Mathematics Phobia and Anxiety among Learners: Perspectives of Mathematics Teachers and Classroom Practices

Amlesh Kumar* and Laxmidhar Behera**
Department of Education RIE (NCERT), Bhubaneswar
Email: amleshedu@gmail.com* and behera17@yahoo.co.in

Abstract- *Mathematics is an important subject with broad applicability to everyday life, yet often considered as a difficult subject for some learners. Mathematics phobia and anxiety are common phenomenon which have a negative impact on learning outcomes. Learners are not born with mathematics phobia and anxieties; they are victims to the educational processes. Learners think of mathematics as an extremely tough subject that they cannot be master over it. In this backdrop it was worth to the study the perspectives of mathematics teachers on factors influencing mathematics phobia and anxiety among learners at secondary stage. The study explores and analyses the perspectives of pre-service and in-service mathematics teachers on suggestive practices on eradication of fear of mathematics among learners. The study also reflects on the best practices performed by mathematics teacher for eradicating the mathematics phobia and anxiety among learners. Based on a descriptive survey research, the present study was confined to pre-service and in-service mathematics teachers of Bhubaneswar locality. Both quantitative and qualitative approaches have been used for collection of data. The tools included questionnaire for teachers (pre-service and in service), classroom observation and case study protocol. Forty-three secondary level pre-service mathematics teachers and 5 in-service mathematics teachers of Bhubaneswar locality participated in the study. The major findings of this study revealed lack of confidence in performing mathematics/mathematical tasks, lack of courage to express their feelings about mathematics to their respective teachers, negative attitude towards mathematics, and avoidance of mathematics courses/classes, parental pressure, negative peer pressure etc. were the major factors influencing mathematics phobia and anxiety among learners at secondary stage. The study provided suggestive practices like to create learner friendly mathematics classrooms, individual attention on every learner by their teachers, use of different approaches and strategies in teaching mathematics among learners etc. to eradicate fear of mathematics among learners. The study also reflected on the evidence based practices performed by mathematics teacher like use of mathematics kit, use of community resources, relating mathematics to learners' prior experiences, providing ample scope for practices in mathematics instructions for eradicating the mathematics phobia and anxiety among learners. Based on the findings the study lists educational implications for teachers, students, parents and school board.*

Key Words: *Mathematics Phobia, Mathematics Anxiety, In-service Mathematics Teacher, Pre-service Mathematics Teacher.*

Conceptualisation of the Problem

As mathematics is a compulsory subject at secondary stage, access to quality mathematics education is the right of every child (NCERT, 2005). The knowledge of Mathematics is very essential in our day to day life. Mathematics is the mother of all sciences. The world cannot move without Mathematics. Nature is the greatest Mathematician of all. Many Mathematical concepts, pattern, laws, etc. are observed in the nature. Mathematics fulfils most of the human needs related to different aspects of everyday life. Every person whatever he or she requires a knowledge of Mathematics in day to day life for various purposes. Mathematics is the means of sharpening the individual's mind, shaping his reasoning ability and developing his personality, hence, its immense contribution to the general and basic education of the people of the world (Asiedu-Addo and Yidana, 2000). A mathematics teacher should therefore needs to provide students with stimulating and wide-range of mathematical learning experiences that will develop their skills and knowledge. This will enable them function as useful citizens.

Mathematics is one of the major subjects in the educational process which is considered as the toughest subject in the existing scenario. Many school going students are scarred of the subject like scaring from an evil. Around the world, the Mathematics phobia and anxiety is spreading and students think they will fail in the subject. Low math achievement is a recurring weakness in many students. Mathematics phobia and anxiety is more than a barrier to math achievement as it has a widespread impact on other aspects of students' lives. Mathematics phobia and anxiety has been universally recognized as a non-intellectual factor that impedes math achievement. Some students who perform poorly on math assessments have a full understanding of the mathematical concepts being tested; however, their anxiety interferes with their ability to solve mathematical problems (Sparks, 2011; Hellum-Alexander, 2010; Ashcraft and Krause, 2007; Cavanaugh, 2007; Tsui and Mazzocco, 2007). Beilock and colleagues (2010) concluded that "the fears that math-anxious individuals experience when they are called on to do math prevent them from using the math knowledge they possess to show what they know". Physical symptoms of mathematics phobia and anxiety include increased heart rate, clammy hands, upset stomach, and light headedness. Psychological symptoms include an inability to concentrate and feelings of helplessness, worry, and disgrace. Behavioral symptoms include avoidance of math classes, putting off math homework until the last minute, and not studying regularly (Mission College, 2009; Plaisance, 2009; Jackson, 2008; Woodard, 2004).

