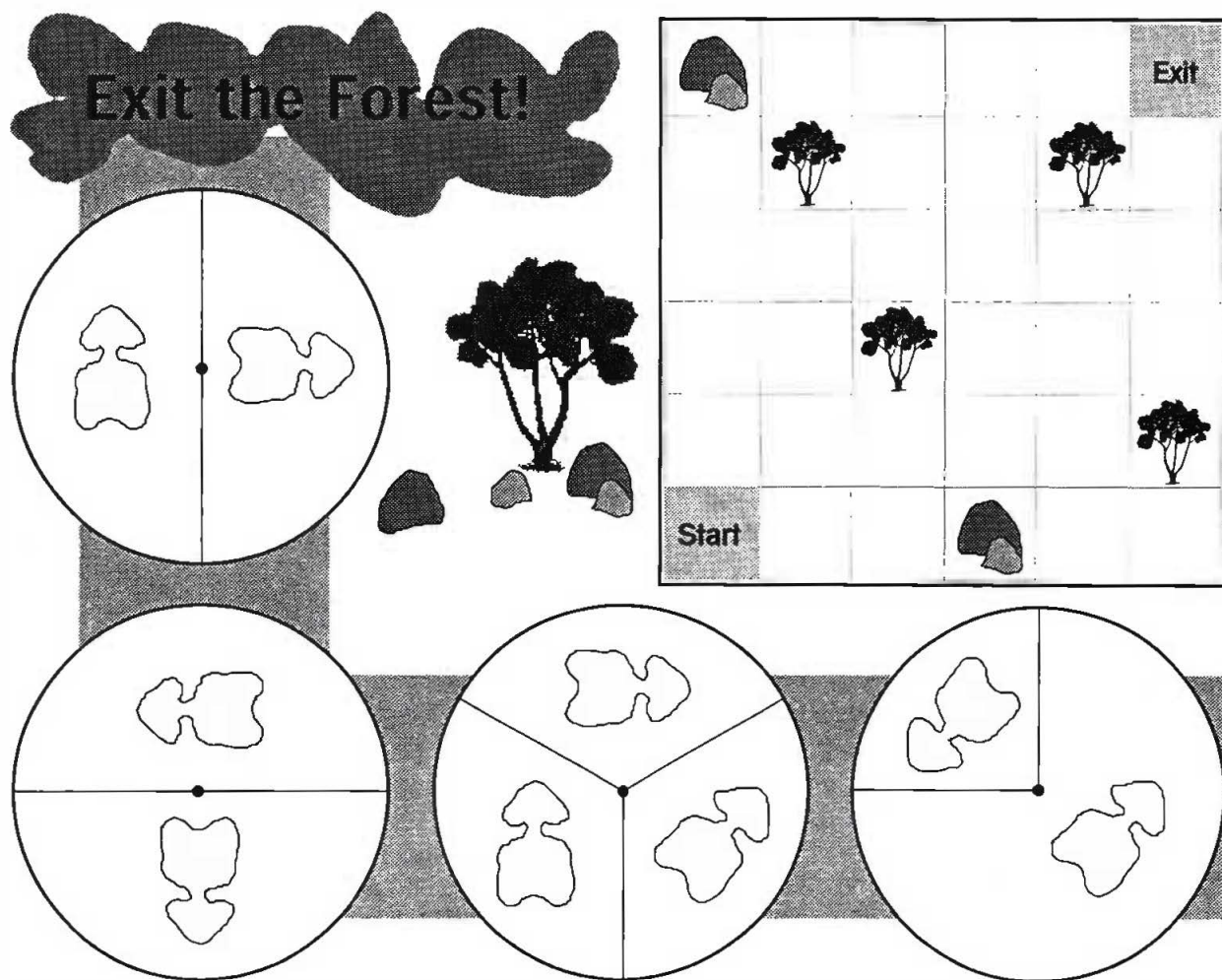
Draw your own monster. Start with a piece of scrap paper. Draw an oval approximately five centimetres long in the middle of the paper. This oval will be the body of your monster. To complete your monster, you need to add a head, nose, wings, legs, arms, ears, eyes and anything else you might choose. To add pieces to your monster, first decide what part you wish to draw and then roll the die to determine how long (in centimetres) that part is to be. For example, if you decide to draw the right leg of your monster and you roll a three, you would draw a leg three centimetres in length. You can add more than one set of arms or legs, or none at all depending on your imagination. Whose monster is the scariest?

Activity 7: Exit the Forest

Objective: Compare outcomes as equally likely, more likely or less likely (Chance and Uncertainty, Grade 4).

Materials: Exit the Forest game board, clear plastic overhead spinner

This is a probability game you can play by yourself, cooperatively with another player or competitively with other players as a race to the exit. To play the game, place a small marker (such as a bean or a block) on the "Start" square in the bottom left corner of the game board. Place the clear spinner on any one of the four given spinner mats and twirl the spinner. Move your marker in the direction spun (one space horizontally, vertically or diagonally). If the game is played competitively, the first player to make his or her way around the obstacles to the upper right corner wins. You may not leave the game board or land on any space occupied by an object or another player.



