

Original Article

Mathematics Anxiety and how to Overcome it in Earlier Stage of High School Level

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Abstract - Anxiety is our body's natural response to stress. It is a feeling of fear or apprehension about what is going to happen. Going for job's interview, going to give maiden speech, the first day to school, the first visit to a foreign country, the first air journey may cause most people to feel fearful and nervous. It is a natural phenomena. But constant and unsubstantiated worry that causes significant distress, avoiding social situations for fear of being judged, embarrassed or humiliated, the pre-occupation with the fear of having another such situation, are the disorders in anxiety. Anxiety is natural- Anxiety disorder is disease. Here we are going to analyze the Mathematics anxiety, which is defined as a feeling of tension and apprehension that interferes with mathematics performance ability.

Keywords - Mathematics anxiety, Distress, Fear, Psychological approach, Gamification.

1. Introduction

Mathematics knowledge is the necessary for the high school level students which is the foundation of the higher education. The anxiety in learning mathematical concepts becomes barrier in their future career and affects them psychologically which leads to negative impact of irritation, frustration, embarrassment. This is to be identified at the earlier stage of learning otherwise it hinders the working memory and it tends to the avoidance of the subject. In some cases, Mathematics anxiety causes trembling limbs, speedy heartbeat and feeling faint while dealing with manipulation of numbers and solving problems. This psychological negativity should be dealt with careful activities to make it as the simple and normal attitude to achieve the mathematical ability. Mathematical achievement is an essential part of the academic achievement in the modern era.

The following methods are discussed to keep away the fear and the distress of Mathematics which leads to Mathematics anxiety. Psychological approach is the basic approach to sow the seed of thinking Mathematics is the interesting adventurous subject in the young minds of the students in the high school level.

Gamification of mathematics concepts make the students to learn Mathematics without fear and with fun and physical activities. Visualization of Mathematical concepts make the students to understand the abstract concepts and develops the creative thinking in the learning of Mathematics. Mathematics Field Trip makes the students to understand the application of Mathematical concepts in day to day life. When the students are away from fear, with the better understanding and make the mind with the thought Mathematics is an enjoyable adventurous subject, certainly they will be relieved from anxiety and will be able to learn Mathematics successfully.

2. Psychological Approach

The teaching of the subject Mathematics is one of the major challenges of the educators. Mathematics is considered as the tough subject. Students find barrier in learning Mathematics as understanding the concept, remembering the formulae, doing the calculations. The reasons behind it is fear and anxiety towards the subject which is developed by the students in their school life and carry it in the whole life.

People who feel tension, apprehension and fear of situations involving Mathematics are said to have Mathematics anxiety. It becomes the barrier in achieving by the students in the subject. It must be addressed accordingly, before it turns into a permanent block.

Anxiety is your body's natural response to stress. Behavior modification is the traditional term for the use of empirically demonstrated behavior change techniques to increase or decrease the frequency of behavior. Positive or Negative reinforcements increases the frequency and Corporal Punishment / repeated cynicism decreases the ability. Psychologists emphasizes that habits are learned due to classical conditioning. Behavior modification is based on learning



theories and its basic principle is that when we consistently respond to a stimulus in a particular manner neural network forms it becomes habit.

Psychotherapy, also known as talk therapy or psychological counseling to the students is nothing but open discussion on the problems, his feelings and actual hurdle in learning Mathematics. Open talk with the students gives the main idea of students anxiety. The teacher can use stress management and relaxation techniques with the students which will teach the students how to manage with anxiety and how to face it. In this psycho therapy there are different therapeutic techniques to treat anxiety and so many psycho analytic approaches have evolved overtime., to identify and understand the negative thinking and ineffective behavior patterns.

In this analytical approach, replacing the negative thinking with more realistic thoughts and effective actions, coping mechanism are result bearing steps of the therapy. It makes them understand there is grey in between black and white thinking.

According to Sigmund Freud, anxiety symptoms reflect unconscious conflicts.

The purpose of psychoanalytic therapy, is resolving them. The thoughts, fears and desires are examined analyzed without any area limitation, which helps the students to think according to the situation, imagination, assumption which are the most intensive forms of cognitive process in learning Mathematics.

When the students at the earlier stage of high school education, are dealt with psycho-analysis, the cognitive thinking in their mind becomes to face the difficulties which are the barrier makers of their mind and they become fearless and facing different problems and trying to solve them becomes adventurous to them. Now, they really enjoy in learning Mathematics.

