APPROACHES OF TEACHING MATHEMATICS

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Mathematics can be learnt and taught joyfully as the subject starts from day one as the child is born and raised at home. The different components of Mathematics like number, numbers operation, space, shape, measure, pattern and data handling can be taught through hands on activity and experiential learning. This paper highlights how the teaching can be made fun and joyful to the students from early days. This study explores the efficacy of the constructivist approach in primary mathematics education, specifically focusing on the teaching of concepts related to numbers, shapes and patterns. The research endeavors to observe the impact of this innovative pedagogical method on students' learning and their overall engagement with the subject.

Keywords: Approaches, Teaching, Mathematics, Numbers, Pattern and Shape

INTRODUCTION

Constructivism is basically the theory of how people construct knowledge. It is based on the observation and how child learn. It advocates that children construct their own understanding and knowledge by experiencing and reflecting on those experiences they observe in their surroundings. When we see something, we ask questions, explore and assess what we know. Confrey (2006) mentions, "As a grand theory, constructivism served as a means of prying mathematics education from its sole identification with the formal structure of mathematics as the sole guide to curricular scope and sequence. It created a means to examine that mathematics from a new perspective, the eyes, mind and hands of the child."

In the classroom, the constructivist learning point out towards different things, like different teaching procedure. This is the process where teachers encourage using active technique (real word problem solving, experiments) to construct more knowledge and talk, discuss among themselves and to understand the concept. In this process teachers help the children to explore the different activities and constantly assess their progress. By questioning themselves about different activities continuously in the classroom, the classroom becomes a place of learning. Vygotsky (1930) suggests, "Investigations of children's thinking when they are required to transpose a relation learned with one set of stimuli to a similar set have shown that their transfer is nothing more than remembering with respect to isolated instances. Their general representations of the world are based on the recall of concrete instances

and do not yet possess the character of an abstraction."

Therefore, by using constructivist approach of learning in classroom we provide ample opportunities for these isolated instances of learning which can later be recalled by the learner in other stages of mathematical learning.

In constructivist approach of teaching, teacher's job is to facilitate the children's learning process. Thompson (2020) states that, "The use of constructivism in the mathematics classroom has many variations. The one thing that these variations have in common, however, is the central role of the student in the learning process." The very important aspect of this learning process is student themselves setting the goals of their learning and it helps them in their own assessment. This process helps them to keep their own portfolio so in latter stage it helps them to see their different stage of change among themselves. Teachers can see in their portfolio what new knowledge the students have created; what students has learned and how the learning environment is changing periodically. Through collaboration among students in this process, the learning takes place among the peer in the class. In constructivist classroom the problem students solve through inquiry, investigation and variety of resources, helps them to do new problem more easily in future. Thompson (2020), also concludes in his study that, "Mathematical knowledge is actively constructed through a process called reflective abstraction."

National Curriculum Framework (NCF-2005), while talking about curriculum areas in mathematics mentions, "Developing children's abilities for mathematisation is the main goal of mathematics education. The narrow aim of school mathematics is to develop 'useful' capabilities, particularly those relating to numeracy-numbers, number operations, measurements, decimals and percentages. The higher aim is to develop the child's resources to think and reason mathematically, to pursue assumptions to their logical conclusion and to handle abstraction. It includes a way of doing things, and the ability and attitude to formulate and solve problems." (NCERT, 2005)

Keeping this goal of mathematisation in mind, during my field visit, I carried out various activities related to the concept of numbers, pattern and shape to firsthand witness how children's construct knowledge when given concrete objects to assist their learning of abstract ideas in mathematics.

Methodology

A field visit was conducted where students in primary classrooms of government schools were asked to perform various activities on the concept of numbers, patterns and shapes. The activities were guided by the suggestions made in Mathematics Teacher's Training Manual for the topics mentioned (NCERT, 2010). The students were observed and asked questions during and after the activities for each module. The observations and findings from the field were then reported supported by the images from the field.

Teaching Numbers

Number generally starts from beginning of our life and goes on further and further till our life ends. For example, if you ask question what

students mean by number, various responses may come. The responses can be: we have seen numbers in house, bus, road, etc. But if we ask question where the number ends, then there might be silence in the class regarding the same. Mathematics Teacher's Training Manual when talking about recognising and writing numerals says, "Learning the numeral becomes more meaningful for children if they are familiar with numbers"(NCERT, 2010). It then adds on to tell how using concrete objects can help students in internalising the concept of numbers.

If we start teaching the concept of numbers with concrete object and ask learners to count the pile of beads, pebble, etc. they will count and may answer 10 or 15 as per as the existence of pebble and size of marble. Again, if we ask to add one more pebble in the pile of pebbles and ask them to count, the child can answer that without counting the number of pebbles. If we keep on increasing the pebble then the child can answer without counting in every situation as we add more pebble in the pile of pebble. By teaching with this approach in the classroom a child may have clear understanding that the number keeps on increasing as we keep on adding pebble, etc. This may further help them to answer the question asked previously about where the numbers end.

Activity: To understand the constructivist approach more, I organised an activity on numbers during my field visit. I gave children blocks and they drew some structure with it. Then I asked them to count the number of blocks to make the structure and write the number. They counted and told the number of blocks required to construct the shape. Therefore, this activity helps students to get familiar with numbers and perceive them in a meaningful manner. Below are some figures showcasing the work done by children in primary classroom to understand the concept of numbers using building blocks.

