

**TEACHING MATHEMATICS- HOW IT TAKES PLACE IN MATHEMATICS  
CLASSROOMS: FROM TEACHERS' VIEWPOINT**

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**Abstract**

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*Teaching mathematics is a complex enterprise. There are numerous factors that are bound to have an effect on Mathematics teaching. There is a need to look into the factors in greater detail. This would be effective if done from the teachers' viewpoint. These viewpoints are studied through administration of questionnaires. These questionnaires are studied in detail. Interview was followed for better insight of the responses. The results are being analyzed qualitatively.*

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**Keywords:** *Mathematics teaching*

**Introduction:** Teaching mathematics is a complex enterprise. Teaching has been described as an art, in the sense that it takes imagination to transfer knowledge. It has also been described as a profession, (Steeves,1962), learned through practice under stressful conditions. Teachers work under constantly changing conditions, responding to students' social, emotional, and intellectual challenges daily. Teachers provide opportunities for students to deepen their understanding of the natural and social worlds by building on the students' knowledge and beliefs (Reynolds, 1995). Mathematics involves a language, a body of knowledge, a way of thinking, and a set of skills. Having mathematical Proficiency involves acquiring several skills and dispositions. According to the National Research Council (2002), these include computing, applying, understanding, reasoning, and engaging in mathematics. Mathematical proficiency also involves mastery of different content strands. The National Council of Teachers of Mathematics Standards classifies these strands as numbers and operations, algebra, geometry, measurement, and data analysis and probability. Alongside the content strands are also the process strands of problem solving, reasoning and proof, communication, connections, and representation.

The teaching and learning of mathematics is a complex activity and many factors determine the success of this activity. The nature and quality of instructional material, the preparation and

pedagogic skills of the teacher, the learning environment, the motivation of the students are all-important and must be kept in view in any effort to ensure quality in mathematics education. Often when one refers to innovations, one only has in mind the first of these, namely, instructional material; even here ‘innovation’ commonly means teaching aids or manipulatives. A large number of such devices that are excellent aids to mathematics learning are indeed available. However, it is important to remember that the other aspects mentioned are equally important and together determine the range of actual and possible innovations in mathematics education. The process of teaching is a complex one and any attempt to represent the complexity will result in simplification. Models for researching the teacher need to reflect this complexity and integrate the research on teaching with the research on learning and be useful for interpreting current research and developing new understanding of the teaching situation.

**Aims of Teaching Mathematics :** Huckstep (Anghileri, 2000), believes that mathematics is taught so that it can provide ‘a tool in everyday life’ and ‘a means of communication’, but he also sees it as providing mental training and a means of empowering people. Orton (Orton & Wain, 1994), states that educators need to keep in mind the aims of mathematics because what takes place in the classroom is not always correct. Mathematics is taught to Learners so that they can acquire the skills that are necessary for them to function effectively in everyday life. The knowledge and skills gained will guide learners to solve mathematical problems logically in daily life, when the need arises. According to Cangelosi (1996), mathematics in the world today is taught for purposes such as “everything from budgeting, to being a wise consumer, to holding down many jobs”. He argues that fundamental mathematical tools are needed as basic survival tools for life. For him, the aim of teaching mathematics is for learners to be able to solve real-life problems in their environment. The knowledge and skills gained will guide learners to solve mathematical problems logically in daily life, when the need arises. According to Cangelosi (1996), mathematics in the world today is taught for purposes such as “everything from budgeting, to being a wise consumer, to holding down many jobs”. He argues that fundamental mathematical tools are needed as basic survival tools for life. For him, the aim of teaching mathematics is for learners to be able to solve real-life problems in their environment. According to Niss (Bishop, Clements, Keitel, Kilpatrick & Laborde 1996), the aims of mathematics education is to:

1. Make a contribution to society in the form of “technology and socio-economic development”.

2. Contribute to "society's political, ideological and cultural maintenance".
3. Provide "individuals with prerequisites which may help them to cope with life in the various spheres in which they live: education or occupation; private life; life as a citizen".

