INNOVATION IN THE TEACHING OF MATHEMATICS IN PRIMARY SCHOOL

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The tribal children of the North East have been considered to be weak in mathematics. Many of them have even an aversion to or a fear of mathematics. Hence, maths is still an optional subject. However, experience has shown that these children are not less intelligent than others, that their aptitude for learning mathematics is the same as that of any other children in the rest of the country. The reason for their backwardness is that perhaps maths in schools here has not been handled as it should have been keeping in mind the tribal and rural background of the children.

Various attempts have been made during the past ten years to make use of the principles, and to apply these in the teaching of maths to the tribal children. In the process a variety of apparatus has been devised and used in the classrooms with success. The following conclusions have been arrived at from the experience gained in this way:

(1) The mathematical concepts are quickly grasped and fairly well retained when they are learned mainly through the concrete, when learning maths becomes an activity of doing and learning at the same time. Hence the use of the apparatus.

(2) Brightly coloured apparatus seem to yield better results as perhaps they make better and lasting impressions on the young minds.

(3) The tribals of this area, even though illiterate, seem to have a unique way of calculating – adding or subtracting. The children seem to have inherited the genius from their parents. From experience we know that quicker learning is possible with the use of Base-Five for calculations.

The exhibits are some of the apparatus used successfully as teaching aids in a few schools. They have been tried out with children beginning from the children of the pre-school age, where the whole body is involved in the learning process, to those of the Class IV age, where the child is initiated into the beginnings of geometry through the concrete. The following is a list of the aids:

i) Floor discs,
ii) Flannel graph discs,
iii) Disc charts for counting,
iv) Dominoes for teaching of numbers and values,
v) Abacus for place value of numbers,
vi) Pocket boards for pattern making,

vii) Geo boards: *(a)* for pattern making for learning the 2 processes of multiplication and division, *(b)* for introduction to shapes-space-area perimeter, graphs,

viii) Attributes for learning the properties of 4 different shapes and the first stage of fractions.

All these aids have been made with the locally available materials. The children of this area are resourceful and dexterous as they are all of them children of farmers who make their own tools. The aids have been made by the students of middle and high schools where such experiments are carried out, as part of their work experience programme.

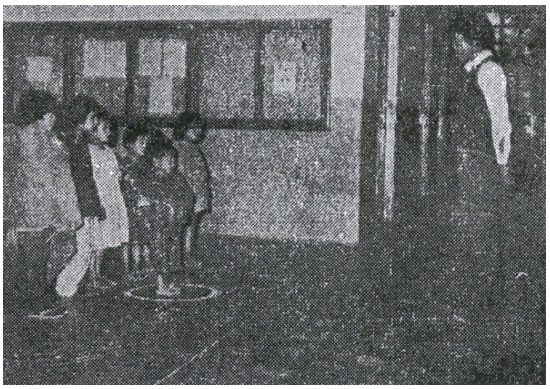
Floor Discs

From experience it has been found that children of pre-school age can quickly grasp the concept of values of the numbers one to ten, with the aid of this method. Not only, the eye and ear, but the whole body is involved in this learning process.

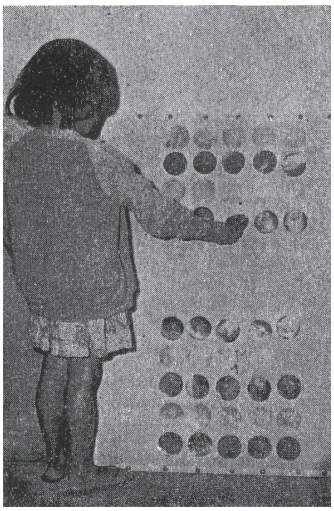
Method : Ten cardboard discs of the same colour are arranged on the floor in front of the class. At the start the child stands a little away from disc No. 1 - a place denoting 'zero'. The child then steps from one disc to the next. At each disc he stops and calls out the number before proceeding to the next disc. Care should be taken that the steps are taken deliberately with a pause at each, before calling out the respective numbers. From disc No.5 to disc No.6, the child does not *step,* but moves with a *jump* using *both feet together,* then proceeds step-by-step as before until disc No. 10 is reached.

Every child in the class should have at least one turn daily for about two months with this method of counting while the rest of the class is lined up facing the discs — disc No.1 being placed to the left of the class and No. 10 to the right. It is not advisable to write the numbers 1 to 10 on the discs as this usually stops mental activity and leads to memory learning, not concept forming. The *jump* between discs 5 and 6 leads the child to the concept:

