International Journal of Soft Computing and Engineering (IJSCE)
ISSN: 2231-2307, Volume-3, Issue-1, March 2013

A Study on the Difficulty of Teaching and Learning Mathematics in Under Graduate Level with Special Reference to Guwahati City

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Abstract- Mathematics, the only subject, which is used in every sphere of our lives. However, it can't be learnt overnight. Understanding and practicing mathematics regularly helps to make a firm base. Though it is a fascinating subject, but a very large fraction of students find the subject creepy. Such problems may crop up as a result of improper guidance in their initial stages. This paper is an attempt to study the difficulty areas occurred while learning and teaching mathematics. It is also aspired to bestow a fruitful implication for the development of teaching learning mathematics at the under graduate level.

Key Words: Pure Mathematics, Applied Mathematics, Teaching learning, Fear, Curriculum, Assessment, Technological Tools

I. INTRODUCTION:

Mathematics is the study of quantity, structure and change (i.e. arithmetic, algebra, geometry & analysis). The word Mathematics comes from the Greek word μα'θημα (mthma) which means learning, study and science. Mathematics begins from many different breed of problems. Initially, these were found in commerce, land measurement, architecture and afterward, in astronomy. But today, all sciences recommend problems studied by mathematicians and many problem arises within mathematics itself. Mathematics is used all over the world as an essential tool in many fields including natural science, engineering, medicine and the social sciences. Applied Mathematics, the branch of mathematics, is concerned with application of mathematical knowledge to other fields. It enthuses of new mathematical discoveries and sometimes leads to the growth of exclusively new mathematical disciplines like statistics and game theory.

Many philosophers believe that mathematics is not experimentally falsifiable and not a science. In 1930, Gödel's incompleteness theorems persuaded many mathematicians that mathematics can't be reduced to logic alone. Karl Popper concluded that most mathematical theories are hypothetico-deductive like those of Physics and Biology. Pure Mathematics, therefore, turns out to be much closer to the natural sciences whose hypotheses are conjectures than it seemed even recently.

Manuscript received on March, 2013.

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Many mathematical objects, such as sets of numbers and functions, exhibit internal structure as a consequence of operations or relations that are defined on the set. Mathematics then studies properties of those sets that can be expressed in terms of that structure; for instance number theory studies properties of the set of integers that can be expressed in terms of arithmetical operations.

Probably mathematics is the only subject which offers misunderstanding between teacher and pupil. The teacher stands at the blackboard. It is perfectly clear to him what the symbols mean and what the conclusion can be drawn from them, but it may be completely otherwise with many of the pupils.

Majority of students discover mathematics as a daunting subject. Such problems may crop up as a result of improper guidance in their initial stages. Efforts may not be taken by their teachers to treat their fear while they were small.

And that fear keeps the students away from mathematics as they grown up. Since the subject needs a lot of practices and understandings, the students who don't remain in touch with it regularly, they don't seem to do well in examinations. As a result their fear remains for whole life.

Mathematics is dynamic and rapidly mounting across a wide spectrum of research areas. For many people the coherence and elegance of mathematics give a sufficient reason to study it. Others are motivated by the fact that it plays a key role in the development of science. The importance of mathematics in developing the models that explain the physical characteristics of the universe is well known. It is basic to the study of engineering. Perhaps less well known is its role in the social sciences and economics. Increasingly it is also used in models for biology and medicine.

Mathematics education is in a deplorable position. In spite of having much popular interest to this fact, the real change is still slow.

Kirkire, P.L. (1981) analysed classroom verbal interaction and related the same to students' achievement in mathematics. He found that creating interest by the teacher in the problems is the single most influential factor of student achievement. According to Foong (1987), college students who dislike mathematics view their former teachers as impatient. Poor performance and negative attitude of students were found associated with restrictiveness and negative use of authority by teachers. Dr. V. Sumangala (1995) in her article "Some Psychological Variables Discriminating between High and Low achievers in Mathematics" found that Achievement in mathematics is related not only to cognitive variables like intelligence, aptitude etc., but

also to the affective variables like attitude towards mathematics and self-concept in mathematics. According to Krishnamurthi (2000), academic accomplishment depends on a number of variables. Among them the most significant are: the students attitude towards the subject of study, their interests in it and their motivation for academic achievement.

