

Developing Math Games Based on Children's Literature

THE NCTM STANDARDS for prekindergarten through grade two state that "children's long-term success in math learning and development requires high-quality experiences during the 'years of promise'" (Joyner et al. 2000, 73). The standards emphasize providing environments full of math and language opportunities in which teachers support children's thinking and value their exploration of materials (Moyer 2000).

Many researchers and educators support greater involvement with math concepts in the preschool years through activities that are hands-on (Hunter 2000), natural (Clements 2001), have meaning for children (Zanger 1998; Moyer 2000), and come from everyday life (Kliman 1999). Rather than teach math skills by drilling and rote memorization, teachers can plan rich environments and offer developmentally sequenced opportunities that allow children to explore math concepts in the context of play.

Children's literature has been widely described as a tool to provide hands-on opportunities to apply math concepts and skills (Conaway & Bostick Midkiff 1994; Whitin & Gary 1994; Smith 1995; Kolstad, Briggs, & Whalen 1996; Moyer

2000). Integrating mathematics and literacy creates an interweaving of curriculum rather than a compartmentalizing of academic subjects. Many children's books provide a natural, meaningful path for exploring and exchanging ideas about math concepts. Also, as children often read favorite books again and again, if a math activity is based on a familiar story line, the math experience can be recalled as the book is being read, providing a powerful mental connection for remembering concepts and skills (Moyer 2000).

Possible game styles for math games

Creating games based on books is one way to provide math experiences. Moving from space to space along a game board supports one-to-one correspondence and rolling dice allows for counting with meaning (Wakefield 1997). Spinners allow for numeral recognition and counting practice. Board

Kay M. Cutler, Ph.D., is an associate professor of early childhood education at South Dakota State University in Brookings. Kay teaches early childhood methods and early childhood special education classes and has conducted literacy-based research.

Deanna Gilkerson, Ph.D., is a professor of early childhood education at SDSU. Deanna teaches early childhood education curriculum classes and has conducted mathematical and literacy-related research.

Sue Parrott, M.S., is a child development specialist for an Early Head Start and Head Start program. She was a preschool laboratory instructor at SDSU where she completed research on family and classroom literacy practices.

Mary Teresa Bowne, M.S., is an instructor at SDSU. Mary works at the SDSU Preschool Laboratory as a lab instructor teaching college students how to implement math within the four- and five-year-olds classroom.

Photos courtesy of the authors.



games allow children to utilize these skills (Moomaw & Hieronymus 1995) and more complex skills, such as addition and subtraction, as children grow (Gilkerson & Cutler 2001).

Many different types of games can be developed for preschoolers and children in the primary grades. **Lotto** games let children use their matching skills, practice one-to-one correspondence, and build early counting skills. **Short path games** such as the Snail's Pace Race game have only 10 to 20 spaces but provide children with initial experiences in turn taking as they follow a pathway with a counter (game piece). Following a path requires more abstract thinking than collecting and matching game pieces during a lotto game.

Circular path games allow for turn taking and following the rules of a game, without the distracting element of competition. Instead of moving to the end of a path, children move their counters in a circle around the board and play until they have achieved the goal of the game. Trivial Pursuit is an example of an adult circular path game. Although competition is present in Trivial Pursuit, competition can be omitted by creating a collective goal that all the children can work together to accomplish. **Long path games** add the element of many counters moving on the same path and the possibility of adding more complex elements, such as landing on a special space and then moving forward to a designated space. A commercially made long path game is Candyland.



Making Math Games

1. Select a book based on math concepts children are ready to learn or for the book's story line or content.
2. Determine the target players' ages or developmental levels.
3. Select the style or type of game (lotto and short path games are best for young children).
4. Create your game. Make it flexible. Some games can grow with the children or be used with various age groups by adding simple things like different spinners or cards. If possible, include features that help children learn more than one concept while playing.
5. Be sure to laminate or make your pieces sturdy for repeated use.

Tug-of-war path games provide an additional element of deciding which direction to move along the same path, with the starting space in the middle of the path and two ending spaces at either end of the path.

Games developed from children's literature

It's easy to invent games based on children's books. Some books have built-in math content, such as *The Doorbell Rang*, by Pat Hutchins, which describes the attempts of a group of children to equally divide Grandmother's cookies as more and more children arrive. Or a book might have a story line that sets the stage for a board game, such as *Lunch*, by Denise Fleming, which tells the story of a mouse that eats its way through many different foods during "lunch." The circular path game board developed by the authors, based on *Lunch*, depicts the foods the mouse eats.

Many times the flexibility of the story setting and plot allows for development of games to support

specific math goals. For example, *Counting Crocodiles*, by Judy Sierra, is based on a Pacific Islands folktale about a monkey and a fox who live on the same island. Both animals want to get to another island where a banana tree grows. They convince the crocodiles that live between the two islands to line up and be counted. This creates a path for the monkey and fox to get to the other island and back again. The plot includes counting and problem solving, yet other math goals could be added to the game. For example, players could order the crocodiles by size or make different shapes as they line them up.

To add challenges to the games they create, teachers can provide cards that children draw at the beginning of each turn. Or they can have children perform additional steps if they land on specially designated spaces on the board. To add more complexity in determining how many spaces to move, teachers can provide two spinners—one with colors and one with numbers—or two dice so children can add up to twelve, or a combination of spinners and dice.