Understanding the subject mathematics is an essential component in daily activities in the community. Mathematics is given a purpose or aim in the world, not just being an abstract component that cannot be reached by people. As a learning area it should be accessible to all individuals, ensuring participation in society through knowledge about the subject. According to Niss (Bishop et al., 1996), "Mathematics education should enable students to master their everyday private life".

There is increasing pressure on learners of today to see the value of mathematics, in the past it having only been compulsory from grades one to nine. As part of the National Curriculum Statements for grades ten to twelve, mathematics has become compulsory in the form of learners choosing between Mathematical Literacy and Mathematics, a sign that it is being viewed as important for the daily functioning of the adult or child in society.

Joann flick ( 2009) conducted a study focuses on high school and middle school teachers. The purpose of this study, then, was to more clearly define the perceived hurdles that impact the use of instructional media in math classes at the middle and high school levels. With a clearer understanding of these hurdles, the providers of instructional media will be able to identify useful strategies that will encourage more math teachers to utilize visual technology for the benefits it offers to instruction and learning. Teachers were asked to report on how frequently they used different types of media and technologies along a graded 5-level scale, similar, but not numerically equivalent, to a Likert scale. Similarly, teachers were also asked to rate the level of different types of support for and access to technology in their schools. They were asked to rate their own level of technology expertise and to provide a rating for their peer teachers at their school. Teachers were asked to provide a short answer to the question: "What single factor most impacts your use of technology for instruction?"

1. *Availability of technology* was reported as the most significant hurdle.

2. *Adequate computers in class* was another concern cited, with 54 percent reporting that they have no computer in class and only 14 percent reporting sufficient or exemplary level of computers in class.

3. The *availability of appropriate content* was the next most frequently reported factor.

4. The issue of *sufficient time to plan* showed up as a significant response.

5. Several teachers mentioned that *the value of the media technology to learning* was an important factor. The *ease of implementing the technology* was also noted several times in the short-answer response. This response group may explain why teachers are more likely to use textbooks and printed handouts than any other media. Survey responses indicated that providing appropriate resources, making certain that materials have positive impact on instruction, are easy to implement and readily accessible are all key factors that will promote use of media. Given that teachers reported such limited time to plan, it is important to consider ways to make media resources known to teachers, so they don't have to search for them and also to provide teachers with tools that expedite planning. Video resources should show a real-life application of key math concepts, as that content description received a great deal of interest from the respondents.

**Ryan Grainger and Denise Tolhurst (1998)** focused on studying the factors that are potentially influential in the successful implementation of technologies in a broader range of learning environments. In the study, survey and interviews were conducted that addressed teachers' perceptions and attitudes towards ICT training, ICT implementation approaches, and ICT support. Results of the study were analyzed according to the following key-factors

1. Characteristics and perception of leadership: survey and interview revealed that they had positive perceptions about the executive staff.

2. Cooperation between the teachers with regard to ICT usage was positively reported.

3. The nature, relevance and usefulness of Training.

**Raffaella Borasi (1997)** in her essay viewed that to promote school mathematics reform must take into consideration the *needs* that teachers engaging in school mathematics reform are likely to experience. These needs should determine the goals of the professional development and, thus, the choices teacher educators make to most effectively achieve these goals. The needs identified were

1. Teachers should Learn more mathematics .

2. Teachers should Learn about the nature of mathematics as a discipline .

3. Teachers should Learn about theories of teaching and learning .
4. Teachers should Learn about students' mathematical thinking .
5. Teachers should Develop images of alternative classroom instruction .
6. Teachers should Become familiar with and adopting effective teaching practices .
7. Teacher should Attend to the emotional aspects of engaging in instructional innovation.
8. Teacher Develop ownership of reform goals and agendas

The advent of hand-held computing does not seem to be a factor that is promoting use of media in the math classroom. Media developers may want to reconsider imminent plans to jump on the podcasting bandwagon, or, while they initiate podcasting, they should maintain other forms of media delivery.