Many math anxious students remember an extremely embarrassing moment in their math history that was the catalyst for their anxieties and dislike for the subject. The catalyst is most often an insensitive remark from a frustrated teacher. As the number of these experiences grows, the student is more likely to give up more quickly when faced with a challenging math problem. Students are not born with mathematics phobia and anxieties; they are victims to the educational system. As we know that India is the land of great mathematician like - Aryabhatta, Ramanujam etc. Yet, this is one subject that our students dread the most. In today's high-tech world, it is

important that our young children grow to become confident in their ability to do mathematics in an ever-increasingly high-tech globally competitive society.

Need and Justifications of the Study

Mathematics is an important subject at secondary stage. It develops students' intellect, thinking and reasoning. It is a channel to various fields of study. In order to have many opportunities or choices of fields of study, learners have to do mathematics while at school. Without mathematics career options will be limited. For a career in science, learners have to pass mathematics in 10+2. There fore there is a need to improve learners' performance in mathematics so that the number of learners who will pursue careers that regard mathematics as a prerequisite may be increased. The poor learner performance in mathematics is a worldwide concern. The performance of learners in mathematics varies from topic to topic. There are topics in which learners continue to perform poorly and at the same time there are topics where they perform well. Generally, the overall performance in mathematics is poor, this may be due to mathematics phobia and anxiety among learners. Mathematics phobia and anxiety among learners has been a research topic for several decades. Several researches indicates that there is a strong negative relationship between math anxieties and test scores, such that as students' math anxiety increases, their test scores decrease.

The vision for school mathematics as enlisted by NCF (2005), suggested that Children learn to enjoy mathematics rather than fear it. But the ground reality is totally different. A number of researchers have hypothesized that fear of mathematics disrupts performances because it reduces students' working memory, leaving them unable to block out distractions and irrelevant information or to retain information while working on tasks (Sparks, 2011; Legg and Locker, 2009; Ashcraft and Krause, 2007; Cavanaugh, 2007; Beilock and Carr, 2005). Researchers have found that both teachers and parents have a strong influence on students' mathematics phobia and anxiety. According to Hadfield and McNeil (1994) the causes of mathematics phobia and anxiety can be divided into three areas: environmental, intellectual and personality factors. Environmental factors include negative experiences in the classroom, parental pressure, insensitive teachers, math taught as a rigid set of rules and non-participatory classrooms (Dossel, 1993). Intellectual factors include being taught with mismatched learning styles, student attitude and lack of persistence, self-doubt, lack of confidence in mathematical ability and lack of perceived usefulness of mathematics (Cemen, 1987). Personality factors include reluctance to ask questions due to shyness, low self-esteem, and viewing mathematics as a male domain (Cemen, 1987).

As we know mathematics phobia and anxiety is a phenomenon in which students suffer from an irrational fear of mathematics that affects their ability to learn, comprehend, practice, and perform mathematical problems and procedures (Miller and Mitchell, 1994). This phobia and anxiety can cause an inability to think and process new information. It is a real issue that can impact a student's goals, many career-related decisions they may make in life and their overall future" (Furner and Gonzales-DeHass, 2011). "Mathematics is nucleus of all subjects" But present prevailing situation in the world of mathematics is "Mathematics phobia and anxiety".

No country today can boost of all its literate citizens to have "Zero Mathematic phobia and anxiety" and Mathematics Phobia and anxiety ceased to attract research. Hence the investigator was interested to undertake the present study.

Operational Definitions

Mathematics Phobia and Anxiety - Mathematics phobia and anxiety is defined as negative emotions that interfere with the solving of mathematical problems. It is a feeling of tension, apprehension, or fear that interferes with math performance. Phobia refers to fear of an object or a particular situation that may be harmless. Anxiety is a state of feeling nervous or worried that something bad is going to happen.

