Effective Strategies under Constructivist Approach of Learning to Reduce Fear and Phobia in Mathematics

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Abstract- *Mathematics is a very important school subject because of its utility in practical life. It is correlated with all the school subjects and is crucial in the career choice, however it is characterized with the fear and phobia among students. Constructivist approach is one of the most effective approach in which learners take self-initiative with positive attitude, are actively engaged in learning and provided opportunity to learn at their own pace. This approach provides flexibility and even welcome of wrong answer in creative perspective because it focuses more on process rather than product. What are the strategies under constructivist approach of learning to reduce fear and phobia in mathematics? What are the exact causes of fear and phobia in mathematics in the opinion of mathematics teachers? This study was conducted to know the answers of the above mentioned questions empirically. A self-constructed interview schedule was administered on a sample of 50 secondary schools mathematics teachers of Aligarh district. The Qualitative analysis of data revealed that emphasizing much on timely test, not valuing the mistakes of students, telling again and again that mathematics is a difficult subject and not realizing the utility of mathematics in practical life are some of the important causes of fear and phobia towards mathematics. Further, teachers opined that focusing on inductive approach, developing confidence in learners, self-construction of knowledge, fun with informative activities, inculcating problem solving ability and focusing on basic skills in mathematics are some of the strategies to reduce fear and phobia in mathematics. Effective strategies under constructivist approach will have the perpetual impact on the attitude of students towards mathematics as it results to learn it at their own ability and interest, thus reducing the fear and phobia in mathematics. The findings of the study, hence, will have much implications for the teachers as well as policy makers.*

Introduction

Education aims at all round development of the body, mind and soul. It is the instrument to mold the students for various professions and vocations. It helps to become aware of oneself and one's environment and also imbibe the moral, cultural, social, ethical and spiritual values**.** Since today's children are citizens of tomorrow, hence, the education not only prepares the students for higher education, but also shapes him/her to be a useful citizen of the society. In this regard real teacher must work for drawing out the best from the child's body, mind and soul. Any nation can

achieve the technological breakthrough with well-planned and effective execution of policies. In India, mathematics is a compulsory subject at both the primary school level and at secondary school level curricula. The compulsory nature of mathematics therefore, requires much attention towards every aspects of its learning.

Importance of mathematics

The literal meaning of mathematics is "things which can be counted". Its dictionary meaning states that, 'Mathematics is the science of numbers and space' or 'Mathematics is the science of measurement, quantity and magnitude'. It is exact, precise, systematic and a logical subject. Mathematics explore the hidden patterns that helps to understand the world around us. Today, mathematics is a diverse and comprehensive subject that deals with the data, measurements of data and observations from science, and their inference, deduction, and proof. Mathematics is not only concerned with daily life problems, but also with using imagination, intuition and reasoning to find new knowledge and to solve complex problems. Mathematics when presented in the classroom or in a textbook, is often a formal, precise, and disciplined step by step progression to a logical conclusion. We need to know the concepts of numbers and quantities because it is necessary for our daily routines. Mathematics is all around us and can be seen in the various patterns in art and music. Psychologically, knowledge of mathematics helps in developing a critical mind and assist for better organization of concepts and appropriate expression of thoughts. In the modern world we all are being increasingly dependent on the application of science and technology in the daily life activities, which in turn increases the role of mathematics. Mathematics is very helpful for the man to give exact interpretation of their ideas and conclusions. It is the numerical and calculation part of man's life and knowledge. It plays a dominant role in our life and it has become a vital factor for the progress of present day world. By observing nature we see so much of symmetry around us and have a deep sense of awareness and appreciation of patterns. There are innumerable examples of symmetry, shapes and patterns in plants. Such examples also exist in animals, in pictures, in objects and other things thus we can say that nature also embraces mathematics completely. Importance of mathematics can be understood by the definition given by Galileo who defined mathematics as 'a language in which God has written the world'. For further elaboration following points are given to understand the importance of mathematics:

- Mathematics develops analytical thinking by developing the ability of inquiry and logical thinking.
- Mathematics develops the ability of clarity, coherence, precision, and reasoning among students.
- Mathematics helps the students to reach their own conclusion, solving a complex problems and reaching to the new theory it's thus developing wisdom among them.
- Mathematics promote the minds for rationality by helping the students to think deeply about the complex problems.