Teachers can create a flexible, multiuse game board by attaching clear plastic packets with Velcro to the game board. Different items or instruction cards can be inserted into the plastic packets, so teachers can use the game board for different game themes or to emphasize different math concepts.

Game-making supplies are inexpensive and fairly easy to find. Create game boards using tag board, foam core board, or old game boards covered with contact paper. Look for spinners and dice at teacher supply stores or make your own to match children's math skills. For example, use a small block of wood to make a die with values one to three or four for younger children. Craft shops and discount stores are good places to find counters or other small pieces to move along a game board. For other unusual game pieces, mail order clearinghouses, such as Oriental Trading or U.S. Toy Company, have a variety of items to choose from.

Here are some of our favorite board game ideas for selected children's books.

***Feast for 10* by Cathryn Falwell**

This counting book about a family grocery shopping trip features family members adding items to the shopping cart in groups from one to ten.

Preschoolers can play a manipulative game based on this book. Game pieces include four shopping carts made from six-by-eight-inch tag board. Each cart has a slot in the front. A piece of tag board on the back creates a pocket, so children can insert laminated paper food items glued on tag board. A spinner indicates the number and kinds of items to add to the cart. While reading the story, children twirl the spinner then add the appropriate type and number of food items to a cart. Another way to play is to use just the spinner to determine what to put in the cart.

This game improves children's one-to-one correspondence and counting skills.

***Have You Seen My Cat?* by Eric Carle**

In this book a child travels the world asking various people from different countries if they have seen his cat.

This long path game for preschool and school-age children uses a board from an old commercial game covered with plain contact paper. At intervals along the



path, there are loop-sided pieces of self-stick Velcro. Hand-drawn and laminated paper cats (matching the cats in the book) have hook-side pieces of Velcro on the back and are attached to the corresponding Velcro pieces on the game board. The spinner shows numbers from 3 to 10 and dots of corresponding amounts. Small rubber cats and baskets round out the game pieces.

Children play the game by using the spinner and moving game pieces accordingly. When children

land their game pieces on spaces with cats, they collect a small rubber cat to put in their basket. At the end of the game, children count the number of rubber cats in their baskets. They can also classify the cats using common traits such as color, markings, or pose.

This game helps children with one-to-one correspondence, counting, classification, and matching. In addition, children can predict which cat they will come to first, second, or third as they retell the story while playing the game.

TOBY! Toby Counts His Marbles by Cyndy Szekeres

In this story, Toby searches his room to find his lost marbles. A long path game design is a perfect way for preschool and school-age children to help Toby find and count all of his lost marbles.

Children roll a die to determine the number of spaces to move their plastic Toby tokens along the path. They visit all the places where Toby looks for his marbles in the book. As Toby finds his marbles in the book, children collect the appropriate number of laminated paper or real marbles at each site along the path. Children each have a little bag to keep their marbles in as they play.

At the end of the game, children count how many marbles they have found. They may also sort and organize their marble collections. As older children move along the path, they can use additional interaction cards that support problem solving or performing simple number operations.

This game helps children in counting from 1 to 10 and classification.

Fish Eyes by Lois Ehlert

This counting book invites children to swim like fish “down the river and splash in the sea” to spot various groups of fish and counting their eyes. The book is extremely appropriate for teaching one-to-one correspondence because



Recommended Resource Books

- Diane Thiessen and Margaret Matthias. 1992. *The Wonderful World of Mathematics: A Critically Annotated List of Children's Books in Mathematics*. Reston, VA: National Council of Teachers of Mathematics. ISBN 0-87353-353-4.
- David Whitin and Sandra Wilde. 1992. *Read Any Good Math Lately?* Portsmouth, NH: Heinemann. ISBN 0-435-08334-1.
- Penny Skinner. 1991. *What's Your Problem? Posing and Solving Mathematical Problems, K-2*. Portsmouth, NH: Heinemann. ISBN 1-884834-03-5.
- Sally Moomaw and Brenda Hieronymus. 1995. *More Than Counting: Whole Math Activities for Preschool and Kindergarten*. St. Paul, MN: Redleaf. ISBN 1-884834-03-5.
- Marilyn Burns. 1992. *Math and Literature: K-3*. Sausalito, CA: Math Solutions. ISBN 0-941355-07-1.

the eyes for the fish are cut-out holes on each page.

This manipulative game for preschool and school-age children includes a set of plastic jewels for eyes, laminated paper fish, and a 16-by-20-inch piece of tag board with an underwater sea scene. Children use the plastic jewels to cover each fish eye as they count how many are on each page. The children can also sort, classify, or arrange the laminated fish by size, color, or pattern. Using the game pieces, children can also count out the number of fish on each page of the book.

Joe Can Count by Jan Ormerod

The boy in this story counts different animals in groups of one to ten. A manipulative game based on the story uses 10 tag board strips with large dots indicating numbers one to ten and small items that match objects from the story. Children can place the items

on the appropriate dots as Joe counts in the book. A small plastic cup attached to each tag board strip serves as a collection site. Children take turns using spinners (with numbers 1 to 10) to see how many of the next item they have to count out.

The game focuses on counting skills and one-to-one correspondence.

Eating Fractions by Bruce McMillan

In this book, children eat foods in wholes, halves, thirds, and fourths. Younger children especially enjoy this book and manipulative game.

Laminated food pieces are divided in sections to match the fractions of food shown in the book. Each child receives a set of food pieces to manipulate while reading the book. This is a good hands-on way to introduce fractions to children in a meaningful context.

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