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Critical Thinking :- To Reduce Anxiety In Mathematics Among Students

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ABSTRACT

Everybody may have different view and opinion about mathematics as subject. While some consider it interesting, challenging and innovative others consider it boring and tough some even try cramming it. Most of the students feel anxiety and become tense while learning mathematics. In order to reduce fear, anxiety among learners, we have to change the mindset of students and to induce liking for mathematics. For this process, the teaching methods has to evolve from traditional (in which the students sit and listen passively) to those which involve more active participation of students. To achieve this we teachers, have a great responsibility to influence teaching methodology such that the students develop reasoning, logic and rational thinking. One such method is critical thinking which we attempt to discuss in this paper.

1. Introduction

Education

Education is the process of facilitating or acquiring of knowledge through learning for all around development of a person which develops and improve the values, skills, reasoning and judgements. In educational system, the main responsibility of teachers is to develop the required essential skills such as Creativity, Critical thinking, Problem solving, Innovation, Communication, Productivity, Collaboration, Accountability, Exploration, Initiative, Responsibility, Leadership etc.

Anxiety in mathematics

Mathematics anxiety is a common problem among students which is faced while teaching in class. Richardson and Suinn (1972) originally defined math anxiety as “a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations” (p. 551).

Due to anxiety in mathematics, the learner develops a negative notion towards his learning, progress and succeed in subject. There will be more confusion, poor level of concentration, worry and tension while learning in class. Nearly, the learner will be physically present but mentally absent. They assume that they are not good in mathematics and they cannot perform in this subject. Due to teacher's attitude of teaching which more emphasized on the memorization of facts, formulas, no step by step explanations, not explaining the students why the problem works in a particular way. But actually, solving problems is like a continuous story where everyone knows the starting point (given statement) and the ending point (required result). The teachers has to teach the students that how to fill the gap in systematic and meaningful way by logical thinking, reasoning, checking of the assumptions.

"Mathematics is the model of a discipline that is based on rational thought, clarity , logical reasoning". Much work is done by researchers to prove that Mathematical achievements are improved with this methodology of critical thinking and that this methodology works (Silver & Kenney, 1995;NCTM, 2000;Semerci, 2005;Jacob, 2012;and Chukwuyenum, 2013).

2. Review of literature

1) Amy smith 2013 :-

Anxiety in mathematics in students is passed to them by their anxious teachers and parents resulting them to be less successful in mathematics. Another reason to fear mathematics is less involvement and no connectivity of curriculum to students. Author has emphasized on using "inquiry math" for reducing anxiety among students. The classrooms needs to be rethought, more responsive and more engaging to get better results. But it highly requires the efforts by the teachers. Author give fact that females and marginalized group have less confidence in mathematics as compared to their counterparts as it has been thought as a masculine subject. He further says that females are found to be least interested in pursuing mathematics as a career as compared to their male counterparts. The author suggests to use primary data for further research and use this “inquiry math “approach for better result.

2) Marzita puteh & khalin S. z.(feb.2016) :-

In this paper , authors has primarily focused for students from Malaysia and showed that majority of students from Malaysia have moderate level of anxiety and factors resulting in mathematics anxiety are curriculum weakness, peer pressure, negative experiences in mathematics, parents and teacher’s pressure and also the way of teaching .Author confirms that there is evidence proof in research that Anxiety in mathematics adversely affects the performance of students. More the anxiety and less the achievement of students. This anxiety in mathematics must be detected early .Students finds abstract question s and question based activities more easy than theoretical mathematics. Writer have given some symptoms of students that confirm anxiety among students. These includes sweating, dizziness, nervousness, increased heart rate etc. when mathematics was taught through game or activity results were significantly improved. Mathematics through fun based learning gave them more confidence,

comfort. So these techniques should be more implemented rather than rhetoric ways of teaching.

3) Edutopia Nov.17 :-

In this discussion, author well explains the fear about learning mathematics. He believes that if approach for teaching mathematics is changed ,it must include more active participation of students rather than conventional old ways. The strategy should be to divide them in short groups and asking them to look for their respective solutions and then discussing and finalizing the result. This method of problem solving will be a lifelong learning method ,which will enable the students to use this knowledge attained anywhere throughout their life and will make them successful.

In this paper, there is more focus on developing two important skills used while teaching mathematics i.e. Critical thinking and Problem solving . And teacher should be more aware of this method and use it often to reduce the anxiety among students.

3. Critical thinking and problem solving

Critical thinking is the ability to use knowledge to conceptualize, apply, analyze, and synthesize information to successfully solve problems. In critical thinking, the information available must be firstly analyzed and then synthesize to solve the problem.

In order to solve problem in mathematics, critical thinking and problem solving methods both are used simultaneously. Critical thinking consists of two parts:-

1) primary part is to analyze the given information, data which is given in the problem.
2) then to use the information collected in the first step to get the desired results by synthesizing it properly.

It is thus different from

1) the only remembrance , cramming of the data, facts, formulas, knowledge
2) The art of using that data without knowing their applications and use.

Now, out of various possible questions originating due to critical thinking are

1) What is aim and final conclusion,
2) Language and progress of the problem,
3) From where information is coming,
4) the technique and worth of information collection,
5) the method of judgement and the thinking used,
6) the thought process that works for the analysis of data
7) the reasons to use the concepts/ assumptions,
8) the results we get from assumptions we use

In other words, questioning that occur due to these assumptions of thoughts and reasoning are now the basis of critical thinking.

4. The values of teaching through problem solving

1) Problem solving converge the thinking process of students from cramming the things to understanding.
2) Problem solving attitude in mathematics develops confidence in students that they can solve mathematical problems. It is now more easy for them to use the mathematical terms and language.
3) It helps in evaluating the learning graph of students and thus the teachers can help them in overcoming their shortcomings.
4) Teaching by problem solving method becomes more innovative which results in more understanding of the concepts rather than to learning or cramming.