2.1. National Council of Mathematics Teachers suggests that

- Accommodating for different learning styles like, through songs. Drama, field trip, games, exhibition, workshop etc
- Creating a variety of testing environments like slip test, measuring themselves, creating toys for depicting concepts, etc
- Designing positive experiences in Mathematics classes
- Refraining from tying self-esteem to success with Mathematics
- Emphasizing that to err is human being
- Linking the concept to real day-to-day life
- Pragmatic approach to evaluate themselves
- Allowing for different social approaches to learning Mathematics
- Emphasizing the importance of original quality thinking rather than rote manipulation of formulae.

3. Gamification of Mathematics Concepts

The high school level students have always fun in physical activities like playing, jumping, hopping, etc. If the Mathematics teachers use all the physical activities having funny games combined with Mathematical concepts, they can easily make them understand. At the beginning students are attracted towards the game and they understand the mathematical concepts behind them. Psychologically they will be out of fear and they come towards the subject with interest. Understanding the meaning of the concept gives them confidence to try for the next step of calculation.

Games give the opportunities to explore counting sequence, reciting multiplication table, number combinations, place value, patterns etc. According to many research studies, using games in teaching can help increase student participation, foster social and emotional learning, and motive the students to take risks.

Classroom games are a great way to harness the power of play and use it to enhance the students' learning experience. Not only are games fun and engaging, they can also

- Help the students focus better
- Present educational material in a new and interactive way
- Give the whole class an opportunity to get to know each other better.

By playing games, students become more motivated to learn, pay attention and participate in the whole event in full-hearted manner. Games help students to become a part of team as well as take responsibility for their own learning. They can also be a great classroom management tool, helping to motivate a class. We can list out the benefits of teaching Mathematics through games as

- ✓ Students become acquainted with good mathematics instruction as well as study techniques;
- ✓ Students recognize what type of information needs to be learned;
- ✓ To be an active learner and create problem-solving techniques
- ✓ Students are in a position to evaluate their own learning;
- ✓ Students develop calming and positive ways to deal with fear of Mathematics including visualization, positive messages, relaxation techniques, frustration breaks
- ✓ Gradual repeated success to build Mathematics confidences which drives away the fear in students.

When considering the use of games for teaching mathematics, educators should distinguish between an ‘activity’ and a ‘game’. A game needs to have two or more players, who take turns, each competing to achieve a ‘winning’ situation of some kind, each able to exercise some choice about how to move at any time through the playing. The key idea in this statement is that of ‘choice’. In this sense, something like Snakes and Ladders is not a game because winning relies totally on chance. The players make no decisions, nor do that have to think further than counting. There is also no interaction between players – nothing that one player does affect other player’s turns in any way. The games framed by the teacher should be of simple physical activities and every time the students should be appreciated. The game can change the students’ perceptions that the mathematics is difficult and contribute them to feel relaxed in the course. The high school children can improve the informal mathematical knowledge they have acquitted in game activities, if they attend problem solving process. The effect of using games in the process of teaching Mathematics on academic achievements has been always fantastic and has very good improvement. When it is computer-based games, though improvement in learning is found, the actual happiness and fitness given by the physical game gives overall improvement in the learning Mathematics by the students.

3.1. Students Engaged in Playing Game to Identify Prime Numbers



3.2. Students Learning the Types of Angles



3.3. Students Learn to Find the Difference Between Divisor and Factor



4. Visualization of Mathematical Concepts

One of the main reasons behind the Mathematics Anxiety is the problem in visualizing the mathematical concepts in the mind. Students have difficulty visualizing patterns or the parts of a mathematical problem in their mind. They have difficulty associating mathematics symbols with the concepts they represent. Students are not comfortable using mathematical language, or has difficulty with mathematics vocabulary words; Students have difficulty seeing how concepts of abstract ideas are related to each other. Students have problems transferring the concepts learned in the Mathematics classroom to real life situation. In Mathematics learning, visualization can be a powerful tool to explore mathematical concepts and the relation between the meaning and application of mathematical concepts. Visualization allows for reducing complexity when dealing with a multitude of information. Visualization is the ability, the process and the product of creation, interpretation, use of and reflection upon pictures, images, diagrams, in our minds, on paper or with technological tools, with the purpose of depicting and communicating information, thinking about and developing previously unknown ideas and advancing understandings. “A PICTURE IS WORTH A 1000 WORDS” highlights the importance of visualization in general. Likewise, visualization has a long tradition in mathematics and the list of famous mathematicians using or explicitly advocating visualization is large. “ A WORKING MODEL DEPICTING MATHS CONCEPT IS WORTH A 10000 WORDS” , though a picturization is traditional and working model in mathematics is a trend in the areas of teaching learning in mathematics.