Alphabet City by Stephen T. Johnson

This is actually a picture book of art; no reading is necessary to thoroughly enjoy this work. *Alphabet City* is a collection of watercolour paintings and drawings that show where many of the letters of the alphabet occur in a city setting. The pictures do not show just how letters are used to form words on signs and so on, but also how the actual shapes of the letters themselves are all around us, if only we would notice. *A* is not for apple in *Alphabet City*; the letter *A* is formed by a traffic barricade. *B* is found on some metal stairs, *C* is found in a cathedral window, *D* makes a great border for a flower garden and so on. Can you guess where the letter *Q* can be found? My favourite is the letter *S*. What's yours?

Activity 8: Symmetry City

Objective: Create and verify symmetrical 2-D shapes by drawing lines of symmetry (Transformations, Grade 4).

Materials: Geoboard, elastics, mira board or mirror

As you look at the wonderful pictures in *Alphabet City* you will notice that many of the letters have more than one line of symmetry. Which letters have one line of symmetry? Which letters have two lines of symmetry? Which letters have more than two lines of symmetry? What words can you make that have a line of symmetry running through the entire word by using the letters? You may need to spell some words from top to bottom on your page to see the line of symmetry.

Try making some of the letters of the alphabet with elastics on a geoboard. Use a mirror or your mira board to explore the letters in the book, and use the geoboard to find all the lines of symmetry.

Activity 9: Word Sums

Objective: Apply a variety of estimation and mental-mathematics strategies to addition and subtraction problems (Number Operations, Grade 2).

Materials: Calculator

Have you ever heard of a two-dollar word? Usually we refer to very long or unusual words as two-dollar words. Begin by making a list of all the letters of the alphabet and writing a number next to each letter showing its place in the alphabet. Write 1 next to the *A*, 2 next to the *B* and so on. These numbers represent the values of each letter. Find the value of your name by adding up the values of each letter in your name. Whose name has the greatest sum? Can you find a word with a value of exactly 100? What about 200?

Blue Sea by Robert Kalan

This story is about a little fish that encounters a big fish, which would like to eat him for lunch, except that along comes a bigger fish. These fish are chased by an even larger fish! How should the littlest fish escape? Each fish is eventually trapped until the little fish swims away safely into the blue sea. This story incorporates many mathematical concepts, including simple addition and subtraction, as well as relative sizes and shapes.

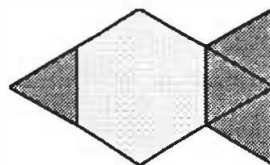
Activity 10: Pattern Block Fish

Objective: Use manipulatives and diagrams to demonstrate and describe the processes of addition and subtraction of numbers to 18 (Number Operations, Grade 1).

Materials: Pattern blocks, pencil crayons

This is a simple exploration activity in which students construct models of simple addition equations. In this activity, students select any number of two different colours of blocks and arrange them to resemble the shape of a fish. The students then write an addition sentence to represent the number of blocks of each colour used.

For example, in the fish below, one yellow hexagon and four green triangles were used. The related sentence is $1 + 4 = 5$.



Ask students to trace the blocks on a piece of paper in the shape of their fish and colour the fish according to the colour of the blocks before writing the addition sentence.

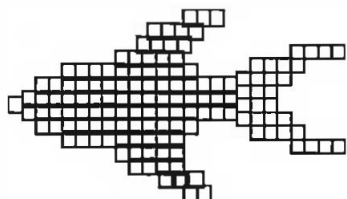
Activity 11: Going Fishing

Objective: Estimate, measure, record and compare the area of shapes, using nonstandard units (Measurement, Grade 2).

Materials: Coloured tiles (or paper squares cut approximately one inch on a side)

In this exploration activity, you will use coloured tiles (or paper squares) to create fish shapes. Whose shape has the greatest area (measured in tiles)? Whose shape uses the greatest number of blue tiles? How about red tiles? Create the best fish shape using exactly 24 tiles. If you build your fish out of paper squares and glue them to a larger page, the children

can create a giant aquarium bulletin board. Develop estimation questions based on your bulletin board display. For example, how many tiles were used in all to make these fish?



The Doorbell Rang by Pat Hutchins

Don't you just hate it when someone calls or the doorbell rings just as you are sitting down to supper? Or even worse, a caller arrives just as you are about to dive into a plate of fresh-baked cookies! In this story, several children are about to do just that—share a plate of cookies—when the doorbell rings and several friends walk in. After the cookies are redistributed, the kids are again about to start eating when the doorbell rings and more friends arrive. This happens over and over again until . . .

Activity 12: Cookie Countdown

Objective: Apply a variety of estimation and mental-mathematics strategies to addition and subtraction problems (Number Operations, Grade 2).

Materials: Chocolate chips (or other small markers, such as gram blocks)

This activity is both a problem and a game, based on the traditional game of Nimh. Start with 21 cookies (chocolate chips or small markers) placed on the table between two players. Players take turns removing (eating) one or two cookies. The player who eats the last cookie wins. How can you make sure that you win each time?