The activities in Figure 1, 2 and 3 corresponds to learning by constructing the idea of numbers in child's mind by using unit blocks at a time and slowly building on those blocks. At this point, the child is not just memorising numbers but actively using it to create something which thereby helps them to understand more concretely how numbers are perceived in real life. Through this activity I further found that the concept of one more, one less, two more, two less, five more, five less, etc. can be made clear to the children if we ask them to add or remove blocks from the structure made by them.

Fig.1. Student is showing block made by her

Fig.2. Student is showing blocks made by her

Fig. 3. Student is showing blocks made by her

Teaching Patterns

To teach students pattern, we can ask the children to identify things from their daily life. This may include the shirt they are wearing, flower, tree leaves, etc. and discuss among themselves the findings. Mathematics Teacher's Training Manual while talking about patterns says, "The word 'pattern' can have different meaning such as decorative designs, figures, motifs, shapes, etc. It can also mean a regular arrangement, order, sequence or repetition." (NCERT, 2010) Through this activity I have tried to inculcate both the meanings of patterns into one. The decorative designs and motifs were to give the idea of how patterns can be visualised with concrete objects, whereas the other aspect of order or sequence was later discussed for the mathematical treatment of the topic.

Activity: To make them understand more clearly about patterns mathematically, we can write number 1, 2, 3, 4, 5....., etc. and ask the children what they have observed. The responses might be that they have not observed anything. It means that they have seen something but can't explain it. But if we remind them of the concept of patterns that they learned through decorative designs and motifs, which they have observed while making decorative designs, it can help them to observe the pattern with relative ease and describe the hidden observation by their own words. After this if we ask them to describe the above number series, i.e., 1, 2, 3, 4, 5....., etc. they may say that we get every next number by adding one in the preceding number or that there are infinitely many numbers in their own words.

Figure 4, 5 and 6 shows how students have drawn various patterns using papers and how in all these figures there is an innate idea of symmetry associated within. This same symmetry was later discussed using numbers to develop conceptually connected isolated instances of learning among students.

The same activity can be done for other number series like (2, 4, 6, 8, 10,...); (3, 9, 12, 15,...); (4, 8, 12, 16, 20,...), etc.

Fig. 4. Some patterns made by children

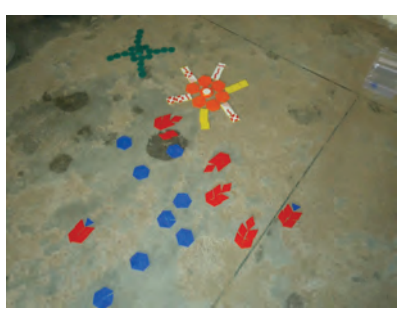

Fig. 5. Some patterns made by children

Fig. 6. Some patterns made by children

Teaching Shape

Mathematics Teacher's Training Manual says, "The children should be encouraged to freely use the language of daily life while describing and naming shapes." (NCERT, 2010). In my first encounter with the children in the classroom I asked them what they understood by shape. In their responses, some talked about the shapes through leaves, paper, box, television, book, ball, etc. When I asked about the description of those shapes, they were able to tell that the ball is round, box is small or big, television is big or small, leaves are big or small. This shows that when the children were given opportunity, they will describe the object in their own home or local language.

Activity: Although for small children the concept of shape at Primary Stage is new, but they were aware about the shape and were able to explain about that object. In this activity, I asked them to draw some objects in their notebook. In the three-step process within this activity students were asked to:

- Describe the shapes of various familiar objects in their own vocabulary.
- To identify different parts of objects, like edges, corner and faces.
- To communicate the association between an object and shape.
- Place an object on the piece of paper and draw it on the paper.

Below I have shown in Figure 7, 8 and 9 shapes which were actually drawn by the children of Class II during field visit. It is interesting to note that the understanding of shapes among students highlights their understanding of the natural world in which they live.

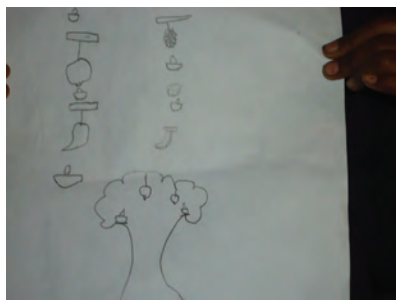

Fig. 7. Some shapes made by a child

Fig. 8. Some shapes made by a child

Fig. 9. Some shapes made by a child

CONCLUSION

In conclusion, the observations from the field demonstrate that the use of the constructivist method to teach mathematics in primary classes produce extremely positive results. Students actively created their grasp of numbers, shapes and patterns in an engaging and dynamic learning environment, and impressive gains in their mathematical knowledge about the topic were noticed. In addition to that student demonstrated deep comprehension and enthusiasm for the subject through hands-on activities and real-world applications. The approach fostered collaboration, critical thinking and creativity, enabling students to apply their knowledge in diverse contexts. This approach not only equips students with foundational skills but also nurtures a lifelong love for mathematics, fostering confident problem solvers. These observations recommend further integrating constructivist approach in the teaching and learning of mathematics, especially at the foundational level and further research in the arena.

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