4.1. The Benefits of Visualization

- Imagination has no limits.
- It can help you reduce stress.
- It gives you a wider point of view.
- Visualization can help you change habits.
- Working model depicting the maths concepts make them understand fully.
- Visualization gives the students the chances to practice. Practice makes them perfect.

4.2. Students Visualize the Concept Of Ellipse; Relation Between Volumes of Cone and Cylinder Having the Same Height and Radius



4.3. Students Practise with Working Model Having Visualization Factor



5. Mathematics Field Trip

Field Trip are the trips that school offers to enhance or supplement the educational experience of students. Field trips include events or activities where students leave the school campus for the purpose of curriculum related study or outdoor education. Going on Field Trip enhances their critical thinking skills and gives students a chance to see the practical usage, the physical work of machinery, the packing, loading, marketing like works which they have studied theoretically or theme from a different perspective. Students nowadays are visual learners and a field trip lets them touch, feel and listen to what they are learning about, which helps them build on classroom instruction, gain a better understanding of topics, build cultural understanding and tolerance and expose them to world's their own.

Field Trip the great way to learn and remember information. Normally Science and Social science subject teachers take the students to Field Trip in the name of educational tours. Mathematics teachers should also take the students to the different places like Carpenter's workplace, building construction workplace, tiles layers workplace, etc. In those Field Trips, students learn so many mathematical concepts by visualizing many things like measuring lengths, breadths, heights using the measuring tapes in different units, shapes of the reinforcing bars in concrete, triangular shapes for building bridges and many mathematical concepts used in structural engineering, masonry work of perpendicular walls, slanted walls, flooring with proper measurements of diagonals, etc

6. Psychological Mind Set Up of Mathematics Teachers

In Teaching-Learning process, we understand that out of all subjects, Mathematics stood aside by its own typical, peculiar style of toughness, abstractness, and the detachment between the teacher and the students. When the teachers try to make the students understand the mathematical concepts, and the students could not imagine/understand the concepts, the process of cognition involves. The teachers could not imagine what it goes in the students' mind and this inability

makes the teachers frustrated. Out of this frustration only, the teachers behave rudely, gives corporal punishment etc. This activity extends the detachment between the teachers and the students.

To ease the mental stress of the teachers, they should be given periodical stress management training and how to deal the young children according to the present scenario. Stress management in teaching-learning process makes the teachers to

- Handle the situation with balancing act of covering the syllabus simultaneously accept the; young children inability to understand
- Understand the young minds cognition.
- Avoid the physical punishment which gives FEAR in this process
- Follow the different methods to teach
- Provide the students Practice to find the solution to the given sums.

The class room situation two decades ago is totally different from the present Class room scenario. Earlier it was teacher centered and now it is students centered. Earlier in class room, students were taught moral education. Now, moral education is given less importance. Teachers were involved only in teaching the subject, maintaining the educational records, and his whole world was surrounded by the education only. Recent trends make the teachers to do the students welfare oriented programmes, survey related works, etc which somehow divert their attention from education. Post-Corona situation also made the education standard of the students in their mental intelligence very low and maintaining the level of the education standard is very difficult to the teachers.

In such situation, teacher's mental health is really affected and the burden of shouldering all the responsibilities and giving the percentage of result in public examination leads them to blood pressure, anger, and into some caged surroundings.

As teachers are soft natured, and always worried about the future of the generation in socio-demographic scenario, the inability to produce the results, the difference of the knowledge and its relation to the examination result, the progress in the learners knowledge, skill, and understanding, the development in the students life based on the factors of the education always bother teachers.

To maintain the teachers' mental health, the administration should care of this. And they should be given time to time training and counseling for their good mental health. Psychological training to maintain the relationship between the teachers and students. When the teachers are healthy to deal with the students and students understand the teachers, the maximum gap between them is reduced and healthy teaching-learning takes place.

The School Administration and Department of School Education should not think teachers as result producing machines. Students are not lifeless product materials. In teaching-learning process, students are mould in progress when students are willing to be mould, otherwise could not. Because they are also human beings, they have their own interest, mood, mischief, way of doing, self respect etc. When both teacher and student go along with the same aim, the result comes as high one.

7. Conclusion

Anxiety is a natural process. Particularly, Mathematics Anxiety is quite natural when young children don't understand, and could not imagine the concepts. When it is dealt with extra carefulness, it can be nipped in the bud itself. Teachers may follow the different methods of approach as we discussed above like visualization, Mathematics Field Trip, Gamification of Mathematics Concepts, students can learn the so called tough subject with adventurous, funny, enjoyable activities. When the students are free from fear in their mind, they are ready to pay attention towards what they are taught. It is concluded that Mathematics Anxiety is a normal one and If teachers and parents deal with it, through different way of teaching whom resultant the fear in the young children mind will hide away and the learning will take place without fear and the gradual learning will make the students progressive in the subject Mathematics.