Mathematics Teachers Perspectives – In this study mathematics teachers perspectives is a set of beliefs and assumptions about teaching i.e. planning a lesson, relating maths with learners prior experiences, utilizing community resources, motivating learners to do the math etc. to eradicate the mathematics phobia and anxiety among learners. In the present study it refers to the perspectives of secondary level pre-service and in-service mathematics teachers. In the present study it was analysed by use of questionnaire and classroom process

Statement of the Problem

Mathematics is a subject that is very important in everyday living. It is applied in sciences, technical and non-technical areas. Mathematics phobia and anxiety is dangerous to the academic growth and development of any nation. It is associated with some negative phenomenon such as physiological reactions (worry, fear) and examination anxiety. In this connection the purpose of this research study was to examine the mathematics phobia and anxiety among learners, and to know the different perspectives of mathematics teachers and their classroom practices to eradicate the fear of mathematics among learners. The present study was an attempt to investigate the **"Mathematics Phobia and Anxiety among Learners: Perspectives of Mathematics Teachers and Classroom Practices".**

Objectives of the Study

1. To study the perspectives of mathematics teachers on factors influencing mathematics phobia and anxiety among learners at secondary stage.
2. To study the perspectives of pre-service and in-service mathematics teachers on suggestive practices on eradication of fear of mathematics among learners.
3. To reflect on the best practices performed by mathematics teacher for eradicating the mathematics phobia and anxiety among learners at secondary stage.

Research Questions

1. What are the factors influencing mathematics phobia and anxiety among learners at secondary stage?
2. What are the suggestive practices which can eradicate the fear of mathematics among learners?

3. What are the best practices performed by mathematics teachers to eradicate the mathematics phobia and anxiety among learners?

Methods and Procedure

Research design: The study was a descriptive survey research and mixed method were followed.

Participants: The present study was confined to Bhubaneswar locality. There were 43 Pre-service mathematics teachers and 5 in-service mathematics teachers of Bhubaneswar Locality were the participants of the study.

Tools: The tools included questionnaire for teachers (pre-service and in service), classroom observation and case study protocol. In the questionnaire there were both open-ended and closed-ended questions were included.

Procedure of data collection: The data were collected with the help of questionnaire and classroom observation scheduled. During this period, the investigators interacted with students and teachers.

Statistical techniques used: The data gathered were analysed by using both qualitative and quantitative analysis technique.

Delimitations of the Study

The study was limited to 43 Pre-service mathematics teachers of RIE, Bhubaneswar and 5 in-service mathematics teachers of D. M. School, Bhubaneswar. This was a group of diverse mathematics teachers. The study was focused on eradication of mathematics phobia and anxiety among learners. Another limitation of the study were that it did not examine the issues related with learners' performance/Academic achievement in mathematics.

Data Analysis and Interpretation

Perspectives of Mathematics Teachers on Mathematics Phobia and Anxiety among Learners

This study showed that mathematics teachers were aware and sensitive towards the mathematics phobia and anxiety among learners. They understood that mathematics phobia and anxiety are the serious issues for mathematics teaching learning processes. As reported by most of the participants' mathematics phobia and anxiety is a kind of feeling of tension and fear of mathematics, which hampers the mathematical performance. Most of the participants expressed that it is a one kind of detachment of mathematics subject, students dislike maths, they have tension to do the math, even they don't want to attend mathematics classes due to this reason. This is developed due to so many reasons such as lack of confidence in doing mathematics, lack of courage to express their feelings about mathematics to their respective teachers, negative attitude towards mathematics, and avoidance of mathematics courses/classes, parental influence, negative peer pressure etc. Participants of this study expressed that with the collective effort we can reduce the fear of mathematics among learners such as to develop strong skills and a positive attitude toward math among learners, relate math to real life or learners prior learning experiences, with the individualized instructions, utilizing different community resources, with the use of technology etc.

Table 1 Perspectives of Mathematics Teacher on Mathematics Phobia and Anxiety among Learners

S. No.	Items	PERCENTAGE (%)				
		SA	A	UD	DA	SDA
1	Fear of mathematics will automatically reduce, when Students will work in groups	20.9	53.5	7.0	14.0	4.6
2	For eradicating mathematics phobia and anxiety among learners teachers should group students on the basis of their abilities	7.0	60.5	4.6	20.9	7.0
3	Eradication of fear of mathematics among learners is impossible	2.3	00	00	23.3	74.4
4	Remedial help must be provided by teachers to eradicate the fear of mathematics	41.9	53.5	4.6	00	00
5	Learning mathematics through use of ICT stimulates learners engagement and reduce fear	18.6	62.8	11.6	7.0	00