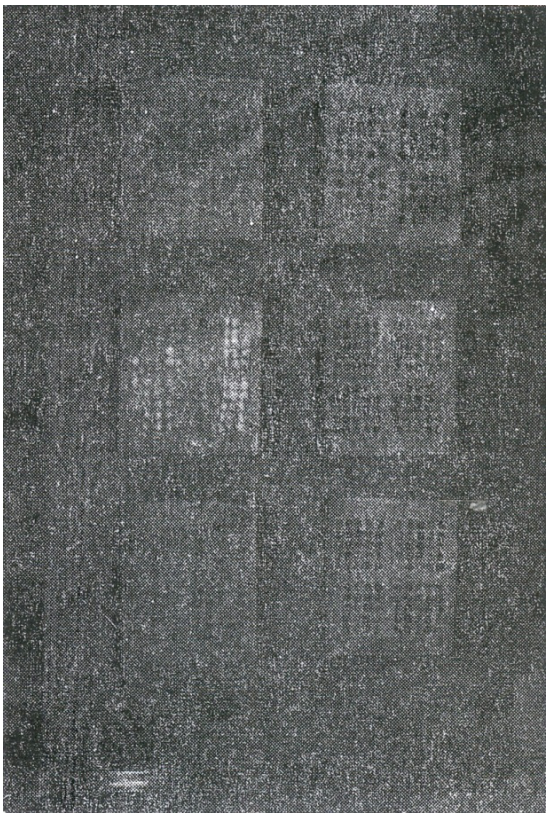
Six is 5 +1; 7 is 5+2 and so on. These mental concepts are very helpful later on for quick and accurate mental work.



Testing : In order to find out whether the children are ready for the next step, the teacher takes his position facing the class with the discs in front of him. The child to be tested and the rest of the class face the teacher and the discs. The teacher then begins to call out numbers. If the child proceeds directly to the required disc, there is the likelihood that mental concepts have been formed. If, on the contrary, the child is not able to identify the disc without counting them all, then it is evident that the child requires more time for the forming of the concepts and should not proceed to the next step.



The learning of numbers up to 100 is a much simpler process if sufficient time is given to this initial stage and the class is not buried through it. Each group of succeeding ten will take about a week. A hundred discs of alternate contrasting colours would be ideal—red and green or red and black—if space permits, 100 floor discs are the best. As a playground activity, this method proves enjoyable.



Flannel Graph Discs

When floor space is not available for the learning of number 1 to 100 the above method should be used to teach numbers 1 to 30. Once the groupings of tens become familiar to the child, the teacher can switch over to the flannel graph board. Here the discs should be of the same colour as those of the floor discs. This is a good classroom exercise. The discs can be easily removed and replaced; the board itself can be seen by the whole class; there is much movement—of discs as well as of children who

have to come forward and remove or replace discs as directed by the teacher. It encourages a great deal of concentration, alertness and mental activity. It is also a good testing apparatus, which enables the teacher to judge the progress of individual children.

Disc Charts

Using the same arrangement of circles, and the same colours, skip counting charts could be introduced in the first year. It would be good to keep the colour scheme the same for the following groups:

(a) groups of tens and fives;

(b) groups of twos; fours; eights;

(c) groups of threes; sixes; nines; and

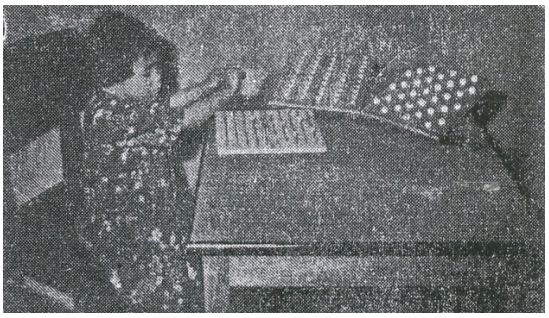
(d) an entirely different colour combination for groups of seven.

Here again the charts are smaller, the whole mental picture becomes clearer. If the circles are closer with no gap between five and six (only a dividing line to help), the colour patterns formed by various groupings becomes quite clear and will form clearer mental pictures. This will be of great advantage in future work with multiplication tables and when learning division.

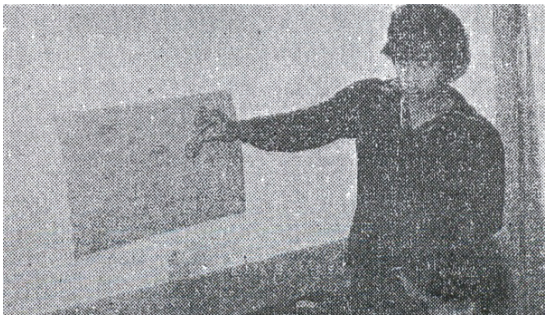
Individual Disc Charts

Children are provided with individual disc charts and are asked to colour the circles, numbers being called out by the teacher. Speed and accuracy are what are aimed at. If different colours are used the patterns are clearly depicted. Patterns should be previously prepared by the teacher. Patterns greatly facilitate the teacher's correction which can be done at a glance. This exercise makes the children alert to probable patterns that emerge while they are colouring.

Geo Board



At this stage the geo board could be introduced, to supplement the learning process. Here again, the moving of coloured beads and the emerging of patterns are two important factors in the process of learning and of fixing the various number groupings. The geo board is a plank of wood thick 1/2 "and 22 cm square. On it are nailed small nails—1/2 "high and 2 cms apart. Across the middle of the board and the down the middle of it are painted lines which take the place of the gap on the disc charts. This line makes for quick calculation.