II. NORTHEAST INDIA AND MATHEMATICS EDUCATION:

Consists with seven states, Northeast region of India is characterised by natural beauty, geographical peculiarity and simplicity of the inhabitants. Most of the people earn their livelihood mainly through agriculture and agri-based industries. Assam, gateway to Northeast India is often described as a land of unity in diversity as dotted with colourful inhabitants from all the seven north-eastern states which ultimately encouraged social bondage. The fusion of cultures and ideas has shaped State's political, economy and societal scenario over the years and it is this distinctive feature which has contributed to the rich heritage of the region. Significance of demographic characteristics and its impact is often reflected in the performance of an organisation. So is the condition in case of an educational organisation. Assam occupies a deliberate position so far as education sector is concerned. A good number of premier institutions are established in the state during the last few years. At present the state is having 8 State Universities, 2 Central Universities and 3 Private Universities imparting higher education to the students of the region. Guwahati, the State Capital of Assam, has become the education hub for the students of the entire northeast India and thus hundreds of institutions either private or government have been grown up imparting higher education.

The requirement of Mathematics subject is experienced in every stream and hence for a Science, Arts, Commerce or Engineering college, Mathematics is an important subject. Scientific methods, tools, techniques and traditional skills are taught to the students from school level. Various competitive examinations are organised by both government and private schools/colleges or other academic research organisations among the students to make them aware, and learn about the subject e.g. Mathematics Olympiads at different levels etc. More recently a good number of organisations like ABACUS, Assam Science Society etc. are organising workshops, seminars, exhibitions etc. among the students and teachers and people concern to popularise and make Mathematics an interesting, enjoyable and accessible subject for everyone by removing the universal fear for the subject. Moreover, students could be benefitted through monthly and quarterly publish journals on Mathematical Science.

III. RATIONALE OF THE STUDY

It is evident that knowledge of mathematics is indispensable for everybody for living his life better. Further, knowledge of mathematics is very much necessary for higher learning and research. From primary education onwards, emphasis is given in Indian education scenario on mathematics learning up to secondary level and it is compulsory there in elementary and secondary level. We therefore in need of good teachers of mathematics to teach in elementary and secondary level. Good students of mathematics could be good teachers in the future. However, in the last few years it has been observed that enrolment of mathematics in the UG level has been diminishing rapidly and the success rates also found to be gone under the expected rate. It could therefore be suspected that there are certainly some problems in the teaching and learning of mathematics in the Undergraduate level which have created the above discussed unfavourable condition. It is therefore felt necessary to study the teaching learning problems relating to mathematics education in the Undergraduate Level (UG Level) so as to get a better picture of the situation and to identify means and ways to improve the teaching learning process with the following objectives:

1. To identify the difficult areas in UG Level both in Major and General course as perceived by the learners and the teachers.
2. To identify the problems faced by the learners in learning and by the teachers in teaching the subject in the UG Level.
3. To study the attitudes of the learners towards learning mathematics and of teachers towards teaching it.
4. To put forward the suggestions for making better teaching-learning in mathematics

IV. METHODOLOGY:

The broad objective of the research study is to investigate the problems of teaching and learning mathematics in the under-graduate level in the colleges of Guwahati, Assam. Sampling frame: The under-graduate colleges situated in the Guwahati City constitutes the sampling frame of the proposed investigation. For taking up the sample, simple random sampling without replacement method have been used. From the city colleges (government or private), 10 colleges having mathematics as subjects have been selected and from each of the selected colleges, 25 students have been selected at random without replacement from both Major as well as General course in mathematics. Data have been collected though questionnaires and through observations in the Experimental classes conducted. Again, a total of 25 teachers from the Mathematics Department of the selected colleges have been interviewed to collect the necessary data for the study.