**The Context of Study:** Student's failures in learning mathematics with understanding and lack of appreciation of mathematics to real life situations are a serious problem. Consequently even adults can't use mathematics in their daily life nor they use in their job. Although there has been an increased emphasis on new ways of mathematics instruction, the teaching of mathematics is far from satisfactory.

Teachers stand at one pole of teaching learning continuum. They are very important factor in overcoming these problems. It is the teacher whose hard work and determination can influence attitude of students towards mathematics and remove the gaps present in implementing the existing mathematics curriculum.

As Pateman said: "There seems to have always been dissatisfaction with the way mathematics has been taught, and that dissatisfaction is apparent at every level." Critics range from disgruntled newspaper editors to employers dismayed at the amount of training they need to provide to make those they employ marginally competent at arithmetic (Pateman, 1989, p. 2).

"Typically curriculum developers and parents hold teachers responsible charging them with inefficiency and incapability. Teachers blame ambitious syllabi, poor school facilities, overcrowded classrooms and incapable children or uninterested parents." (PADMA .M. SARANGAPANI, 1992)

**Method :** The teachers were given questionnaires related to the problems faced by them. These questionnaires are further probed for a more detailed analysis of the responses. These responses are further analysed qualitatively. The investigator also clarified doubts of the teachers regarding understanding of some of the items.

## **Results and findings**

1) Teachers face problems when they resort their teaching to examination- centered teaching learning process. This view is supported by 50% of the teachers who felt that it is a problem that really affects their mathematics teaching. Teacher expressed her views on the statement, “we teach and give sums to practice them and jump to another concept. It never leaves time to revisit unit and solve problem areas. 10% of the teachers are not sure whether resorting to examination centered teaching learning process. While 40 % of the teachers still felt that it is not a problem for them. When asked by the investigator, to support through examples of where they faced problems, teachers reported the following replies:

1. Teachers don't find time to revisit the concept and jumps to another concept.
2. Mathematics is a subject where one should get a proper grade or mark, so in most of the cases, parents and teachers want their child to get good marks in exam. They never bother that their child should understand the concept and they give preference to marks orientation.
3. Syllabus is vast.
4. It makes the children conscious of silly errors (copying and calculating), they commit in mathematics which is difficult for a teacher to make them understand unless they don't see themselves.
5. Time shortage to complete the syllabus.
6. For example, in theorems and axioms for class 1X, teachers explain everything, but it is difficult for children to write it.

As regarding preparing detailed lesson plan for students, 57% of the teachers don't feel problem in preparing for it. 33% of the teachers still feel it as a problem and 3% of the teachers are undecided whether preparing detailed lesson plans is a problem for them.

On asking the reasons from teachers who felt that preparing detailed lesson plans is a problem for them, then following reasons are listed by the investigator:

1. Teachers face time boundation as a problem.
2. Individual differences among students are not met.
3. Incorporating different learning levels for students in lesson plan is difficult for teachers.
4. Teachers are overburdened in the school. They were given extra mathematics classes to teach and lot of checking work.

When innovations and their implementation are concerned, 37 % of the teachers see innovations as imposed and its implementation a not-whole hearted effort. This is not seen as imposition by an equal number of teachers. 37% of the teachers don't see innovations as imposed. While 26 % of the teachers don't clearly see the imposition of innovations as a problem

The teachers, who felt that innovations are problems, supported their statement through following examples

1. Innovations need extra effort other than planning, checking copies etc.
2. Due to lack of time and burden of lot of syllabus, it is impossible to implement new innovative ideas or efforts.
3. It is seen when teachers cover questions to be completed at the end of chapter.

When there is a concern of teachers' inadequacy of subject matter as a problem, 57% of the teachers' disagreed to acknowledge it as a problem. While 26% of the teacher still feel that teachers inadequate knowledge of subject matter causes problem in mathematics teaching. Only, 17% of the teachers are undecided whether the inadequacy causes problems in mathematics teaching.

In response to reasons for the inadequacy, few teachers viewed following as the reasons for the inadequacy of the knowledge of subject matter.

1. Daily new concepts are being introduced. Even teachers were not aware of these new concepts.
2. Lack of seminars for the regular appraisal of teachers.