- Mathematics is helpful in getting the students' job in the well-paid profession of engineering, education, statistics, and technology.
- Mathematics helps to compete in the modern world by giving the students of best college choices and opportunity for research to create new knowledge.
- Mathematics makes student smarter by making them expert in their work and competent in their profession.
- Mathematics protects from loss by giving the sound knowledge of various investment schemes, statistics and calculations of investment.
- Mathematics leads to social up gradation by providing various vocational choices to the students and hence, reducing poverty.
- Mathematics gives knowledge of various calculation which is helpful in everyday life.
- Mathematics stimulates the brain into responding things faster and making the brain sharp.
- Mathematics provides a path to understand the intensity of the problem and the various ways of solving the problems.
- Mathematics helps a person to understand more than one ways of solving a single problem.

Relationship of Mathematics with other school subjects

Mathematics is highly correlated with other school subjects which may be understood by the following points:

- **Mathematics and pure science**: Science without mathematics is completely meaningless, because mathematics is used in most of applications like in motion, energy, electricity, gravitation, magnetism etc. Mathematical calculations occur in every step of physical science and chemical sciences like calculating molecular weights of organic compounds. Mathematics has very high correlation with biology as well because the normal weight, caloric value, rate of respiration, weight of infants' and measurement of blood pressure etc. requires the knowledge of mathematics.
- **Mathematics and social sciences**: Mathematics helps students to read, interpret, and draw the graphs in geography. Various geographical concepts can be explained only in numbers like seasonal conditions, temperatures, lunar eclipse, longitude, latitude and standard time. In history Mathematics helps in carbon dating. Mathematics is used to calculate and to know the volume of trade, trend of import and export like crop production, inflation, etc. hence, making it important for all economist.
- **Mathematics with agriculture:** Mathematics is closely related with agriculture because calculation of yield, area, investment, expenditure and saving in sowing, transportation of goods to the market, etc., requires the knowledge of mathematics.
- **Mathematics and ICT:** ICT is strongly correlated with mathematics because various computer programs, software, applications and different ICT languages can be learnt only

with the help of knowledge of mathematics. Similarly mathematics has strong correlation with various branch of engineering like electronics, mechanical, civil, architect, petro-computer, chemical etc.

Phobia of Mathematics

Mathematics phobia is the persistent, illogical, intense fear of not succeeding in mathematics. It is the belief that one is unable to handle the difficulty associated with learning mathematics. Many students consider mathematics as one of the toughest subject in the school curriculum. Mostly school going students are scarred of the subject like scaring from an evil. Many students also think that it is the scoring subject which otherwise can ruin the score and academic marks, and grades of students.

Some students have a deep-rooted fear of mathematics, and they think that mathematics being an extremely difficult subject, they cannot master over it. This negative attitude hinders them to focus on the mathematics problem which they tackle. Before exams or test they start getting nervous. Some students even learn and understand mathematics but during the time of the test fear clouds their minds and they are not able to perform well. This increases the speculation in their minds that mathematics is too difficult for them.

Constructivist Approach and Mathematics

The constructivism represents a paradigm change in mathematics education. Learning of mathematics as per the views from a constructivist perspective involves epistemological, psychological, as well as conceptual development. According to the view of constructivism, learning should be a dynamic and social process in which learner actively constructs the meaning from his/her own experiences in accordance with the prior understanding about the event or issue and their social setting. The constructivist view of learning advocates that students do not come to the mathematics classroom with empty head but arrive in the classroom with lots of strongly formed ideas about how the people and the natural world works. A Constructivist learning setting differs from the one based on the traditional model. In a constructivist classroom, learning outcomes not only depend on the learning environment but also on the knowledge of the learner. Learning involves the construction of meaning by students from what they see or hear. It is a continuous and an active process, which is influenced largely by existing knowledge. The constructivist approach radically changes the process of teaching and learning by connecting it with daily life, and using a creative approach to solve the mathematics problem. It includes the active involvement of students and their interaction with the creation of new ideas. Critical thinking, problem solving approach and analytical skills are the most important skills that are developed in the process of mathematics education and these are also the cornerstones of constructivist approach.