V. RESULTS AND DISCUSSIONS

Data have been collected from the selected learners and the educators of mathematics from the selected under graduate colleges situated at Guwahati City. The so collected data have been analysed subject to the complexity and difficult areas in teaching and learning mathematics in the colleges. Table 1 demonstrates the percentage of responses against mathematics as difficult, average and not difficult to learn.

Table 1: Responses for Mathematics as difficult subjects

How do students find mathematics?	***Response in percent***
Difficult to learn	52%
Average to learn	27%
Not difficult to learn	21%

The different areas of the subject where students get trouble to learn and understand the subject have been identified from the study. There are two broad specialization for the students of mathematics in the under graduate level namely, pure mathematics and applied mathematics. About 80% students get trouble in learning pure mathematics which is depicted in Figure 1.

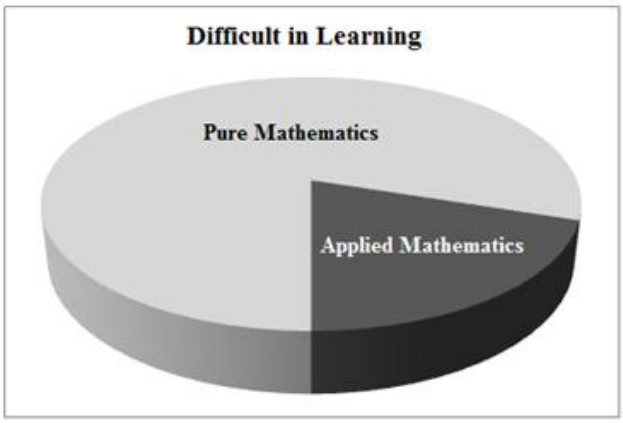

Figure 1: Percent of students getting trouble in Learning Pure and Applied Mathematics

The different areas of pure mathematics that have been identified in the study where the students find difficulties are – *Classical Algebra*- Inequalities, Sequence of Real Numbers, Convergent, Non-convergent, Absolute and Conditional Convergence.

Abstract Algebra- Group Theory (Permutation Group, Cyclic Group, Subgroups etc.), Homomorphism of groups, Ring Theory, Rings Integral domain, Vector Space.

Real Analysis- Characterisation of Real numbers, Sequence of Real Numbers, Bounded unbounded Sequence, Monotonic Sequence, Infinite Series, Mean Value Theorem, Taylor Theorem.

Real and Complex Analysis- Limits and Continuity, Improper Integral & their Convergence, Absolute and Conditional Convergence, rectifiable Curves, Inverse points and Critical mappings, Conformal mappings.

Topology- Dense Subset, Baire's Category Theorem, Uniform Continuity, Isometry, Compactness, Connected Sets, Topological Spaces, Metric Topology, Subspaces and Relative Topology, Continuous functions and Homeomorphism.

Linear Algebra and Complex analysis- Vector Spaces, Subspaces of a Vector Space, Linear Mapping

The study has also traced out certain areas in applied mathematics in the course contents of under graduate level. About 20% students have shown their difficulties in learning the following topics.

Spherical Trigonometry and Astronomy - Altitude of a body on the meridian, altitude of the celestial pole, rising and setting of stars, circumpolar stars, signs of zodiac.

Rigid Dynamic - Conservation of momentum and energy, generalized coordinates, LaGrange's equations, initial motions.

Hydrostatics - Internal energy, adiabatic expansion, work done in compressing a gas, isothermal atmosphere, connective equilibrium

In case of the educators point of view the applied mathematics is based on the practical application of the day-to-day life and hence get more interest in teaching the topics. Conversely, as the pure mathematics is totally based on the theory and cannot be exercised in practical shape, and thus they shows more difficulties in teaching the pure topics. The present study of mathematics education in colleges has identified a range of issues as challenging. These issues can be considered to be core areas of concern which create mathematics as problematic both in learning and teaching. Following are the major issues observed through the study-

