To my mother and my father, Nancy and Ted, who showed me how to love children.

And to Laura and Ryan, who gave me a million reasons to do so.

To Gary, who never complained, even about sharing the dinner table with a typewriter for ten months.

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INTRODUCTION

The world of mathematics for young children can and should be a world of inquiry, exploration, and discovery. When early childhood teachers excite young children about mathematics, they can provide more than a good foundation for future mathematical understanding. They can inspire lifelong positive feelings about mathematics.

Hands-On Math is based on these beliefs:

- There is a lot more to early childhood math than counting and recognizing numerals.
- Young children learn best through manipulation of materials and employment of all the senses.
- Concrete activity should precede abstract, pencil-and-paper activity.
- Most early childhood teachers prefer challenging, hands-on math experiences to rote drill and stifling worksheets, but they need a resource to help them provide affordable, easily prepared activities.
- Early childhood education is soundest when it includes parental support and involvement; teachers need ways to communicate with parents about hands-on experience and learning.

How Can This Book Help You?

If you are a teacher of children 3 to 6 years of age, or if you teach remedial math, or if you work with children with special needs, this book has much to offer.

Hands-On Math

1. Provides teachers with math concepts appropriate for children 3 to 6 years of age and with enjoyable, manipulative activities that allow children to discover these concepts.

2. Provides teachers with follow-up ideas that reinforce the concepts presented, result in take-home materials that communicate learning to parents, and provide a transition from the concrete activities in this book to the more abstract activities that will come at later levels. Many follow-ups are in the form of reproducible playsheets.

3. Takes into account time and buget constraints faced by teachers and provides easily prepared activities that require inexpensive (or free) materials, commonly found around the home or classroom.

4. Takes into consideration the needs and abilities of young children, providing activities that are age-appropriate. Motor development, attention span, safety factors, and even nutritional needs have shaped the activities.

5. Combines many areas of the early childhood curriculum with mathematics. Cooking, art, music, large and small motor skills, games, perception, imagination and creativity, language, science, and social skills are included.

6. Provides methods for communicating with parents about hands-on math activities.

How Should This Book Be Used?

This book can be used as *the* math curriculum for the early years or as a resource book to provide basic math understanding in a fun, hands-on way.

Primarily, the activities are designed for children 3 to 6 years of age. When an activity is best suited to a narrower age group, that age group is indicated at the top of the activity. The entire section, "Joining and Separating Sets," is intended for 5s and 6s and is inappropriate for most younger children.

Activities involving numbers and numerals (the symbols that represent numbers) can be tailored to fit particular children's needs. For the most part, 3s would be working with numbers through five, 4s with numbers through ten, and 5s and 6s through ten and beyond.

The main activities in this book, numbered 1 through 121, are concrete; they are designed to precede the follow-ups, which are slightly more abstract. Teachers may choose to use only the concrete activities, omitting the follow-ups. However, follow-ups should *never* be used alone, without engaging in the concrete activities that precede them. This would defeat the purpose of providing hands-on experience before making a transition to a slightly more symbolic activity.

Follow-ups are sometimes in the form of the playsheets found in the back of this book. Playsheets differ from traditional worksheets by allowing for creativity, involving manipulation of materials, and providing a transitional step between strictly concrete and strictly abstract mathematics. Each playsheet may be used as is or modified, according to the needs of a particular class. For example, Playsheet 8 calls for cutting; if your class of 3s finds cutting difficult, do the cutting ahead of time or use a shortened version of the playsheet to require less cutting. Playsheet 3 asks children to glue a reinforcement, a margarine tub lid, a popsicle stick, and a paper clip on top of their tracings; if you cannot collect these items, then, using the idea behind the playsheet, collect and trace more accessible items.

Generally speaking, the activities are best presented in the order in which they appear. The sections on "Shapes" and "Sizes" contain activities that can be interspersed with activities from other

sections. The section, "One-to-One Correspondence," must precede "Counting with Understanding," and both of these, along with "Recognizing and Ordering Numerals" and "Parts and Wholes," must precede "Joining and Separating Sets," since learning is cumulative.