5. Procedure of problem solving:-

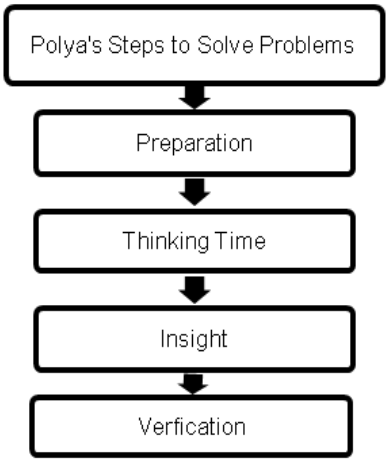
One method cannot be applied to solve all the problems as the problems can be slightly different from one another. One should have the practical knowledge of the given situation which are responsible for solving the specific problem. First of all, one must have to understand the problem and the given specific situations. Only then we can take the correct assumptions which help to solve the problem.

6. Steps for Problem solving:-

Polya's gives four-step approach to problem solving.

1) Preparation
2) Thinking time
3) Insight
4) Verification

And the process is followed as given below diagram.



1. Preparation:-

Understand the mathematical terminology (symbols, operations etc.) and needful concepts which are used in the problem.

1) what type of problem is asked for?
2) what is the required result?
3) the meaning of terms, symbols.
4) The required information is given completely or more needed ?
5) What is given, not given and needed ?

Rephrase in your own words the given problem.

2. Thinking Time:-

To attain result, now it is time to make a strategy and work on it . In this part, we have to start with the thought

process that how are we going to attack the problem? Take possible strategies. We will

1) draw diagrams/ shapes
2) use known and unknown variables
3) follow systematic procedures to solve
4) check whether the procedure works or not.
5) if not, try another possible ways.

Once the problem is understood, the mind will keep working on it which results in more clarity about the concept and our thinking become more rational, logical, scientific, creative .

3. Insight:-

Carry out the plan (try try again with various plans that come to mind)

While solving a problem, one has to keep looking for different solutions and checking which one is leading to solution. Each unsuccessful attempt will lead to removal of that option. Repeatedly think about the problem it will often give you a new idea or new dimension or a new approach for solving the problem. The mantra is to keep trying ,not stopping until something firm is achieved.

4. Verification:-

Once you got a probable solution, check the validity of that solution.

1) Did you answer the question?
2) Is your result reasonable?
3) check again and again and see whether all the conditions are being fulfilled or not.
4) computations must be checked carefully.

Sometimes, only modification of some simple mistakes do the work. But if still answers are not found before completely scrapping work on correcting the current attempt.

Remember what you have tried, it must be more useful at the end. Check the possibility of finding alternate and more optimum solution to the problem. is there any chance of generalizing the problem or method itself, which may be beneficial to other similar kind of problems. Thus, critical thinking is significantly required in mathematics and it must be considered as an essential basis for which the teaching is meant for i.e. to carry out and understand problems.

This process will enable the students to

1) Systematic and consolidating their mathematical thinking in a adequate manner.
2) Communicating their ideas in a lucid way to teachers, peer groups and others.
3) Scrutinize and understanding of other's mathematical thinking and strategies.
4) Utilization of correct mathematical language and terms to communicate their ideas/ calculations more precisely.

7. Advantages of this method

Students are now expected to examine their strengths and weaknesses for the various methodologies rather than to get the answers for their questions. They will now become more independent learners. There performance in the subject will be enhanced. The students now will communicating their own ideas with each other. The students to feel free in expressing their ideas, to think, to formulate hypotheses, to listen to one another and mutually estimate their judgements, had better results in the examinations. So, there will be a positive transformation of a passive behaviour of the students in a classroom to more physically and mentally active participation. So, communication can be done for learning mathematics as well as for mathematical terms.

8. Conclusions

It is obviously easy for the teachers to deliver their lectures on the topics of mathematic with the conventional methods, i.e. by using blackboard, make students to learn more intensively the formulas and using same explanations and methodologies. This method is a challenge for the colleagues, an urge for them to try something else. Of course it is not a easy process .It takes time to develop critical thinking among students. Consistent efforts and participation from both teacher and student are required. This process needs a rigorous preparation of the lesson and material also has to be framed specially. These critically planned lessons will be particularly efficient, both from the point of view of the learning of mathematics, as well as considering the development of their skills in analyzing, logical and sensible thinking, decision-making, communicating and cooperating with others.

9. Educational Implications

1) Critical thinking must be the foundation of imparting education in mathematics. And the syllabus must be planned according to it.
2) Our government should take steps as workshops, seminars, talks etc to train the teachers keeping critical thinking as basis over and above innovative methods.
3) The teachers should be ready to modify their traditional old teaching patterns into more interesting methodologies.
4) All queries of the students about the subject matter must be clarified by the teachers such that they provide in-depth knowledge.
5) Teaching should be such that it increases the level of creativity, fun and motivation among students.
6) The principle of "abstract to concrete" should be followed where it is possible while delivering the lecture.
7) The real life applications of the subject matter should be illustrated to the students, so that they can correlate it with their daily life, other subjects.
8) Students have to be appreciate by teachers and their parents for their achievements thus enhancing their confidence and preparing them to tackle more complex problems.
9) Teachers should be easily available for the queries of the students.
10) Sometimes in special cases efforts must be taken by teacher to clear the backlog of students if any.
11) Teacher should solve the problems where ever possible in more than one way.

12) The topics must be prepared by teachers which induces critical thinking in the minds of students and results in broadens the horizons of their intellectual level.

13) Students themselves must be motivated to do self study, and gain more knowledge in the subject matter.

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