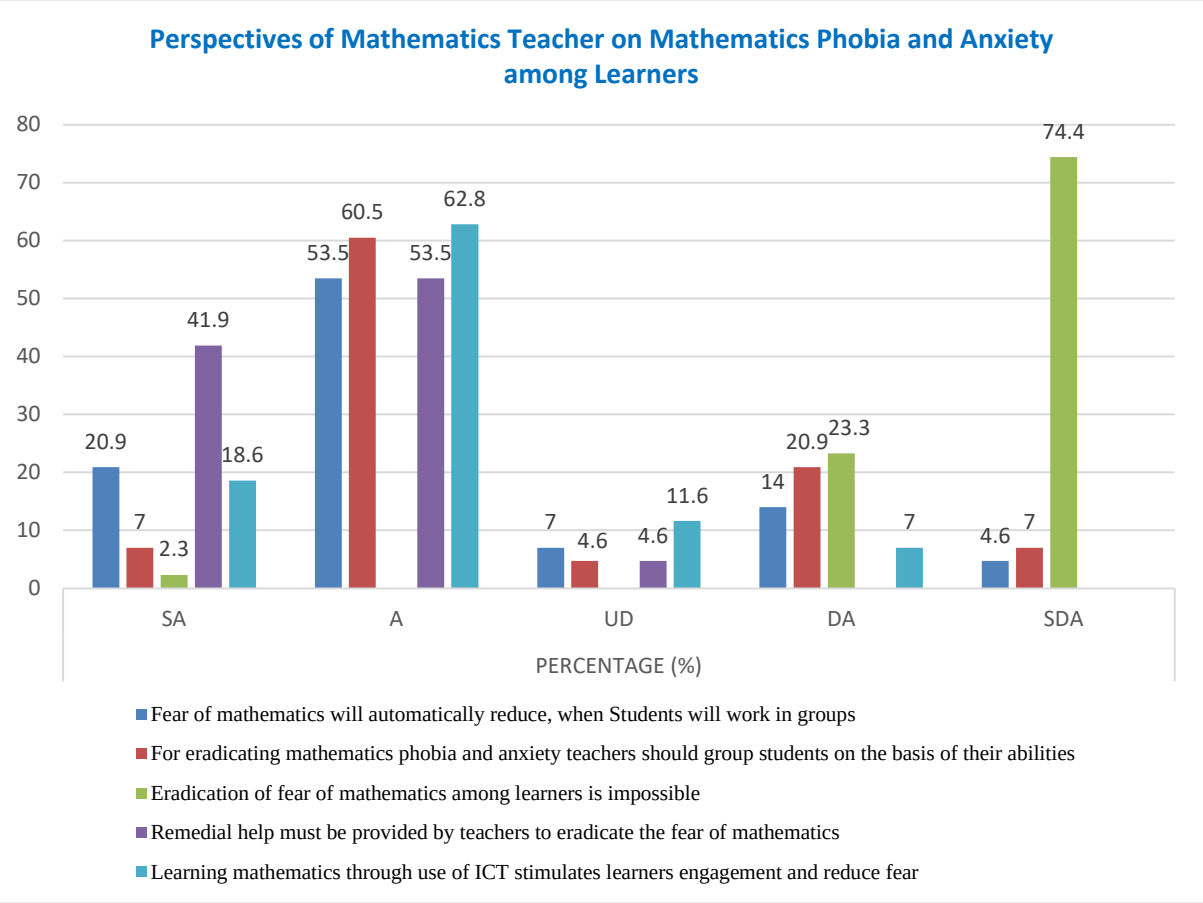

Figure 1 Perspectives of Mathematics Teacher on Mathematics Phobia and Anxiety among Learners

The figure 1 deals with the perspectives of mathematics teachers on mathematics phobia and anxiety among learners. Most of the Mathematics teachers (53.5% A and 20.9 SA) believed that fear of mathematics will automatically reduce, when students will work in groups. Mathematics teachers (60.5% A) believed that for eradicating mathematics phobia and anxiety among learners teachers should group students on the basis of their abilities. Most of the teachers (74.4% SDA and 23.3% DA) were disagreed over the statement that Eradication of fear of mathematics among learners is impossible. The teachers (53.5% A and 41.9% SA) were agreed that Remedial help must be provided by mathematics teachers to eradicate the fear of mathematics among learners. Mathematics teachers (62.8% A and 18.6% SA) were also agreed that learning mathematics through use of ICT can stimulates learners engagement and reduce fear.

