Concept of Mathematics Lab

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NCERT

BASIC PRINCIPLES OF METHODS OF TEACHING MATHEMATICS

- Mathematics has always been the most important subject in the school curriculum.
- Traditional mathematics teaching has been found to be unsatisfactory.
- During recent years the demand has grown to make mathematics teaching more imaginative, creative and interesting for pupils.
- Clearly the demands made on the mathematics teacher are almost unlimited. The teacher must have a specialized understanding of the foundations of mathematical thinking and learning.
- He/she should also possess skills to put together the whole structure of mathematics in the minds of his/her students. He, like a master technician, should decide what kind of learning is worth what; realise and make use of motivation and individual differences in learning.
- He/she should be able to translate his/her training into practice. Finally, he/she should plan or design the instruction so that an individualized discovery-oriented (or problem-solving) learning is fostered.

Principles of Child Development and Learning

- How does one teach most effectively ?
- Very simple : teach the child in the way he learns best.
- Therefore, it is necessary that the teacher understands how a child learns, and the factors which affect learning.
- Thus, the teacher has to understand the way in which growth and development affect learning.
- A child learns best when he is clear about the purpose or goals to be achieved. It is better if he/she is guided by a self-selected goal. His/her purpose determines what he learns and the degree to which he learns.
- Children grow physically, mentally and socially at different times and with different growth rates.
- Various growth curves giving data about heights-weights, age, intelligence and interest or aptitude inventories which apply to children of a given age group are available. However, deviations are observed many a time in a given group of children.

Principles of Child Development and Learning cont..

- The studies of Jean Piaget make it clear to us that a child's mental growth is a continuous process from birth and that his thought processes are by no means those of an adult.
- The stages of cognitive development which Piaget claims are important for the teaching of mathematics are:
- Stage 1 : **Sensory motor operations** : This stage lasts for about the first eighteen months since birth.
- Stage 2 : **Concrete thinking operation**: This stage lasts until about eleven or twelve years of age.
- Stage 3 : **Formal thinking operations** : This stage comes to form at the age of about fourteen or fifteen.

Principles of Child Development and Learning cont..

- The actual age at which each age is attained varies considerably from child to child because of the differing cultural backgrounds and environment. There is no clear borderline between the end of one stage and the beginning of the next.
- However, what is important is that Piaget considers that the order in which the stages appear is fixed and this provide a framework against which we can examine the teaching strategy.

Principles of Child Development and Learning cont..

- Learning is a continuous development process. It is change in behaviour brought about by thinking while facing situations that call for making discoveries, recognizing patterns and formulating abstractions or generalizations in mathematics.
- A child grows through experiences which provide both security and adventure. A learner learns what he does himself. Inefficient rote learning does not cause permanent learning and results in frustration and dislike for the concept/subject.
- If an experience is motivating only then it stimulates the creative faculty of the child and encourages exploration and ensures the fullest development of the child's mathematical potential.
- "Learning by doing" or the "discover approach" through carefully controlled situations or chosen problems has proved to be a sound teaching strategy and a highly motivating activity.

Principles of Child Development and Learning cont..

- A closer examination of the vast literature on "mathematics learning" reveals mainly four levels or steps of learning.
- 1. Readiness  2. Experimentation  3. Verbalization or symbolization 
  4. Systematic generalization
- The necessary conditions leading to the acquisition of new responses are
  - (1) Real situations: first-hand experiences with concrete things,
  - (2) intuition, exploration, discovery through investigation,
  - (3) formulation : verbal or symbolic representation based on logical reasoning and
  - (4) assimilation, classification, generalization or concept formation through thinking and reasoning.
- New concepts are developed as an extension of previous learning. The process of learning as well as the product should be emphasized.
- Generalizations in mathematics are formed inductively and applied deductively.

Rationale behind Mathematics Laboratory

- Mathematics should be visualized as the vehicle to train a child to think, reason, analyse and articulate logically.
- Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning.
- With the introduction of computers in schools, educational computing and emergence of learning through understanding of cause-effect relationships and the interplay of variables, the teaching of Mathematics will be suitably redesigned to bring it in line with modem technological devices.
- The teaching and learning of Mathematics should enable the child to consolidate the mathematical knowledge and skills acquired at Primary stage.

Rationale behind Mathematics Laboratory cont..

- Assimilated knowledge of mathematics should enable the child to solve the real-life problems by developing abilities to analyse, to see inter-relationship involved, to think and reason.
- To develop the ability to articulate logically.
- To develop necessary & sufficient skills to work with modern technological devices such as calculators, computers etc.
- To develop appreciation for mathematics as a problem - solving tool in various fields, for its beautiful structures and patterns etc.
- So, in order to develop creative and original thinking and gain practical experience of mathematical concepts, assumptions, assertions and rules an appropriate communicative method to disseminate the knowledge of mathematics was required.

Need and Purpose of Mathematics Lab

- It provides an opportunity to students to understand and internalise the basic mathematical concepts through concrete objects/ virtual activities and situation.
- It enables the students to verify or discover several geometrical properties and facts by using models or paper cutting and folding techniques.
- It helps the students to build interest and confidence in learning the subject.
- The laboratory provides the opportunity to exhibit the relatedness of mathematical concepts with every day life.
- It provides greater scope for individual participation in the process of learning and becoming autonomous learners.
- It provides scope for greater involvement of both the mind and the hand which facilitates cognition.
- The laboratory allows and encourage the students to think, discuss with each other and the teacher and assimilate the concepts in a more effective manner.

Approach

- The mere repetition of tasks by students-whether manual or intellectual-is unlikely to lead to improved skills or keener insights or develop such innovative ideas.
- Mere practice of calculating answers to predictable exercises or unrealistic "word problems," leads to memorization of concepts of topics of Mathematics.
- The students to learn to think critically, analyse information, communicate scientific ideas, make logical arguments, work as part of a team, and acquire other desirable skills unless they are permitted and encouraged to do those things time and again in many contexts.
- Learning often takes place best when students have opportunities to express ideas and get feedback from their peers. But for feedback to be most helpful to learners, it must consist of more than the provision of correct answers. Feedback ought to be analytical, to be suggestive, and to come at a time when students are interested in it. And then there must be time for students to reflect on the feedback they receive, to make adjustments and to try again-a requirement that is neglected, it is worth noting, by most examinations-especially finals.

Approach cont..

- So, a proper strategy and a proper platform for teaching mathematics are the need of hour.
- The Mathematics Laboratory has already been introduced in most of schools affiliated to Central Board of Secondary Education.
- However, its utility is in the context of bringing teaching learner centered is still a question-mark. The reason for this, the laboratory is neither used in a constructive way nor any new strategy being employed to teach mathematics.
- Teachers using Mathematics laboratory are found to be using age-old methods of teaching. For instance, to teach the concept of the sum of three angles of a triangle is supplementary, teachers use either static models or repetitive method or if computer used display of PowerPoint Presentation, which are no different to teacher centered techniques.
- Further, the laboratory concept was introduced mainly to provide hands-on-experience to students and thereby enable them to see a link between knowledge assimilated with real world situations.
- The mathematics Laboratory undoubtedly a right platform and it would definitely serve as a tool to the students to understand and discover the beauty and importance of mathematics as a discipline, also enhances the student's understanding of the subject as taught at the school and provides a glimpse of what is beyond, provided, a strategy for teaching mathematics in a Laboratory atmosphere is appropriate and a learner centered one.