- *Fear and Failure* – There have been a sense of fear and failure regarding learning mathematics among a majority of students. Above 60% of students get the subject scary. The undergraduate students in mathematics courses are indifferent. They are anxious to hypothesize and scared to reach into themselves for ideas. These types of problems arise in our society due to improper guidance in initial stages of the students.
- *Disappointing Course Curriculum* - Another major issue of creating difficulties in teaching and learning mathematics at college level is the disappointing curriculum. The students at under graduate level have to study a much vaster syllabus than they have studied in their 10+2 level. Also the un-uniform course contents in the curriculum generate disappointment in the minds of both teachers as well as learners. 45% of the teachers think that the frequent changes in the curriculum by the affiliated university create problem in preparing and adjusting in teaching the subject.
- *Crude Assessment* – The methods of assessment can be considered as one of the issues in crafting mathematics education as problematic. The crude methods of appraisal followed in the under graduate level have encouraged the perception of mathematics as like the mechanical computation.
- *Lack of Preparation and Practice*- Lack of teacher preparation and support to the students in teaching mathematics creates difficulties for suitable teaching-learning process. Majority of students opined their views as it is important to do much more practices in learning mathematics which is not so possible due to short period of time in semester system and for the equal load of the other elective subjects.
- *Social Influences* - Structure of social discrimination has also worsened the situation that gets replicated in mathematics education as well. The gender dimension in this regard directs to a typecast that boys are better at mathematics than girls. Pessimistic attitude towards the mathematics education has also played a vital role in the difficulties occurred in teaching and learning mathematics at the college level.
- *Lack of use of Technological Tools*- The teaching-learning process followed by the colleges, mostly the government colleges, in the region are still based on the traditional black board concept. Of concern was the lack of use of technological tools in mathematics teaching and learning.

VI. CONCLUSION AND RECOMMENDATIONS

The augmentation of a state is dependent on the quality of the civilian who hold active participation in the process of progression, innovation and creation. Mathematics- being the subject of validity always attracts scholars, researchers, academicians, scientists and stakeholders of the informative society to build a new sovereignty for achieving success

among each individual. Educational institutions generate a large number of graduates every year. The time has come to cultivate a strong liking for the subject among the students community through a methodical study on the need, advantages, scope, problems and limitations of mathematics teaching. Importance of the subject is to be felt by both teachers and students. The efforts and the results of this study would definitely help to bridge the gap among various sections that uses mathematics as a tool for socio-economic as well as scientific development at personal level in particular and society in general.

The analysis of the problems observed though the study guide us to recommend the changing the focus of mathematics education from achieving 'narrow' aspiration to 'higher' aspiration, connecting every student with a sense of achievement and proposing conceptual challenges to the budding mathematician. It is also expected to change the assessment modes for examining the students' mathematization abilities rather than procedural knowledge, and to enhance the teachers with a variety of mathematical resources.

Apart from the above, a few suggestions have been summarised below after encountering the real picture on teaching and learning of mathematics in Guwahati city.

- Recruitment process of Mathematics faculty and Faculty development programmes on Mathematics should be done carefully and methodically so that no loophole remains on the part of educators to do away with the fear of mathematics among students.
- The concerned appointing authority, while screening and selecting the teachers of Mathematics, should emphasize more on mathematics teaching skills apart from theoretical knowledge.
- Role of parents is also important to cultivate an environment at home for encouraging a student to practice more and to make them aware of the fact that this scoring subject could help them to build a good career.
- An educational institution should also participate in creating a positive attitude among the students and teachers. A committee on mathematics could be formed with teachers, students and guardians to discuss and make aware everyone the scope, new areas and interdisciplinary relevance of mathematics. Sharing of feelings brings the students closer to the teachers and ultimately they become dedicated towards the subject.
- Last but not the least the role of educators i.e. the teachers who hold the torch of knowledge and influence a student. They are the guide and motivators to show the practical examples and lead the students. Teachers should have up dated knowledge and skill to tackle a student. During the study it was observed that most of the students have found to be poor (50%), while 30% are average and around 20% are found to be brilliant. So a teacher should be well equipped to impart mathematics education to all these categories of students with efficiency.

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