Suggestive Practices on Eradication of Fear of Mathematics among Learners

Table 2 Perspectives of Mathematics Teachers on Suggestive Practices for Eradication of Fear of Mathematics among Learners

S.No.	Items	PERCENTAGE (%)				
		SA	A	UD	DA	SDA
1	Relate math problems and vocabulary to prior knowledge and background	48.8	46.5	4.7	00	00
2	Apply mathematics problems to daily life situations	65.1	27.9	4.7	00	2.3
3	Teachers should positively engage learners to mathematical problem solving	67.4	30.2	00	2.3	00
4	Build positive attitudes towards math	53.5	46.5	00	00	00
5	Encourage the children to discuss math stuff.	53.5	41.9	4.7	00	00
6	Math Centre need to be utilised to teaching in mathematics	41.9	55.8	2.3	00	00
7	Appropriate teaching methods need to be adapted to meet the needs of diverse students' population in mathematics classrooms	65.1	34.9	00	00	00
8	Effective use of community resources in maths can reduce the mathematics phobia and anxiety among learners	60.5	37.2	2.3	00	00
9	Teacher must create lessons and activities where students from diverse backgrounds can work together.	65.1	34.9	00	00	00
10	Use a step-by-step approach to teach the maths	72.1	27.9	00	00	00

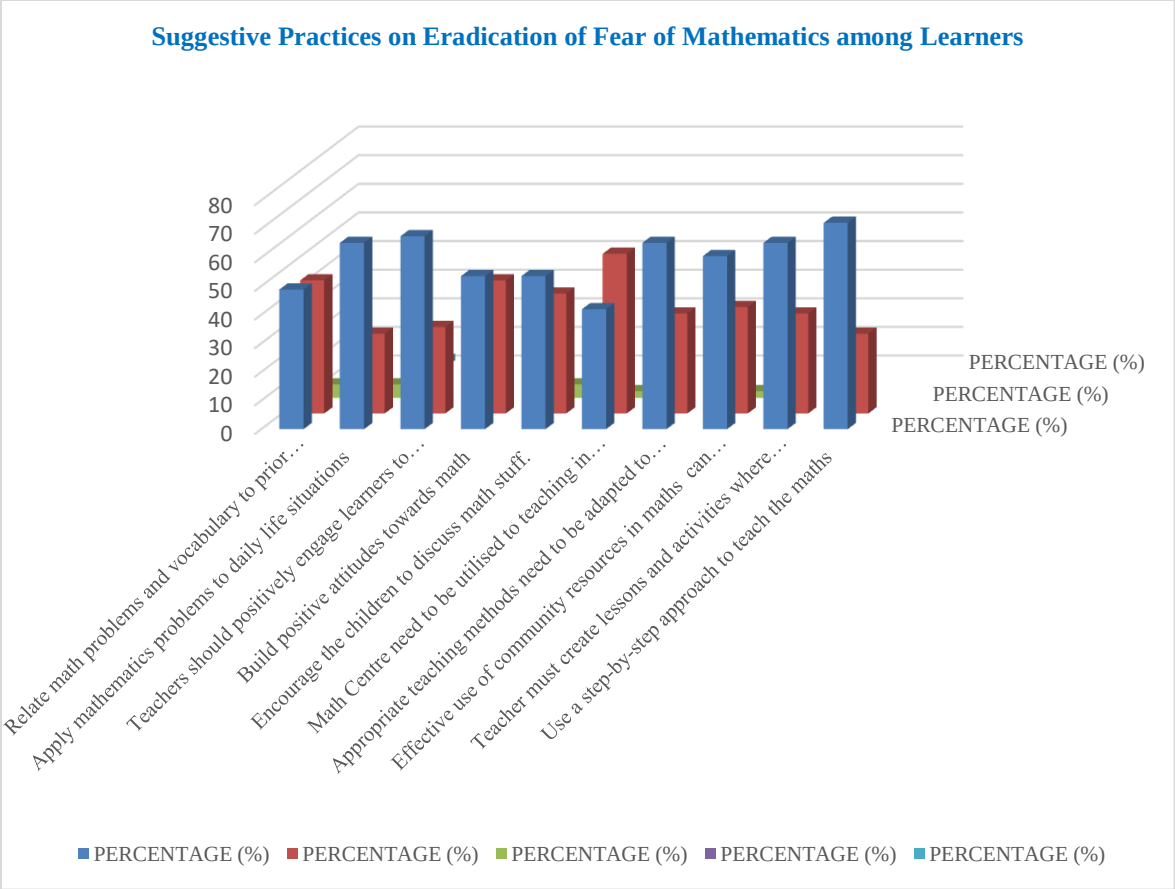

Figure 2 Perspectives of Mathematics Teachers on Suggestive Practices for Eradication of Fear of Mathematics among Learners