The concrete activities may be used with entire classes or at smaller, teacher-directed centers. Smaller groups are especially recommended for remedial groups, special education, and whenever activities call for taking turns. Follow-ups may be completed at centers or individually.

Following the "To Do" section of each main activity, the benefits to be gained from engaging in the activity are listed. Young children are growing in many areas at once, and the activities contribute not only to understanding math concepts, but to many other areas of development as well. Many activities combine music, art, science, social skills, imagination and creativity, perception and language, or motor skills with math, making the activities part of a total early childhood program instead of isolated events. The "To Be Gained" section indicates areas enhanced by the activity, as well as specific skills to be gained from the activity.

The "To Discuss" section provides suggested questions for discussion. Most are open-ended questions for which there are no right or wrong answers. Children's enthusiasm for discussion is directly related to the teacher's acceptance of their ideas. Positive teacher responses such as eye contact, nodding, and comments (i.e., "Interesting idea!") keep children thinking, imagining, suggesting, and participating.

Communicating with Parents

Because parents can play an important role in the full use of this book, much thought has been given to communicating with them about the book's activities. Parents can help supply materials, reinforce concepts by becoming involved with the products and activities children bring home, listen to children who are excited about the classroom activities, and expand on learning through questions and discussions.

For many activities, the book suggests labeling a child's paper in a particular way. Such labels tell the parents the process used by the children and can initiate parent–child discussions regarding the activities. When a paper is labeled "Timed Marble Roll Painting," for example, parents are inspired to ask how a marble was used and how long a time it required. Without the label, discussion about the activity could be limited or it might never occur.

For some activities, it is suggested that parents be asked to send in materials ahead of time. This is helpful to the teacher and lets parents participate in the activities. They become interested in how the materials are used and engage in more positive dialogue with their children concerning mathematical activity.

The directions found on the playsheets, in most cases, are too difficult for the children to read, but they are provided to help teachers give oral directions and inform parents about how each playsheet was approached.

For some activities, Parent Notes are provided in the back of this book. Directions for activities indicate when these should be sent home. Parent Notes provide parents with information concerning math activities and usually suggest ways to expand learning at home.

Needed Materials

Most of the materials needed for the activities in this book are found or collected easily or purchased inexpensively. Many items are already in your classroom or home or even on the playground. Because the activities encourage learning through manipulation of materials, the materials list is extensive, however:

1. The more you encourage parents to help collect items, the more they will become involved with the activities.

2. You may not need all the materials listed because some activities may not be appropriate for your particular class, or you may use the alternative materials suggested in certain activities.

3. Some materials, such as the Big and Small Bag, the Bag of Halves, and the Bag of Parts, can be prepared by one teacher and then circulated among many classrooms, avoiding duplication of efforts.

4. Some materials are used for more than one activity; for example, gift boxes and lids are used for printing rectangles and squares, for matching lids to boxes, for nesting and ordering by size, and for enclosing matching-sized "gifts." If possible, save collected materials that are reusable.

5. Most activities that require food conclude with using the food for snack or lunch. This allows the food to be purchased within the snack and meal budget.

All of the materials you will need to complete the activities in this book follow, with two exceptions: ingredients for recipes that can be found within each "cooking" activity and some items that you will select (suggestions are given within the individual activities) and that will vary from classroom to classroom. You may want to start gathering materials now or, if storage is a problem, prepare for just one or two activities at a time. With each activity's directions is a list of materials needed for that paticular activity.

Cross-Curriculum Areas Index

The activities in this book extend beyond mathematics, involving and overlapping many other areas of the early childhood cirriculum. The following index can be used as an aid to planning. It indicates curriculum areas, aside from mathematics, that each activity includes.