57% of the teachers felt that difference between teachers' professional beliefs and official curriculum goals affects their mathematics teaching. While, 37% of the teachers are undecided whether it is problem affecting mathematics teaching. But 6% of the teachers don't view it as a problem.

When asked by the investigator, how the difference between the goals affect mathematics teaching, following responses were enlisted:

1. Teachers were never taught what a real school demanded from them. Their philosophical beliefs took time to change the system
2. Some teachers believed that some topics should be done at a higher level.

3. Some teachers aim at the students solving ‘toughest of all’ question and they might overlook their ability.
4. Official curriculum goals are result oriented. Getting good marks are criteria of intelligence.
5. Many mathematics teachers believe that mathematics is all about calculations only. They end up giving short- cut to students without nay understanding behind it.
  
6. Sometimes, for instance, the belief to get right answer hampers the teachers’ ability to see what/ how teachers understand the concept and learners. Product overshadows the process which is very significant.

Teachers face problems in planning according to various abilities of students. This is evident, when 50% of the teachers felt that they face problems in planning. This is contrasted when 40% of the teachers felt they don’t felt problems in planning according to various abilities of students. While, 10% of the teachers felt that they are unsure that the planning causes problem to them. Teachers also reported the reasons on why they felt the problem. Reasons quoted by the teachers are as follows:

1. There are students of different aptitudes and grasping.
2. There are students who differ in speed of solving questions and understanding of the concepts. This makes the lesson plan incomplete.
3. The backlog of students creates trouble and it is especially seen in mathematics.
4. Teaching need spontaneous decision as pupils has different cognitive strategy.
5. The strength of the class.
6. Time shortage.
7. Students with god – gifted ability are usually not dealt properly.
8. Inability to effectively address multiple needs due to managerial problems.

Teachers also face problems in providing personalized and individualized instruction. Majority of 53% of the teachers felt that providing individualized instruction is a problem for teachers. This is contrasted by 30% of the teachers who don’t agree that it is a problem for them while, 17% of the teachers are unsure whether providing individualized instruction is a problem for them or not. When asked for the reasons of the problems faced, teachers held following reasons

1. High classroom enrollment.

2. Lack of proper training of teachers to teach mathematics through new innovative ideas, activities and experiments.

3. Students are restless and are slow in taking instructions. So instructions have to be repeated again and again which wastes a lot of time in the class.

4. Lack of time

When asked from the teachers whether they face problem with teaching with vast curriculum, 77% of the teachers felt that they did face a problem. This had been seen from the responses of the teachers where large syllabus was being quoted as the reasons for the other problems. Also, 20% of the teachers didn't agree to the view that large curriculum syllabus is a problem for them. However, 3% of the teachers were unsure that teaching vast curriculum affects their mathematics teaching.

As far as the teacher's creativity is concerned, 61% of the teachers feel that their creativity is hindered by the prescribed syllabus. Other reasons that hamper teachers' creativity were also mentioned. 33% of the teachers felt that their creativity is not hindered by prescribed syllabus whereas 6% of the teachers are undecided whether syllabus hampers the creativity of the teachers.

Other hindrances mentioned by the teachers that hamper the creativity of the teachers were-

1. Examination focus.

2. Lack of lab equipment and other facilities in school.

3. No proper time schedule for the organization of activities.

4. It is difficult for the teachers to create balance between allocation time to make it creative and to cover content in prescribed time.

5. No organization of science and mathematics exhibition to create students interest in mathematics.

6. Flaws in evaluation and assessment.

7. Coaching centre has made students sloppy they are last bothered about what the teacher is teaching and how she is teaching.

Regarding duration of academic session, 57% of the teachers felt that duration of academic session are shorter than required to properly teach the concepts. However, 30% of the teachers find duration of academic session as appropriate. On the other hand, 13% of the teachers were

unsure whether shorter duration of academic session caused problems in their mathematics teaching or not.

40% of the teachers feel that students lack interest in mathematics and it causes problem in their mathematics teaching. While equal proportion of 30% of the teachers feel that they are either unsure or don't feel that lack of students interest causes problem in mathematics teaching.

