

# ***INNOVATION IN MATHEMATICS TEACHING***

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## **INTRODUCTION:**

Mathematics plays an important role in accelerating the Social, Economical and Technological growth of a Nation. Today the world mostly depends upon Science and Technology demands more and more Mathematical knowledge. India is one of the nation rapidly moving towards Globalization in all its aspects requires strong base of mathematical knowledge to face the challenges of modern technological society the teaching and learning Mathematics assumes grater significance in the present century as most of the people using Mathematics to meet the challenges of the society.

The twenty first century is characterized by the emergence of multiculturalism due to industrialization, urbanization and globalization. Since education is viewed as an instrument to develop the cognitive qualities, tolerance and understanding of people, it should prepare the younger generation to understand and face the realities of globalization. In this context, the schools and the teachers have more responsibilities in molding the character of students.

Professionalism demands teachers to be innovative in their attitudes, flexible in their approach, always refreshing themselves with the day-to-day developments in their subject area. At the same time they should be capable of recognizing the value of human potentials, understanding the diverse needs of learners and provide enriched environment for their growth. In essence the dream of a learning society becomes real only when the teachers are well equipped with moral, professional intellectual, practical and communication skills. Mathematics is the base of all essential knowledge and progress in Science and technology. Bacon has rightly said “Mathematics the gate and key of science.” Today what we enjoy in our life as a result of scientific inventions has only been possible through Mathematics.

Mathematics in the real sense is a Science of space and quality that helps us in solving the problems of life related to numeration and calculations. It provides opportunity for the intellectual gymnastic of the man’s inherent powers. It is an exact science that involves high cognitive abilities and powers. Mathematics is responsible for giving us a system; organization and essential abilities for leading a successful life. We will remain too much handicapped in our life in if we ignore Mathematics.

There is a general appreciation among any students, parents, and teachers that Mathematics is difficult subject to learn. This impression has to be modified and a better atmosphere for learning mathematics should be created by the teacher of Mathematics. The teacher of mathematics face many challenges in Mathematic class room with the kind of knowledge explosion taking place through internet, cyber space and other sources. The teaching of mathematics is a complex activity and many factors determined the success of this activity. Such as nature, quality of instructional material, the presentation of

content, the teaching skill, the learning environment, the motivation are all the important and must kept in view for effective and qualitative teaching – learning process. Mathematical concepts are hierarchical and inter-related and inter-connected unless lower level concepts are mastered high level concepts cannot be understood.

The main goal of mathematics education in school curriculum is the mathematisation of the child's thinking. Clarity of thought and pursuing assumptions to logical conclusions is central to the mathematical enterprise. There are many ways of thinking, and the kind of thinking one learns in mathematics is an ability to handle abstractions, and an approach to problem solving. Universalisation of schooling has a grate impact on mathematics curriculum. Mathematics being a compulsory subject of study, access to quality in education develops speed and accuracy, logical thinking, Estimation and conclusion. We want mathematics education that is affordable to every child, and at the same time, enjoyable, and help children to prepare for the challenges they face in future life. The teaching and learning mathematics involves the children learn to enjoy, children must able to use abstractions to perceive relationship and structure, Children pose and solve meaningful problems. Teachers are expected to engage every child in class. The teaching and learning of mathematics should develop the skills prescribed in academic standards such as (1) Problem Solving, (2) Logical Thinking/Reasoning-Proof, (3) Mathematical Communication, (4) Connection, (5) Representation-visualisation.

For teachers to understand and absorb difficult issues in curricular and pedagogic perspectives duly focusing on learning. Also coping with a mixed classroom environment is essentially required for effective transaction of curriculum in teaching learning process. By creating effective classroom environment to inculcate positive interest among children with difference in opinions and presumptions of life style, to infuse life into knowledge is a thrust in the teaching job.