ACTIVITY	small motor	large motor	language/perception	art	music	cooking	social skills	science	imagination and creativity
1		X	X		X		X		X
2	X		X						X
3	X		X	X					X
4	X		X	X		X	X	X	X
5	X		X	X				X	X
6	X		X						X
7			X						
8	X		X						
9	X		X	X		X			
10	X	X	X				X		
11	X		X				X		
12		X	X				X		X
13	X		X	X					X
14	X	X	X			X		X	X
15	X		X						
16	X		X	X					X
17	X		X						
18	X		X	X				X	
19	X		X	X					
20	X		X			X		X	
21	X	X	X					X	X
22	X		X						
23	X		X	X		X			X
24	X		X						X
25	X		X						X
26	X		X						X
27	X		X						
28	X		X						
29	X	X	X				X		
30	X	X	X						
31	X		X						
32	X	X	X					X	X
33	X		X				X		X
34	X		X			X			
35	X		X				X		X
36	X		X					X	X
37	X		X						
38	X		X						
39	X		X						
40	X		X						
41	X		X						
42		X			X		X		X
43	X		X						
44	X	X	X						
45	X					X		X	
46	X		X						
47	X		X						
48	X	X				X			
49	X		X						
50	X		X						X
51		X			X		X		
52	X	X	X						
53	X	X	X						
54	X		X	X					X
55	X		X				X		
56	X		X				X		
57	X		X						X
58	X		X	X					
59	X		X				X		
60	X		X			X			
61	X					X		X	
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71	X		X	X				X	X
72	X		X			X		X	
73	X		X	X					X
74	X		X						
75	X		X						
76		X	X				X		
77			X		X		X		X
78	X		X	X					X
79	X	X	X		X		X		
80	X		X						
81	X		X	X					X
82	X		X						
83			X				X		
84	X		X						
85	X		X						
86		X	X				X		
87	X		X				X	X	
88	X		X			X		X	X
89	X		X						
90	X		X						
91	X		X						
92	X		X						
93	X		X						
94	X		X				X		
95						X	X	X	
96			X						X
97	X		X			X		X	
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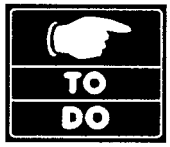
102		X	X				X		
103	X		X						
104	X		X			X			
105	X		X						
106	X		X						
107	X		X						
108			X				X		
109		X	X				X		
110	X	X	X						X
111	X		X			X		X	
112	X		X						X
113	X		X						
114	X		X						
115	X					X		X	
116	X		X	X					
117	X		X	X			X		X
118	X		X						
119	X						X	X	
120	X		X			X		X	
121	X		X				X	X	

Activity 6

Stick Shapes (for 4s, 5s, and 6s)

Dark poster board, 1 sheet
17 popsicle sticks, plus 6 additional sticks for each child
Glue



Cut the poster board into fourths, one for each shape poster. On one fourth, make a square with 4 popsicle sticks and glue. On another fourth, make a triangle with 3 sticks and glue. On another fourth, make a diamond with 4 sticks and glue. On the last fourth, make a rectangle with 6 sticks and glue.

Give each child at least 6 popsicle sticks. Let children make their own designs and shapes for a while.

Hold up the square poster you have made. Let the children observe it and try to make a similar square with some of their sticks on the table. Have the children count to see how many sides their squares have.

Show the triangle poster. Have the children manipulate their sticks to try to duplicate it. Have everyone count the number of sticks in the triangles.

Continue the same procedure with the diamond and the rectangle. Let the children share sticks and work together to make stars, doors, tables, and any other shapes and pictures they want.

Children become familiar with the square, rectangle, diamond, and triangle.

They see that straight lines are needed to create each shape.

Children see some limitations of working with only straight lines and see positive aspects of sharing.

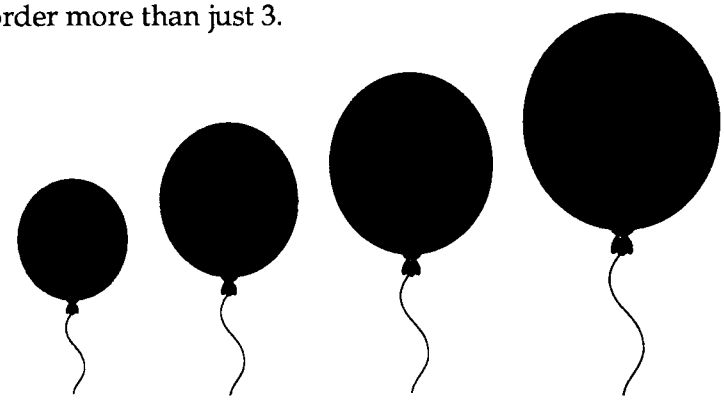
Why did the rectangle need more sticks than the square, when they both have only 4 sides?