The Present Study

The present study was conducted to know the Effective Strategies under constructivist approach of learning to reduce fear and phobia in mathematics and to know the exact causes of fear and

phobia in mathematics in the opinion of mathematics teachers. The researcher administered a self-constructed structured interview schedule based on 8 questions on a sample of 50 mathematics teachers, teaching in various secondary schools of Aligarh. The gathered information was analyzed through qualitative method.

Findings of the Study

After analyzing the data, the investigators are summarizing the findings under the following two sub-headings:

Causes of Mathematics Phobia

- **Mistakes are not valued**: The respondents opined that the one cause of phobia is that teachers do not ask the student about wrong answer. They do not instruct them to explain that how they had come up with this answer and also do not ask whether anyone get the same answer. Sometimes, wrong answer is only wrong because of small mistake, and it is achieved by adopting a different reasoning process, and the process is itself valuable. Mistakes actually help to grow our brains and leads towards success.
- **Much emphasis on timed tests:** Respondents narrated that tests are a part of learning but they shouldn't be the actual goal. The true aims of mathematics learning is to make students able to apply math in practical life and also prepare them for higher education. Tests, especially timed tests, are one of the main reasons for math phobia among students.
- **Negative attitude towards mathematics as difficult subject:** Students with average intelligence level can also learn mathematics. The respondents described that if the teachers or other stakeholders believe that the students cannot learn mathematics or they are not good in mathematics, then it causes them to develop a fixed mindset towards their intelligence and learning ability. It is teachers' responsibility not to give such messages to any student, and help to develop a positive mindset.
- **Not presented as creative subject:** The respondents in the study opined that one of the reasons of mathematics phobia is that teachers teach by only one way to solve any problem whereas, students need to learn it and do it by various methods.
- **Not getting sound reasons to study math:** Mathematics teachers responded that students are more motivated when they realize the need of any subject. For example, basic math such as estimating prices, totals, decimals, fractions, and measuring skills are very helpful in everyday life. Therefore, correlating the everyday use of mathematics to classroom mathematics problems is the need of the hour.
- **Poor teacher-student relationships:** Mathematics teachers opined that most of the time students feel more fear of teachers than mathematics as a subject. In general, the strength of students in classroom is too large that's why a healthy student-teacher relationship is very poor. This poor interaction between teacher and students leads to the fear and phobia among students.

- **Lengthy home assignment:** Usually in comparison to other subjects mathematics teachers give more assignments and homework to the students in mathematics subject. Mathematics teachers opined that such type of burden and attitude leads to phobia in mathematics.
- **Use of abusive words:** Sometimes teachers themselves do not take interest to teach mathematics. Uninterested teachers do not use any innovative approach that's why students are not able to understand mathematics and solve the problems. As a result teacher uses abusive words which further increases fear and phobia.
- **Non conducive learning environment:** For best learning outcomes in mathematics, environment should be like a catalyst. Most of the mathematics teachers believe that conducive environment having infrastructure facility, positive attitude, best mathematics teachers and best reason to learn mathematics makes environment favorable to minimize fear and phobia.
- **Poor mathematics background:** Some of the teachers said that one of the causes of phobia in mathematics is that their students are first generation learners and hence, have a very poor basic mathematics skill. They have no academic support from parents and it leads to fear and phobia.

Effective strategies under constructivist approach to reduce mathematics phobia

- **Teachers should be positive**: Most of the mathematics teachers opined that perception can hurt the student's confidence and self-esteem. They opined that the teachers should help students to understand that everyone has different abilities and they should be proud of their students. Some extra efforts and a little additional help will certainly encourage them to do best in mathematics. Such a positive view will boost the learner's confidence and help them to perform better.
- **Teachers should encourage to discuss about fear and phobia**: Teachers opined that constructivist approach provides more opportunity to interact with students thus, provides the chances to discuss the causes of fear in mathematics. In constructivist approach acceptance is always the first step towards taking any problem that's why fear and phobia can easily be tackled by this approach.
- **Focusing on previous knowledge**: Mathematics teachers responded that constructivist approach emphasizes on the construction of knowledge with the help of previous knowledge. Therefore, improving the ability of students to solve basic math problems, setting aside a particular time for basic skill practice, investing extra time and effort etc. will bring about a great change in performance.
- **Making mathematics simple and fun**: Respondents opined that teachers should simplify the teaching methods even for complicated problems. It can be made easy by breaking them into smaller and simpler steps. Involving students in math games, apps and puzzles will make the learning an enjoyable experience.