But the present stage of teaching and learning of mathematics in the majority of the schools is far from satisfactory levels. The rate of failures and low achievement rate in mathematics is considerably higher than in any other subjects. Many pupils find mathematics as a difficulty subject and most of the students do not show considerable interest and feel difficult in learning mathematics. A sense of fear and failure regarding mathematics among a majority of children, as well as the present curriculum of mathematics that disappoint both a talented and a slow learner. As a result the students' achievement/performance comes down in mathematics. Those who did not get proper opportunities to study mathematics and not having proper attitudes develops a wrong notion in their minds that mathematics is a dry and uninteresting subject. These attitudes and circumstances raise certain pertinent questions like, How to involve students actively in learning mathematics? What are the parameters that contributing difficulties in learning and teaching mathematics? What exactly is needed to overcome these difficulties, attitudes and improve the present situation in teaching and learning mathematics?

In this paper the presenter has made an effort to discuss innovations practices in teaching mathematics under teaching methods, strategies and pedagogic resources.

## **Aims and Objective of Teaching Mathematics at High School Stage**

The teaching of Mathematics should essentially help the students in acquiring essential Mathematical knowledge, skills and abilities. The term aims of teaching mathematics means the goals, targets broader purposes that many be served by the teaching of Mathematics aims are like ideas, they need a long term planning. Their realization becomes a difficult task for a subject teacher; they are divided into some definite, functional and workable units named as objective. Objectives of teaching Mathematics are therefore those short terms – immediate goals that may be achieved within the specific classroom resources. Thus a teacher may have certain clear – cut well defined objectives before him at the time of teaching a particular topic. In this way the aims of teaching Mathematics are divided into some specified objectives to bring desirable behavioral changes. The objectives of teaching Mathematics may be classified as under:

### **A. Knowledge and Understanding Objectives**

1. The language of Mathematics, various Mathematical concepts, Mathematical ideas, facts, principles process and relationships, the inter relationship among different topics and branches of Mathematics etc.

### **B. Skill Objectives:**

- To develop the Mathematical skills like speed – accuracy, neatness – beauty and estimation to develop reasoning, logical thinking, analytical – thinking and critical – thinking.
- To develop the technique of problem solving.
- To develop the ability to estimate performs calculations orally or mentally.
- To develop the skills in drawing geometrical and graphical statically figure.
- To develop the ability to use Mathematical tools, apparatuses skillfully.

### **C. Application Objectives:-**

- To make use of Mathematical concepts and process in everyday life, and solve the problems of Mathematics independently.
- To express preciously, exactly and systematically by making proper use of Mathematical knowledge.
- To draw interferences and generalize. The collected evidences and data.
- To develop the ability to make use of Mathematics learning in learning other subject and equips himself for higher mathematical studies.

### **D. Attitude Objectives:**

- To develop the habit of Systematic thinking and objective reasoning and to analysis the problems, tries to verify his results.
- To develop proper self – confidence for solving mathematical problems.
- To show originality and creativity.
- To develop heuristic attitude and tries to discover the facts or solve the problems with his own independent efforts.
- To develop personal qualities i.e., regularity, punctuality, honesty, neatness and truthfulness.

### **E. Appreciations and Interest Objectives:**

- To appreciate the role of Mathematics in everyday life and understanding the environment.
- To appreciate Mathematics as the Science of all Sciences and art of all arts.
- To appreciate the contribution of Mathematics in the development of culture and civilization. Facts, principles and processes.
- To appreciate the occasional value of the subject Mathematics.
- To appreciate the contribution of Mathematics in development of subject and civilization.
- To feel relax and entertained by Mathematical recreations and amusements.
- To utilize the leisure time properly and the vocational value of subject Mathematics.

- To takes active interest in the activities of Mathematic club, working on Mathematical projects and doing practical work in Mathematical laboratory.