The figure 2 deals with the perspectives of mathematics teachers on suggestive practices for eradication of fear of mathematics among learners. Most of the mathematics teachers (48.8% SA and 46.5% A) were agreed that we have to relate math problems and vocabulary to prior knowledge and experiences of learners. Teachers (65.1% SA and 27.9% A) were agreed that we have to apply mathematics problems to daily life situations. Most of the mathematics teachers (67.4% SA and 30.2%) believed that teachers should positively engage learners to mathematical problem solving, and build within learners a positive attitude towards math. Teachers need to encourage the children to discuss math stuff within them. The teachers (55.8% A and 41.9% SA) were also agreed that math centre need to be utilised to teaching in mathematics. They were (65.1% SA and 34.9%) agreed that appropriate teaching methods need to be adapted to meet the needs of diverse students' population in mathematics classrooms. Mathematics teachers (60.5% SA and 37.2%) believed that effective use of community resources in mathematics instruction can reduce the mathematics phobia and anxiety among learners.

Mathematics Teachers perspectives on Best Practices for eradicating the mathematics phobia and anxiety among learners

Table 3 Mathematics Teachers perspectives on Best Practices for eradicating the mathematics phobia and anxiety among learners

S.No.	Items	PERCENTAGE (%)				
		SA	A	UD	DA	SDA
1	Students should be given enough drill exercises to mastery the skills	30.2	44.2	25.6	00	00
2	During a lesson, students need to be given opportunities to test, debate and challenge ideas with their peers	62.8	37.2	00	00	00
3	In mathematics classrooms, students should be encouraged to challenge ideas while maintaining a climate of respect for what others have to say	39.5	60.5	00	00	00
4	Group students heterogeneously during cooperative learning	39.5	44.2	11.6	4.7	00
5	Teachers should listen to the students and seek elaboration of learners' responses.	32.6	67.4	00	00	00
6	It is important to incorporate technology in the mathematics classroom.	41.9	51.2	7.0	00	00
7	Make interdisciplinary connections to what students are learning in math	39.5	60.5	00	00	00
8	Introduce/reinforce and/or practice specific concepts	37.2	32.6	14.0	9.3	7.0
9	To solve most math problems learners have to be taught the correct procedure.	60.5	37.2	2.3	00	00
10	Mathematics should be taught as a collection of concepts, skills and algorithms.	46.5	44.2	00	7.0	2.3