- **Believing math as a creative discipline**: Mathematics teachers should encourage students to experiment with different steps of solving a problem. More over introducing mathematics lesson with open-ended problems such as figuring out how many ways you can solve this problem, creating some unique way to solve this problem etc. makes a positive attitude that mathematics is a creative subject.
- **Connecting with daily life**: Most of the mathematics teachers focused to bridge the gap between classroom learning and practical life application of knowledge. They opined that teachers should try to integrate math into student's daily life, to make it more real and meaningful.
- **Encouraging peer learning**: Mathematics teachers responded that cooperative learning under constructivist approach which draw interdependence of students, group work and pair-work to solve math problems will be effective way of reinforcing concepts learnt.
- **Giving objectives of mathematics**: Respondents suggested that teachers should help the students to understand the need of numbers in daily life work. A large percentage of jobs in the future require mathematics skills and a strong foundation in the subject. This goal oriented learning is supported by the constructivist approach and such kind of motivational approach will lead to positive results.
- **Bringing positive attitude towards mathematics**: One of the best remedies to handle mathematics phobia according to the respondents is to teach students to love mathematics. In the opinion of teachers, connecting mathematics to many games, puzzles and music will help in bringing positive attitude.
- **Not focusing on speed**: The respondents in the study pointed that one of the reason for mathematics phobia in students is that they feel that they are very slow to solve problems while their peers do them in a matter of seconds. Teachers should apply constructivist approach of learning because it emphasizes more on process rather than product.
- **Using music**: We know that the construction of knowledge occurs in very active and jolly mind. So there are many mathematics teachers who claim that listening background music in low volume helps them to solve mathematics problems correctly. This may not applicable to all time, but it can be remedies to reduce math phobia.
- **Varied methods of teaching**: Most of the mathematics teachers claim that phobia can be stem from the students but teachers should try to integrate the various innovative methods of teaching to bring novelty in the classroom. The trick to know math is that students can solve the same problem in many ways to get the same result.
- **Knowing the exact reasons of students fear**: Mathematics teachers opined that first of all we should locate students' fear in mathematics i.e. in which area they are weak which ultimately creates fear. Since constructivism always opposes the myths about concepts hence, the students should first identify their reason of fear in mathematics.
- **Discussing with students on doubts**: The respondents opined that constructivist approach provides flexibility and openness in classroom so this approach allows us to

discuss freely and frankly. Teachers should provide the opportunity to ask doubts and try to understand what students learn actually.

- **Using instructional materials:** Mathematics teachers opined that the learning with ICT is good way, because if a student is doing any mistake then ICT is very helpful to realize it. ICT provides practicing the questions many times and in giving positive and negative feedback to do it again with joy. Teachers should give time to solve student's mistake and students should also try to learn from mistake so that it can be rectified.
- **Reduce the number of assignments: -** Mathematics teachers responded that number of assignment in mathematics creates an academic pressure on students in comparison to other subjects. Teachers opined that less number of assignment can help to sustain the motivation of students.
- **Moving from whole to parts:** The respondents opined that teachers should try to present topic as a whole rather than part because the complete picture of any concept minimizes confusion and mistakes. A clear concept of mathematics helps to solve the problems and also helps in its application.
- **Encouraging low achievers through attention**: Mathematics is the means of sharpening the individual's mind, shaping his/her reasoning ability and developing his/her personality, hence most of the mathematics teachers opined that encouraging the low achievers to perform better in this subject is important.

Conclusion

Learning is an active process in which an individual continues to acquire new knowledge and understanding based on previous experience of choosing and transforming information. The methods used to teach mathematics skills affects student's success and develops self-confidence so teachers should try to use the innovative approach like constructivist approach. Mathematics phobia can be overcome with the patience of an experienced and enthusiastic teacher. Once a person gains even minimal amounts of success with mathematical concepts, the phobia will decreases gradually.

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