Why is it hard to make a heart shape with our sticks?

Follow-Up

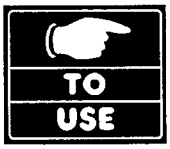
Ordering Paper Balloons

Cut balloons out of construction paper that are small, bigger, and biggest. Have 3 sizes for each child. Have the children place them in size order and paste them to a paper labeled, "I order balloons by size!" The 5s and 6s may wish to cut out the paper balloons for you and to order more than just 3.

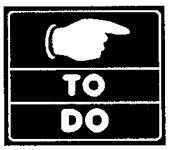


Activity 25

Boxes and Lids



Many assorted-size gift boxes and their lids (ask parents to save them for you)



Remove the lids from the boxes and scramble the boxes and lids on the floor. Let the children try to put the right lid on each box. Children discover that paying attention to the sizes of the boxes and the lids aids in matching.

Select some boxes that will nest inside each other and scramble them. Let the children try to nest them or line them up in increasing or decreasing size order.

Children realize that boxes come in many sizes.

They learn that size plays an important part in matching lids to boxes.

Which box would you most like to get a present in? Why?

Can something good come in a very small box?

Name some small things you would like to give or get as a gift.

Activity 46

Matching One-to-One

TO USE

Wallpaper sample books (ask for free books of discontinued patterns at paint or wallpaper stores)
Scissors

TO DO

Cut a number of pages from wallpaper sample books; select varied designs, colors, and textures. Cut each page in half. Line up one set of halves across the table. Make a pile of their matching halves and give them to the children. Ask each child to feel and look at the wallpaper design he has received and find a matching design on the table. Each child places his design with its mate.

TO BE GAINED

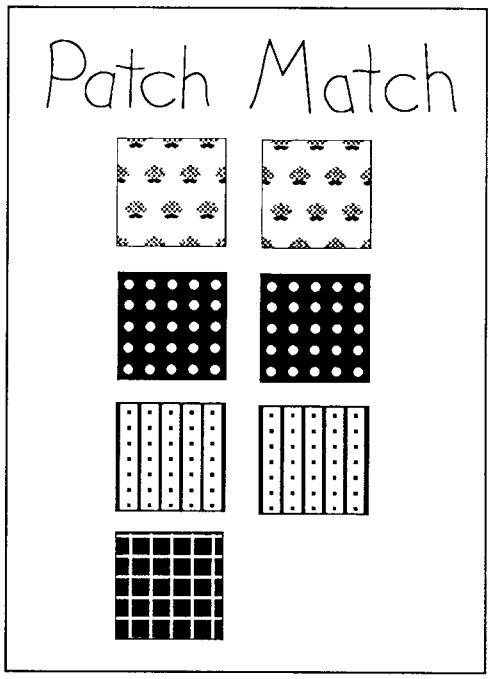
Children discover that each design has one identical mate and one only.

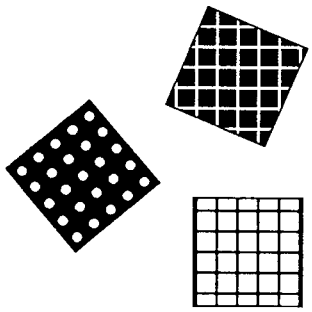
They gain experience in one-to-one matching, noting similarities and differences, and using visual and tactile clues.

Follow-Up

Patch Match

Cut many wallpaper samples from Activity 46 into small pieces (about 1-inch square). Glue at least four wallpaper pieces down the side of each child's paper. Spread the remaining pieces on a table. Have children examine the pieces glued on their papers, and then look for identical mates for each on the table. Have children glue matching wallpaper designs next to each piece on their papers.





Playsheet

5 Cutters and Cookies

Cut out each cookie at the bottom of this paper. Paste each next to the cutter that could have made it!