Activity 13: Cookie Dough

Objective: Calculate products and quotients, using estimation strategies and mental mathematics strategies (Number Operations, Grade 3).

Materials: Chocolate chips (or other small markers), one six-sided die

This is a game for two or more players. Each player starts with 20 chocolate chips. The first player rolls a die and divides the chips into groups according to the value rolled. For example, assume a player rolls a three on his or her turn while owning 20 chips. This player would divide the 20 chips into

six sets of three chips with two chips remaining. The remaining chips are given away to the next player, who now rolls the die. Each time, the leftovers are passed to the next player. Players each take several turns. The player with the most chips at the end of the game wins.

Selina and the Bear Paw Quilt by Barbara Smucker

This story is about a displaced Mennonite family during the American Civil War. Those of the Mennonite faith tried desperately to stay out of the conflict and were therefore mistreated by both the North and the South. As a result, many found that they had to relocate to Upper Canada. This is the story of Selina and how her family is driven apart by war when Selina's grandmother is forced to stay behind, unable to make the journey. To comfort her and to remind her forever of her grandmother, Selina is presented with the beautiful bear paw quilt.

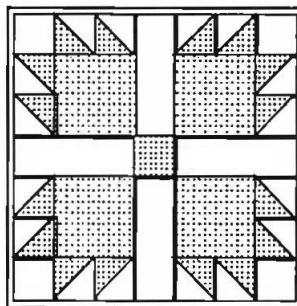
Activity 14: Mirror Quilts

Objective: Recognize motion as a slide (translation), turn (rotation) or flip (reflection) (Transformations, Grade 5).

Materials: Quilt pattern page, crayons

Quilt patterns can be made by applying mathematical transformations to specific shapes or designs. For example, quilts can be designed so that adjacent squares are mirror images of each other (reflections) or so that adjacent squares are turned a quarter turn from one square to the next (rotations). In this activity, students are given a pattern for a quilt (such as the one shown). One student colours the left side of the page using crayons. This page is then passed to another student who colours the right side of the page so that it is a mirror image of the left. For a more challenging activity, ask students to construct quilt patterns or pictures that demonstrate rotations, reflections or dilations.

Please refer to the quilt pattern sheets at the end of this article.



Activity 15: Pattern Block Quilt

Objective: Create, extend and describe patterns, including numerical and non-numerical patterns (Patterns, Grade 2).

Materials: Pattern blocks, paper

In this problem-solving activity, students will attempt to build a quilt design by covering a plain piece of paper entirely with a collection of pattern blocks arranged in a design. The student will write questions about the quilt, such as, How many yellow blocks were used? How many more blue blocks than green blocks were used? If this panel were only one of 12 needed to complete the quilt, how many red blocks would be needed? Students will get a friend to try answering their questions. The friend may then attempt to extend the quilt using the same pattern.

Alexander, Who Used to Be Rich Last Sunday by Judith Viorst

Alexander is a lot like the rest of us: his money is all gone! Have you ever felt rich right after you were paid, and then slowly watched it all disappear as you paid bills, loans and everything (and everyone) else? This is the same thing that happens to Alexander. He starts with a dollar on Sunday but, by the next Sunday, all he has are bus tokens. Alexander's money simply disappears on bad debts, bubble gum and renting snakes. If you had a dollar, what would you spend it on?

Activity 16: A Change of Heart

Objective: Create and recognize that a given value of money can be represented in many different ways (Measurement, Grade 3).

Materials: Coins

Using a collection of coins, students try to solve the following problem: How many different ways are there to make 55¢ using only dimes and nickels? How many more ways are there if you can use pennies, nickels, dimes and quarters?

Activity 17: Dollar 1-2-3

Objective: Estimate, count and record collections of coins and bills up to \$10 (Measurement, Grade 3).

Materials: Coins, one six-sided die

This game is played with two or more players. Place a large collection of coins (pennies, nickels, dimes and quarters) between the players. The first

player rolls the die and, based on the value rolled, takes that number of coins from the pile in the centre of the table and adds them to his or her collection. For example, if the player rolls a 5, he or she can take three nickels and two quarters, or any other combination of five coins. Play passes to the left.

Players try to build a set of coins with a value of exactly \$1. Players can trade in coins—two nickels for a dime, and so on. Players cannot take coins that would take the amount of their collection over \$1. For instance, if the player rolls a 3 when his or her collection totals 99¢, the player simply passes the turn. After a player has collected exactly \$1, he or she tries to collect another dollar. The first player to build \$1, then \$2 and finally \$3 is the winner.

Conclusion

By simply using the main theme or idea of a story—whether it is money or monsters—it is easy to develop a wide variety of mathematical activities to enhance our instruction in the elementary grades. In the activities above, examples of games, manipulatives, applications and problem-solving activities can be found. Teachers should select books and stories that they find interesting because it is likely that their students will find them interesting, too. Consider asking your students to bring in some of their favourite books. Perhaps they would enjoy the challenge of developing and sharing some activities of their own. By capitalizing on the inherent interest and motivation that these stories hold for students, we can introduce increased variety and excitement into our mathematics lessons.

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