

Sorting, Classifying, and Patterning: Critical to Mathematical Understanding in Kindergarten



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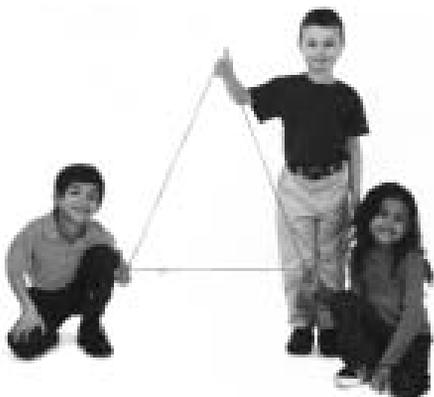
Due to increasingly rigorous national, state, and district standards, it has become imperative that kindergarten teachers begin laying the groundwork for mathematical concepts that will be more fully developed in subsequent grades. It is also vital to help children start to get comfortable thinking about, talking about, and using mathematics as

part of the kindergarten curriculum.

Mathematics is a natural activity for children: they demonstrate a great capacity for learning mathematics long

before they enter school. Children entering kindergarten already have some basic understanding of mathematics (Kilpatrick, et al, 2001, p. 158), and teachers can build upon that experience by encouraging children to communicate about and

extend it. Exploring mathematics can help kindergarten children satisfy and deepen their natural curiosity about sizes, shapes, numbers, and relationships they encounter in the world.



Activity

Shape Puzzles

Whole Group 10-15 minutes **Visual, Tactile**

Materials: 3 sizes of squares, rectangles, and triangles from Learning Tools 20 and 21 (Circles and Rectangles) and (Squares and Triangles)

WHY IT WORKS

1. Cut out several of each shape and give one shape to each child. Tell children that they will use their shapes like puzzle pieces to build a larger shape.
2. On your signal, have children find others with the same shape as they have.
3. Have groups work on the floor or on a table to combine their puzzle pieces to make a larger square, rectangle, or triangle.
4. Invite children to present their completed puzzle to the class. Scramble the pieces to repeat the process.

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SORTING AND CLASSIFYING HELP CHILDREN UNDERSTAND THE NATURE OF MATHEMATICS

As the authors of NCTM’s *Principles and Standards* point out, “Classifying and ordering are natural and interesting to children” (NCTM, 2000, p. 37).

Sorting and classifying objects not only teaches children about attributes and relationships, but also promotes thinking logically and applying rules.

Sorting and classifying exercises can also provide children with models for organizing things in the real world, such as putting blocks away or setting the table for dinner.



First, children learn to compare objects, then categorize or classify them. “Concept development is based on classification, so helping children develop this skill is an important responsibility of a teacher of young children” (Tucker et al, 2002, p. 51). Or, as Bassarear notes in his book, *Mathematics for Elementary School Teachers*, “Learning theorists tell us that a large part of the cognitive development of young children is driven by classification” (p. 41) and classification for kindergarten mathematics begins with ideas of making, describing, and comparing sets.

Kindergarten teachers should therefore involve

children in classroom exercises that require them to “use a systematic classifying scheme to make comparisons among objects” (Sheffield and Cruikshank, 2000, p. 87) and encourage young learners to construct their own sets. Children learn to classify by focusing on attributes of included objects, then later focus on which objects were not included and why. For example, certain people belong in the set called family, and other people do not. Kindergarten can also practice sorting by moving objects into different groups based on observable characteristics such as size, shape, color, or number. By learning to follow rules that take into account the defining characteristics of sets, they are grasping concepts that form a basis for understanding mathematical functions.

PATTERNING: AN INTRODUCTION TO ALGEBRAIC THINKING

We live in a world of patterns, and it is natural for children to describe, extend, and create patterns. By the time they are in kindergarten, children are

A screenshot of a page from a teacher's edition. At the top left, there is a 'Activity' icon. The title of the activity is 'Paper Sort'. Below the title, there are three boxes: 'Small Group', '10-15 minutes', and 'Visual'. The 'Materials' section lists 'Learning Tool 4 (Four-Part Mat)', 'scraps of paper in four colors', and 'glue'. There are three numbered steps: 1. Display the scraps of colored paper and ask how to sort them by color. 2. Give each group scraps of paper and a four-part mat, asking them to sort by color. 3. Have groups glue their sorted scraps and discuss similarities. At the bottom, there is a photograph of a young girl sitting at a table, working on a paper sort activity with a four-part mat and colored paper scraps.

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learning to use the same pattern using different materials or symbols. To alternate clapping with snapping their fingers, for example, is a repeating A, B, A, B pattern. This is the same pattern as day, night, day, night; red light, green light, and so on. Kindergartners can also work with growing patterns, like picture and number sequences, such as 2, 4, 6, 8. By comparing objects to one another and understanding the relationship between pairs of objects, children are demonstrating the ability for transitive thinking: Amy is taller than Betsy, but Betsy is taller than Candice. Who is tallest? Who is shortest?

Children's understanding of mathematical relationships develop gradually over time, and by describing and working with patterns in the world around them, children are starting to use ideas that are foundational to algebraic thinking. As the authors of NCTM's *Standards* suggest, "We need to view algebra as a strand in the curriculum from pre-K on to help students build a solid foundation of understanding and experience as a preparation for more sophisticated work" (NCTM, 2000, p. 37).



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HOUGHTON MIFFLIN MATH: DESIGNED TO DEVELOP UNDERSTANDING

The most important characteristics of a program designed for student success are its scope and sequence. The scope includes a variety of mathematical ideas needed for success in school and life. The sequence of the lessons affects students' ability to understand, retain, and apply concepts or skills that are universal to mathematical proficiency.



In kindergarten, *Houghton Mifflin Math* begins the school year with sorting and classifying in sequential lessons with a single objective for each lesson. Then sorting and classifying are integrated with other math strands throughout the school year. This concept is built upon at every grade level as students learn to:

- Analyze and extend patterns
- Graph functions
- Analyze and sort data into categories to make graphs and tables
- Identify and categorize numbers, such as even and odd, or primes and composites
- Identify and categorize polygons by the number of sides or angles
- Determine the appropriate measure for a given object.



Sorting, classifying, and patterning form the foundational basis for analytical thinking, and “logical thinking is the lifeblood of mathematics” (Hung Hsi Wu, 2001, p. 3). A solid background in these concepts is prerequisite to gaining a working comprehension of algebra, and what NCTM has determined are the five strands fundamental to mathematical learning: algebra, data and graphing, number and operations, geometry, and measurement. A successful math program should therefore teach and reinforce these concepts from an early age, and consistently build upon those strands in subsequent grades. By teaching and reinforcing these important mathematical skills starting in kindergarten, a proactive math curriculum can help children learn from their experiences as they order and make sense of the world around them.

REFERENCES

- Bassarear, Tom, (1997). *Mathematics for Elementary School Teachers*. Boston: Houghton Mifflin.
- Kilpatrick et al. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, D.C.: National Academies Press.
- NCTM. (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.
- Sheffield, Linda Jensen and Cruikshank, Douglas E. (2000). *Teaching and Learning Elementary and Middle School Mathematics*. New York: John Wiley & Sons.
- Tucker, Benny, Singleton, Ann H, and Weaver, Terry L. (2002). *Teaching Mathematics to ALL Children*. Upper Saddle Creek, New Jersey: Merrill Prentice Hall.
- Wu, Hung Hsi. (2001). *What Is So Difficult About the Preparation of Mathematics Teachers?* Plenary Address at National Summary on the Mathematical Education of Teachers.

