PRIMARY NUMBER THROUGH CONSTRUCTIVE MEASURING: A MANUAL FOR TEACHERS

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A MANUAL FOR TEACHERS

BY

GERTRUDE EMMONS BIGELOW

TEACHER OF MATHEMATICS IN THE BOSTON NORMAL SCHOOL

EDITED BY

WALLACE C. BOYDEN, A.M.

HEAD MASTER BOSTON NORMAL SCHOOL

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sion, and a decided gain in interest in the subject, all of which should make the later work in arithmetic advance more rapidly and be less mechanical.

Masters and teachers alike have expressed a wish to have the work continued, with an earnest request for a manual which can be placed in the hands of the teachers as a guide. The one naturally and logically to undertake this work was Miss Bigelow, a teacher of wide experience, who has herself taught a class of children by this plan throughout the three years, and who has been at the same time the able and inspiring leader in the experiment.

This little book has been prepared in response to the above request, with the hope that it may be useful to those who by their cordial coöperation have made it possible, and also to those who may wish to try the work for the first time.

THE EDITOR.

PRIMARY NUMBER

NUMBER is one of the keys with which the child unlocks some of the doors leading into the wonder room of the world. He begins to use this key very early in life, showing in his play that he recognizes a difference between one and many. Before he enters school, his life experiences have increasingly developed this number sense. The work in the kindergarten helps in the same direction, and he enters the primary school with varying degrees of development but with more or less definite ideas of number. It is the work of the primary school to continue this development: not primarily to teach number facts, though these are important and have their place, but to help the child to get acquainted with number, to develop the number sense. It is the purpose of this manual to suggest some ways of doing this.

Number is essentially a relation, a relation between magnitudes. Hence the ideas of number cannot be obtained through perception alone, although careful observation is necessary that we may obtain definite images of the things to be related. But seeing relations demands more than mere observation; these images must be compared, related one to another quantitatively in many ways that we may get ideas of number.

These truths give us some valuable suggestions for primary number work. If number is a relation between magnitudes, the child who is to get the idea of number must be put directly into contact with material. He must use this material first in getting clear images; and as the power to see relations clearly

depends upon the definiteness of the image, this material must be simple, such as can be easily visualized. Next, since relations reveal themselves through comparison, the material must be used by the child in such a way that he will compare, and as we wish to reveal to him relations of quantity, the material must permit of definite numerical comparisons. Again, since these relations must be seen repeatedly under many and varying conditions, the child must have constant opportunity for constructive work, and hence the material must be such as can be easily handled and used in building many and varied forms. In a word, the material must be in the hands of the child, and must be used by him in imaging, in comparing, and in constructing.

Measures of lengths, surfaces, and solids have been found by actual experience to have characteristics which make them desirable for this work. They give clear visual images, they have definite numerical relations, and they can be freely used in construction. They are also of interest to the child, as he is already familiar with their use through his blocks at home and through some of the gifts in the kindergarten.

The greater part of the work outlined in this manual may be called number work with measures. The other part to be discussed is counting. This is, of course, closely related to measure work — McClellan and Dewey saying that when we count we measure, and when we measure we count. Counting helps the child to get acquainted with number, and therefore has a place in primary work.

The plan of this manual is to outline the work of each of the primary grades in measure work and counting, discussing the material to be used, the work to be done, and the ways of doing it.

GRADE I

MEASURE WORK

The work of the first year in number should be very simple. It is the time to develop the number sense, not to ask for number facts. The purpose may be stated briefly thus: to help the child to become acquainted with number, first by getting clear images, and next by repeatedly discovering numerical relations through comparison and simple constructive work with measures.

The work divides itself naturally into three parts, — work in linear, square, and cubic measure. While each part will be discussed by itself, it is not intended that the work of one shall be completed before that of the next is begun. The connection will be shown as the work goes on.

Linear Measure

Material. — The material needed is a supply of lengths of from 1 to 12 inches. No material can give length alone; in order that the children may handle it, there must be three dimensions. But it is found that sticks, splints, or narrow strips of cardboard generally suggest length, and length only, to the children, as that is the most prominent characteristic. Lines drawn on the board and edges of surfaces and solids are also useful. These lengths must be very accurate, an exact number of inches from 1 to 12. The measures are taken through 12 because of the common use of the foot-rule.

General Lesson. — In seeing relations the child does not begin with the definite numerical relation of twice as long or three inches shorter, but the general relation of longer or shorter. The first lessons should help him to see relations with increasing definiteness.

The greater part of the work of the first grade would be better carried on at a number table sufficiently large for fifteen or eighteen children to gather around. Let us suppose a number of children with their teacher around such a table, ready for the first lesson. On the table are scattered the linear measures 1 to 12 inches long. The teacher directs each child to pick up a measure and place it on the table just before him, then to pick up another and place it by the first. The children are asked to tell what they notice about the measures. When the answers show that length is the important characteristic seen, the teacher suggests that measures of the same length be put together. Let each child continue sorting and matching the measures, until he has several piles, and shows by the way he works that he is beginning to recognize likenesses and differences. Thus far few statements have been required from the children, although some will doubtless have used the terms "longer" and "shorter." Now all the children are encouraged to use these terms intelligently in some such way as this: the teacher directs each child to pick up one measure, to show another longer than this, and asks different children to talk about their measures until they use the phrase readily, "This measure is longer than that." Similar work is done with the terms "shorter," "just the same," "just as long," or "equal," the child always having the measures he is comparing in his own hands, placed in such a position that the fact stated is evident.

Next may come the comparison of his own measure with another's. Each child is directed to take a measure, and the teacher holds one. She tells Roy to look at his measure and at hers, and asks him what he thinks about his measure. The reply, "I think my measure is longer than yours," should at once be tested by placing both together. (Train the child from the first to the use of *I think* when he has not proved his statement, and *This is* when it is a known truth. Train him,

also, to test his judgments, and to say orally or silently, *I am right, I am wrong.*) As this work continues, expect the children to introduce such statements as, "I think Abbie's measure is very much longer than this one," or "I think John's is only a little shorter than mine." This will show that the relations are being seen with increasing definiteness. Thus far no length has been named numerically, as "this 4-inch measure," nor any definite numerical relations seen. But soon some child may say, "I think this measure is two times as long as Harold's." This indicates that he is seeing definite numerical relations, and he should be helped in this by the study of exact lengths. Before considering that part of the work, however, a few additional suggestions for the introductory lesson are given.

Suggestions for the Introductory Work.

This general lesson may continue for several days according to the children's needs. By their quickness in sorting and matching, by their accuracy in comparing, by their ready and intelligent use of language, and by the stating of a relation numerically, they will show when they are ready for the next work. Group together those who have reached this stage of development, and let them advance.

Many and varied exercises are possible in this introductory work for general comparison; a few are suggested.

Group measures according to length.

Select measures to match others (shown by the teacher).

Find measures longer, shorter, very much longer, etc.

Children choose any measure and compare with the one shown by the teacher.

Arrange the measures in steps from the shortest to the longest.

Much of the sorting and matching can be done as seat work or busy work.