Teachers also gave the reasons for the same. They are:

1. Missing of a concept and not coping with the pace of the class tend to make students loose interest in mathematics
2. Due to abstract nature of concepts
3. Inability to relate to the ideas taught and connection to thought processes causes disinterest
4. Students are interested in junior classes but lose interest in senior classes
5. Math has become phobia due to lack of activity based approach.

When asked from the teachers whether they face problems when curriculum reforms do not correspond to students need, 47% of the teachers agreed to the viewpoint. However, 23% of the teachers don't view the same as a problem affecting their mathematics teaching.

On the contrary 30% of the teachers were unsure whether it affects their mathematics teaching.

When asked to specify through examples, teachers viewed the following examples-

1. There is no relevance of Pythagoras theorems in the lives of the students
2. Sets, functions and topic like these don't fulfill students' need who doesn't want to take mathematics as their career.

Lack of teachers reward, motivation and incentives are also a factor that affects the mathematics teaching. 43% of the teachers felt that proper lack of motivation affects the mathematics teaching. On the other hand, 40% of the teachers were unsure whether this factor cause problem and affects mathematics teaching. The same view is disregard when 17% of the teachers don't felt it as a problem affecting their mathematics teaching. In response to the statement a teacher commented, "Still waiting for the 6<sup>th</sup> pay commission to be applicable. Why it is that rest of all professions are best paid but not teaching".

The teachers also presented the examples where they fit the utmost need of incentives and motivation. They are-

1. Every time from practice, the post active phase of teaching, teachers are not provided with sufficient facilities, much less of reward or incentives.
2. In the economy, as it is the fixed salaried employees that are mostly affected.
3. It largely depends on what teachers expect. The biggest reward for a teacher would be the effectiveness with which she delivers for her learners to grasp.
4. Teachers don't earn income in profession for rewards either just want to earn or just as a stepping stone to other.

71% of the teachers felt that employing of effective teaching aids in mathematics causes problems in their mathematics teaching. However 26% of the teachers didn't felt it as a problem. On the other hand, only 3% of the teachers were unsure that employing of effective teaching aids is problem for them.

The teachers who agreed were asked to view the reasons for the same. They were as follows-

1. Preparation of teaching aids in mathematics need more accuracy, clarity, so it is sometimes difficult.
2. The subject is vast, less scope of using teaching aids.
3. No support from the institution.
4. Time shortage.

Teachers face problems in the usage of ICT in classrooms. The reasons mentioned by the teachers are:

1. Difficulty in balancing content integration.
2. limited availability of time and resources.
3. Pressure to cover the prescribed curriculum
4. Difficulty in learning the technology

Out of the total teachers asked, 40% of the teachers felt that they faced problems in balancing content integration along with the usage of ICT. 26.7% of the teachers viewed limited availability of time and resources for the usage of ICT causes a problem for the teachers. On the other hand, 20% of the teachers faced pressure to cover the prescribed curriculum in time as a problem by teachers while teachers who faced difficulty in learning the technology accounted to 13.3%.

Teachers faced problems while teaching using an activity based-approach. But this is supported by less number of teachers as compared by 74% of teachers who didn't view teaching through activity based approach as the problem.

When asked by the teachers who faced problems to mention the reasons for the same, following viewpoints came under focus:

1. Time constraint.
2. Less time, syllabus completion
3. Parents expectations
4. Content to teach to students is lot for students to understand in one year
5. It burdens the child.
6. Due to large class-size and in groups we have to meet each and every students needs which is not possible to consider for each and every student
7. It is only applicable for classes up to primary level.

**Conclusion:** In regard to mathematics teaching, main issues considered were shortage of time, vastness of concepts, and difficulty in catering to individual needs. Difference in attitudes of parents and teachers were the main problem affecting mathematics teaching.

Lack of resources especially infrastructural resources as a problem have been complained by many teachers. Hence, proper steps should be taken by the government for the provision and maintenance of the resources. The present study will provide an insight to curriculum developers and textbook writers to make the curriculum interesting and related to students life.

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