### **Need for innovations in teaching Mathematics:**

In order to achieve the above said mathematical objectives new methods should be adopted scientific analysis is required. While looking to the aims of teaching mathematics it can be seen that more focus is laid to the higher level of objectives like Critical thinking, analytical thinking, logical reasoning, decision – making, problem – solving such objectives are difficult to be achieve only through verbal and routine methods used in the class of mathematics. The verbal method of instruction give all important to speech and texts the book and teacher. Teachers have to think must imply logic, logic being linked to language. One of the reasons for poor performance of students in Mathematics is inadequate understanding by teachers of the learning difficulties of their students. Various methods have been developed in Mathematic education to understand root cause of learning difficulties of under – achievers.

After deciding “Why to teach” and “What to teach” it is proper to think about “How to teach”. In which way the subject matter and learning experiences to be imparted should be given to the pupils, so that the set aims and objectivity may be properly realized. The Education Commission (1964 -66) points out that “In the teaching of mathematics emphasis should be more on the understanding the basic principles. Commenting on the present situation n schools today it is observed that the routine verbal, mechanical teacher dominated methods are used so that results are dull and uninspiring. Keeping these things before him a subject teacher wants to adopt some special ways, new techniques, innovatives to inspire and to create effective and scientific methods of teaching. Success in teaching, learning depends on two factors.

1. Mastery over the subject matter 2.Skill in teaching.

### **INNOVATIONS IN TEACHING MATHEMATICS:**

“What to teach” relates to content of the subject and how much matter to be thought at a certain level of education. But “How to teach” is really a difficult problem for the teaching because teaching is said to be an art. Methods are the ways to understand and practice art. How to impact Mathematical knowledge and how to enable the child to learn it is the questions before the Mathematics teacher.

Innovations in teaching mathematics can be described in terms of Methods, Pedagogies, Resources and Mastery learning strategies used in teaching learning process. For the effective teaching learning process a teacher of Mathematics has to select and follow appropriate method of teaching. A resourceful teacher may use an intellectual combination of methods to make teaching more and more effective.

### **Methods:**

Teaching methods are systematical procedure adopted by teachers in presenting the subject matter to the students in an orderly manner so as to reach the goal. The main methods are the Inductive and the Deductive, the Analytic and the Synthetic, the Laboratory, the problem – solving, Project methods and the Play way – method.

## Inductive and Deductive methods of teaching mathematics:

All the new teaching should be started with Inductive method and should end in Deductive method. Inductive method is laborious and lengthy leads to knowledge and discovery. One should proceed from concrete to abstract, known to unknown. The teacher needs to start with specific examples and concrete things and then move to generalization and abstract things. This method will help the students for better understandings.

**Example:** Volume of a cone =  $\frac{1}{3} \pi r^2 h$ . This can be derived the inductive method by taking to containers one cylindrical and other conical in shape having the same height and diameter. By filling the cylinder with cone leads the conclusion as value of cone =  $\frac{1}{3}$  volume of cylinder.

**Example:** “If two parallel lines are cut by a transversal the corresponding angles are equal” by drawing and measuring students get a generalization on the statement.

## Analytic and Synthetic Method:

Analytic is breaking down and moving from unknown to known i.e., Formational and Synthetic is putting together and moving from known to unknown i.e., informational. These methods are basically used in providing the results and solving sums.

**Example:** Prove that the diagonals of a parallelograms bisects each other. By drawing parallelograms and its diagonals students will come to a conclusion by applying the knowledge vertically opposite angles equal, alternate angles equal.

## Laboratory Method:

This method involves “learning by doing, learning by observing and concrete to abstract” etc.. It provides a practical base to inductive reasoning. Students learn through hands and experience and to discover Mathematical facts. It gives them happiness, mental satisfaction and encouragement.

In geometry much can be experimented and practiced. The drawing of straight lines, angles dividing them into required parts and construction of triangles quadrilaterals, models, paper folding, paper cuttings etc. all demands the use of laboratory work.