References

- [1] Sheila Tobias, *Overcoming Math Anxiety*, Revised and Expanded Edition.
- [2] Jo Boeler, *What's Math Got to Do with It? How Teachers and Parents Can Transform Mathematics Learning and Inspire Success*, 2015.
- [3] Jo Boeler, "Mathematical Mindsets, Unleashing Students' Potential Through Creative Mathematics, Inspiring Messages and Innovative Teaching," 2016.
- [4] Marian Small, *Understanding the Math We Teach and How to Teach It*, Stenhouse Publishers 2019

- [5] Dash B.N, “Trends and Issues in Indian Education,” p. 213, 2013.
- [6] Mohanasundaram, K, and Williams ,R.C., “Information and Communication Technology in Education,” p. 34-38, 2006.
- [7] Soosai Raj, J, and Mohanasundaram, K. “Effectiveness of Video-Assisted Instruction with Reference to Study Habits and Achievement of Students in Mathematics,” SETRAD, p. 126, 2002.
- [8] M.Valkkil, and Saroj Aurora, “Assessment Learning Disabilities and ADHD, P-297-302 in Innovations in Modern Educational Research”.
- [9] Megan R. Smith, “Math Anxiety: Causes, Effects, and Preventative Measures” pp. 7-12, 2004.
- [10] Mr. Pankaj Singh, “Management of Mathematics Anxiety through Behaviour Technology, Super Brain Yoga and Varmalogy in Ninth Standard Students,” *International Journal of Indian Psychology*, vol. 3, no. 2, 2016. Crossref, <https://doi.org/10.25215/0302.092>
- [11] Souman Chandra Kundu and Susantha Kar, “Mathematics Anxiety and its Relationship with the Achievement of Secondary School Students,” *IJRAR- International Journal of Research and Analytical Reviews*, vol. 5, no. 3, pp. 451-455, 2018.
- [12] Meharunnissa Sirajudeen, and Roshini, “A Study on the Role of Parenting and Peer Attachments in Mathematical Anxiety,” *International Journal of Research and Analytical Reviews*, vol. 5, no. 3, 2018.
- [13] P.B.Cemen, “The Nature of Mathematics Anxiety”.
- [14] Karen Morrison, and Lisa Greenstein, “Changes in Maths Pedagogy Making Maths Accessible for All,” 2022.
- [15] Sonali Gupta, *Anxiety: Overcome It and Live Without Fear*, 2020.
- [16] Manan Khurma, “Overcoming Mathematics Anxiety,” Business World, 2017.
- [17] Mageswaran Sanmugam, “Perspectives and Practices of Gamification,” NOVA Science Publisher, 2022.
- [18] Christine Mulgrave, “Gamificatin of Maths Class Room”.
- [19] Judson Brewer, *Unwinding Anxiety- Train Your Brain to Heal your Brain*, 2021.
- [20] Dr. Radha Arora, and Kirandeep Kaur, “Mathematics Anxiety of Secondary School Students in Relation to Self-Motivation, Self-Regulation and Responsibility of Emotions, Self- Esteem besides Confidence with Metacognition,” *Research Journal of Humanities and Social Sciences*, vol. 9, no. 4, 2018. Crossref, <https://doi.org/10.5958/2321-5828.2018.00162.6>
- [21] [Online]. Available:
https://www.researchgate.net/publication/295073313_mathematics_anxiety_motivation_and_the_basic_psychological_needs_from_the_perspective_of_self-determination_theory
- [22] S.K.Mangal, *Pedagogy of Mathematics*, pp. 176, 2018.
- [23] James S.Tandon, *The Power of Mathematical Visualization*, 2016.
- [24] Samer Habre, *Enhancing Mathematics Understanding Through Visualization the Role of Dynamical Software*, 2013.
- [25] SK Chandrasekaran, *Scientific Mathematics*, pp. 67-69, 2014.
- [26] Gaurav Tekriwal, *Maths Sutra – the Art of Vedic Speed Calculation*, 2015.
- [27] Sandeep Srivathsava, *All That Matters in Mathematics*, Nextgen Books Pvt. Ltd, 2021.
- [28] Gaurgopal Das, *Energize Your Mind – the Ways to Keep Anxiety Away From Your Mind*, 2022.