Motivating Mathematics Materials for the Elementary School

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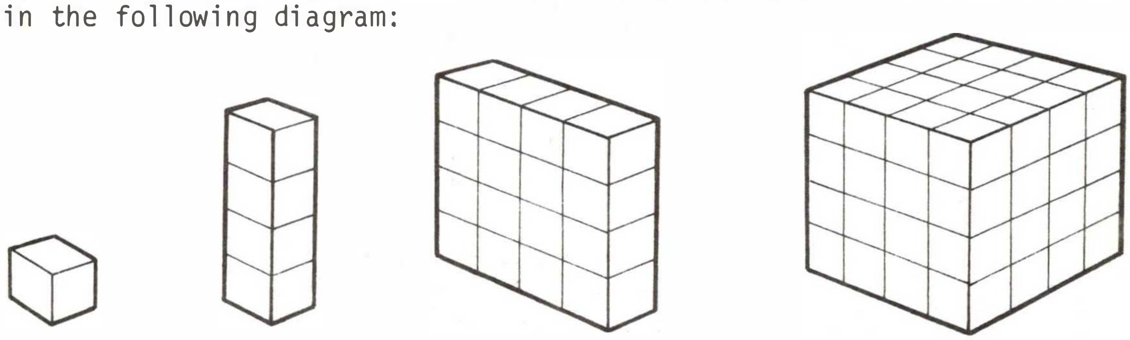
Activities with real things in an experimental setting help children to develop mathematical concepts. Sylvia Farnham-Diggory has shown why mathematics activities are so important: "Neurologically correct instruction in mathematics involves the development of 'strong' connections between the visual and motor systems ... The symbol systems (notational systems) are processed visually and must then be connected to another kind of information (action in the case of mathematics) if comprehension is to happen ... Every school needs to be stocked with materials to provide visual and action-based mathematical experiences for all children."[1]

Certain types of equipment highlight the mathematical concepts taught in the elementary grades more vividly than do others. In choosing materials for the teaching of mathematics, we need to decide which materials help children most in discovering mathematical relationships. Some of the most useful types of materials in this respect are multi-base blocks, the abacus, the geoboard, a set of balances and logical blocks.

A set of materials which teaches the concept of *BASE* is the Multi-base Blocks, invented by Z.P. Dienes. In three wooden boxes, there are very carefully made wooden blocks which represent quantities useful in demonstrating Base Three, Base Four, Base Five, Base Six, and Base Ten. In Base Four, the materials are as shown in the following diagram:

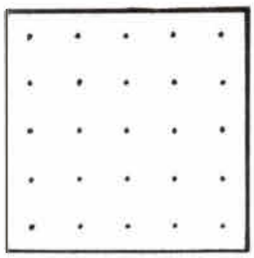


[1]Sylvia Farnham-Diggory, "On readiness and remedy in mathematics instruction", *The Arithmetic Teacher.* Washington, D.C.: NCTM, November, 1968. Pp. 616,621.

Children can learn the meaning of a base system with these blocks apart from the idea of place value. In this way, they can distinguish more readily between the idea of base and the idea of place value.

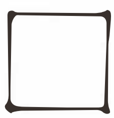
The abacus is useful in teaching place value. The type in which moveable beads can be shifted from the front over the wire to the back can help to clarify the idea that 10 ones can be replaced by 10. Ginn and Co. produces Arithme-Sticks of this kind. For the study of larger numbers to the millions, an abacus having 10 rows of beads is available from Moyer-Vico. A Japanese soroban or abacus could also be used for computing with large numbers. Experienced operators of the soroban in Japan can compute more rapidly than one can use a desk calculator.

An indispensable pupil aid is the geoboard. It can be purchased commercially or can be homemade. Twenty-five nails having round heads are placed in a five-by-five matrix on a six inch by six inch board. A class set of 40 pupil boards and a large demonstration board should be kept in the materials center. A good supply of colored elastics is needed.



The geoboard can be used in teaching the meaning of multiplication. Equal groups can be shown with one color and the total group can be shown with another color. The commutative property and the associative property of multiplication can be discovered by the students with a little guidance from the teacher or with the use of activity cards.

Perimeter and area can be taught using the nail board. Care must be taken here to emphasize that the distance between two nails is the unit of length, and the space enclosed by four nails is the unit of area. Geoboards can also be used extensively in the teaching of geometry in the elementary grades. Concepts such as line segment, angle, polygons can be illustrated by the students on their individual boards.



Geometric solid models may be obtained commercially in clear plastic or in wood. Individual kits provide children with the opportunity to handle and experiment with the models. Poly-O Labs are real time-savers. They contain triangles, squares, pentagons and hexagons made of heavy cardboard. They can be easily attached along the edges with elastic bands. Poly-O Lab C#3043 contains five instruction books plus 100 triangles, 60 squares, 25 pentagons, 15 hexagons, 100

rubber bands. This kit is large enough for 15 students. Students could prepare additional cardboard polygonal shapes as needed. The instructional booklet shows nets and photos or drawings for the five regular solids and for many other polyhedral shapes. Poly-O Labs may be obtained from Book-Lab, Inc., Dept. AT1
11218, 1449 - 37 Street
Brooklyn, New York.

An equalizer balance with 20 washers for weights can be used for discovery lessons in addition, subtraction and multiplication. True or false sentences can be pictured on the balance by the children.

Logical blocks can be used in a variety of ways to build mathematical concepts through experimentation. These blocks consist of sets of large and small circles, squares, rectangles and triangles, each of which has two thicknesses in the colors red, yellow and blue. Games can be played in which a player changes one, two or three attributes during each turn. For example, have the students take turns placing pieces in a line such that the piece being laid down is different from the previous piece by exactly one attribute. If the first piece is a small, thin red square, the next piece to be laid down could be a small, thin blue square. This is the "one-difference game".

Another game which can be played with the logical blocks requires a rectangular grid. The pieces can be placed in such a way that there is one difference in one direction and two differences in the other. To score this game, allow as many points as there are differences between the piece on the board and the one laid down.

The logical blocks can be used with hoola hoops or ropes to show intersection and union of sets. The experimental approach with real blocks can lead to greater understanding than the visual approach through chalkboard diagrams and textbook illustrations.

Experimental work in elementary mathematics is motivating because it results in greater understanding of the major mathematical concepts.