Example: For determining the ratio between the circumference and the diameter of a circle, students may be asked to draw circle of radius 7 c.ms on card board and cutout such circular figure. Ask them to measure the circumference by thread tied around it or by rolling and measuring establish the facts. Repeat these with other measurements.

$$\frac{\text{Circumference of circle}}{\text{Diameter}} = 22/7 \text{ i.e. } \pi \text{ (a constant value)}$$

## Problem-Solving Method:

This methods involves the use reflective thinking, reasoning. The main objectives of problem solving method is to stimulate the reflective and creative thinking of students. A method which provides opportunity to the pupil for analyzing and solving problem faced by him on the bases of previous knowledge. In the process of solving problem the students are required to use the information and skills

available, gather data, analyze and interpret the information to arrive at a solution to the problem. Mathematics teaching primarily aims to make the students able to solve problems with their own independent efforts; this method helps much in the attainment of these objectives. In the study of Mathematics students are constantly required solving different types of problems, this method will help them in developing divergent thinking.

**Example:** Put a problem for finding the water in a cylindrical tank by deriving the formula for volume.

### **Play way Method:**

It is one of the best methods of teaching Mathematics especially in lower classes. All types of knowledge should be imparted to the children through play way activities. Children have spontaneous and interest in these activities. Irrespective of time and energy required. This method helps to develop interest in Mathematics, to motivate students learn more.

**Example:** Mathematical games, puzzles etc.

### **Project Method:**

What is to be taught should have a direct relationship with the actual happenings in life. This central idea forms the bases of project method. It provides a practical approach to learning. Learning takes place not only through doing but also through living. Children are trying to relate learning to life. Project method cannot be used as regular method of teaching because Mathematics is a sequence subject and it must be taught and learn systematically. The projects are useful to create interest to encourage and to provide a sense of achievement to the students. Small projects can be occasionally undertaken to provide necessary supplements to regular teaching.

Example: In teaching statistics collection of data analysis, interpretation and finding the average, mean etc... In this pupil work according to their capacity, ability and interest.

### **Pedagogic resources:**

Teaching, learning material used for effective teaching should be used in teaching Mathematics. Like Charts, Ready made / teacher made / student made material, manipulative/ programme learning material, Computer and Televisions. Selection of method and pedagogic resources depends on many factors like type of content, objectives to be achieve, level of the student, entry behavior, availability of resources. There are researches which show that some innovations are carried out in the classroom and have shown the positive effect on teaching learning process, but their practical usage and implementation in classroom is not seen to the expected level.

### **Suggestions for Teachers:**

- For effective transaction of the curriculum and achievement of curricular objectives appropriate method and pedagogic resources should be used in providing learning experiences to the students.
- A number of factors need to consider while making use of a particular method and pedagogic resource: learners' capabilities, availability of resources, entry behavior, school environment, objectives to be achieved, the nature of content and the teachers own preparation and mastery.
- Decide on and plan in advance the innovative idea that the teacher would be incorporating to transact a particular concept so that loss of instructional time is prevented or minimized.

- The immediate environment of the learner both natural and human should be used when and where possible for making learning concrete and meaningful.
- Involve the students in the process of learning by taking them beyond the process of listening to that of thinking, reasoning and doing.
- Receiving regular feedback for teaching and learning should be an inbuilt component of teaching – learning process. Continuous and comprehensive evaluation has to be ensured as it plays an important role for the required modification in teaching – learning process.
- Mathematics – teaching organization at different level should be formed collaborative manner and experiences, developing resources in a Collaborative manner and the mechanisms that enable teachers to carry out innovations is being discussed. Mathematics – teachers organizations can be instrumental in establishing a climate of confidence in carrying out innovations and a positive attitude to new approaches in teaching mathematics.

**The teacher can always ask himself two questions:**

1. Is there some new way in which I can present this material in order to make it more meaningful and more interesting?
2. ‘What activities, demonstrations, teaching aids, etc. would enrich the classroom presentation and direct attention of students to the important elements?’

Once the teacher discovers innovative ways to arouse interest and enthusiasm in the class, he will be able to use these ideas again the following year.

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