Pocket Boards

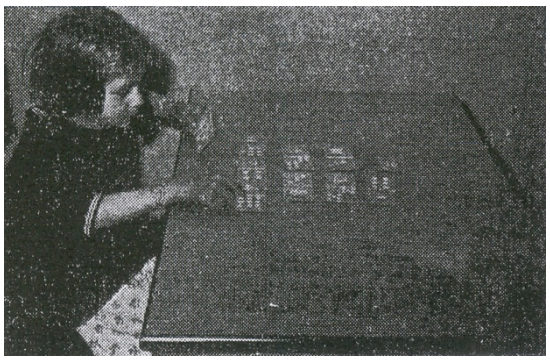
The aim in using these boards is three-fold:-

(a) learning the value of the numbers 1 to 20,

(b) learning the component parts of numbers, and

(c) pattern making.

The teacher places his discs on his board and the children copy the patterns on their boards. This helps concentration; careful placing of discs and selection of colours; later children are made to discover patterns of their own, given a fixed number. Incidentally, the children learn the component parts of numbers by using two or more colours when forming their patterns.



Dominoes

A common game which could be used effectively for testing children's knowledge of the numbers and their values. Each set consists of eleven cards of plywood, carrying the numbers 1 to 10 and groups of coloured dots. No two sets should be similar. The game begins by placing the card that carries a group of dots and a blank. The child is asked to place the cards in such a way that the number corresponds in the number of dots, until he arrives at a blank card. This game is self-correcting. If the child arrives at the last blank card and still holds cards in his hand, he has probably made a mistake and is asked to shuffle up the cards and start all over again. Since no two sets are alike, this game is a good test of speed and accuracy, if a time limit is given.

The Decimal Abacus

This bit of apparatus could be used in the first two years of schooling to teach the place value of numbers up to 1000. A quick and sure means of fixing the place value in the mind of the child is the use of specific colours.

White—for units

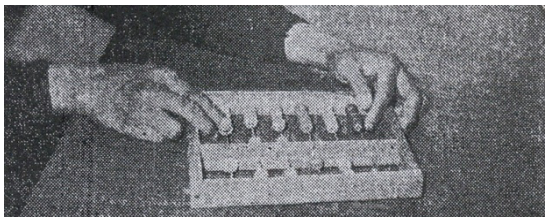
Light pink—for tens

Light green—for hundreds

Red—for thousands

The colours chosen are the same as those used in the Australian Quissinaire method.

The Chinese Abacus



This apparatus is helpful for calculation up to one lakh. Though it has not yet been introduced into the classroom, individual children have taken to it readily and easily. It seems to fit in with some method of calculation of the locals. The fact that each bead on the top half stands for a group of five, does not pose a difficulty. In fact, it facilitates their method of calculation which seems to be in groups of five rather than in tens.

Attributes

A set consists of:

(a) squares 4" . . . .5 each of the four colours: red, blue, green and yellow

(b) squares 2". .. do

(c) circles 4" diameter... do

(d) circles 2" diameter... do

(e) rectangles 4"x 2" ... do

(f) rectangles 2"x 1"... do

(g) triangles 4" (equilateral)... do

(h) triangles 2" (equilateral)... do

A wealth of concepts can be gained through this set, beginning with the pre-primary stage right up to Class IV:

(a) differentiating the four basic colours,

(b) discovering 4 different shapes,

(c) discovering 2 different sizes,

(d) discovering differences in lengths, breadths, angles,

(e) first ideas of fractions, quarters, eights, thirds, sixths, and

(f) pattern making.

Geo Board (Geometry)

Much practice on these boards is essential if children of the primary classes are to move to more abstract forms of thinking in the study of theorems, and the solving of riders. The Geo board besides being an endless source of interest, is a simple and sure way of forming concepts.

(a) Being with plotting of points—north, south, east, west, with the help of coloured beads.

(b) Joining of points with rubber bands forming various kinds of lines—horizontal, vertical, perpendicular.

(c) Forming of angles with rubber bands of two colours—one of the arms should be stationary while the other is moved around to form acute, obtuse, right, straight or reflex angles.

(d) The idea of square measure, perimeter, properties of various figures—3-sided, 4-sided or more—can be *discovered* with the help of rubber bands.

(e) Plotting of graphs—the x and y axis could be learned with the help of the same rubber

bands in the form of various games. In all these forms of learning the stress is on *discovering facts* for themselves.

The above apparatus are designed not to *teach* certain facts but to enable children to *acquire* and *build* up concepts, *discover* facts and, above all, to bring about a quickening of mental activity. These tribal children are on the whole sluggish in their way of thinking. Their reasoning is very slow, but accurate and steady. One of the reasons could be their home background: there is no colour in their homes—no toys, no place for play—they are strapped to their mothers' backs during their most formative and impressive years. Girls have heavy loads laid on their heads from very tender years which perhaps is the reason why they are slower than boys, in thinking.

These learning methods can be introduced by opening crèches where the children are exposed to the influences of colour and play things. They are almost incapable of abstract thinking in their early years, but learn very quickly whenever there is concrete to work with. For this, a variety of opportunities should be given to them in their early years.

Cubic measure, liquid measure, money and time are some of the topics that have yet to be covered by the experiment.