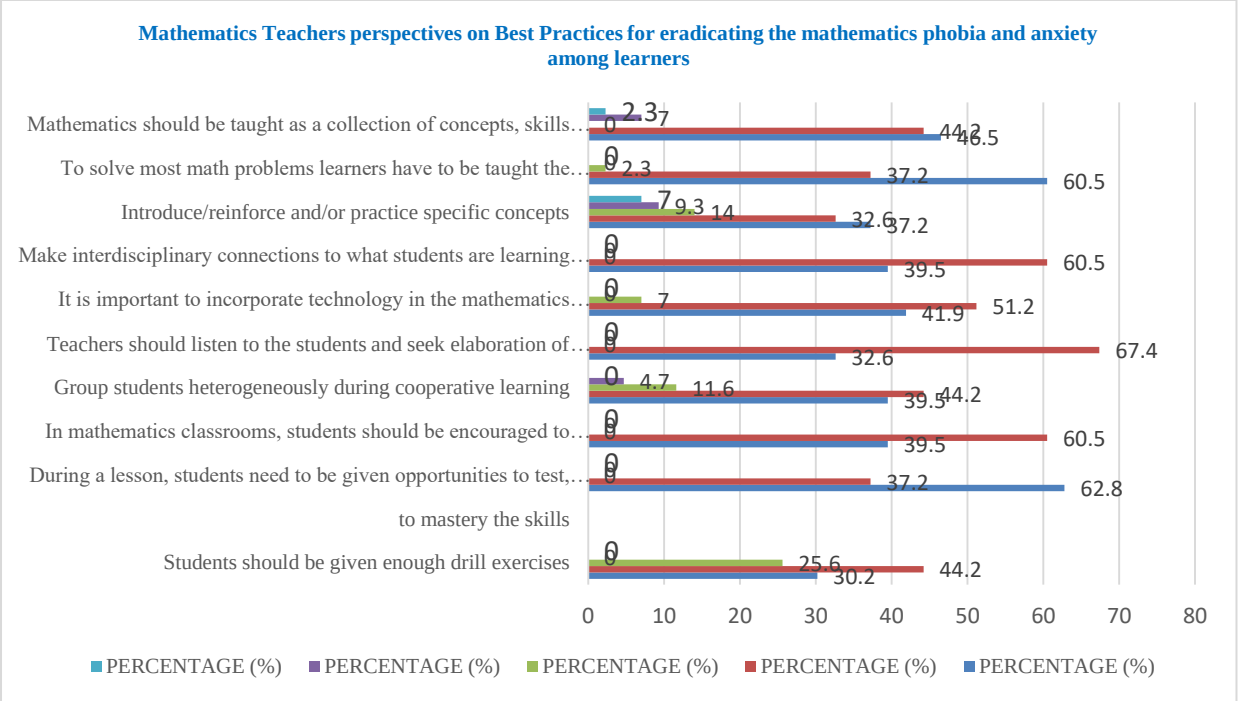

Figure 3 Mathematics Teachers perspectives on Best Practices for eradicating the mathematics phobia and anxiety among learners

The figure 3 deals with the mathematics teachers perspectives on best practices for eradicating the mathematics phobia and anxiety among learners. Most of the teachers (44.2% A and 30.2% SA) viewed that students should be given enough drill exercises to mastery the skills, but some of the teachers (25.6%) were undecided about this statement. They believed (62.8% SA and 37.2%) that during a lesson, students need to be given opportunities to test, debate and challenge ideas with their peers. Mathematics teachers (60.5% A and 39.5%) believed that in mathematics classrooms, students should be encouraged to challenge ideas while maintaining a climate of respect for what others have to say. Most of the mathematics teachers (51.2% A and 41.9% SA) viewed that it is important to incorporate technology in the mathematics classroom to reduce the fear among learners. Most of the teachers (60.5% SA and 37.2% A) were agreed that to solve most math problems learners have to be taught the correct procedure. The mathematics teachers (46.5% SA and 44.2% A) were agreed that mathematics should be taught as a collection of concepts, skills and algorithms.

Major Findings

Perspectives of Mathematics Teacher on Mathematics Phobia and Anxiety among Learners

- Most of the Mathematics teachers (53.5% A and 20.9 SA) believed that fear of mathematics will automatically reduce, when Students will work in groups.
- Most of the teachers (74.4% SDA and 23.3% DA) were disagreed over the statement that Eradication of fear of mathematics among learners is impossible.

- The teachers (53.5% A and 41.9% SA) were agreed that remedial help must be provided by mathematics teachers to eradicate the fear of mathematics among learners.
- Mathematics teachers (62.8% A and 18.6% SA) were also agreed that learning mathematics through use of ICT can stimulates learners' engagement and reduce fear.

Perspectives of Mathematics Teachers on Suggestive Practices for Eradication of Fear of Mathematics among Learners

- Most of the mathematics teachers (48.8% SA and 46.5% A) were agreed that we have to relate math problems and vocabulary to prior knowledge and experiences of learners.
- Teachers (65.1% SA and 27.9% A) were agreed that we have to apply mathematics problems to daily life situations.
- Most of the mathematics teachers (67.4% SA and 30.2%) believed that teachers should positively engage learners to mathematical problem solving, and build within learners a positive attitude towards math.
- Mathematics teachers (60.5% SA and 37.2%) believed that effective use of community resources in mathematics instruction can reduce the mathematics phobia and anxiety among learners.

Mathematics Teachers perspectives on Best Practices for eradicating the mathematics phobia and anxiety among learners

- Most of the teachers (44.2% A and 30.2% SA) viewed that students should be given enough drill exercises to mastery the skills.
- Mathematics teachers believed (62.8% SA and 37.2%) that during a lesson, students need to be given opportunities to test, debate and challenge ideas with their peers.
- Most of the teachers (60.5% SA and 37.2% A) were agreed that to solve most math problems learners have to be taught the correct procedure.
- The mathematics teachers (46.5% SA and 44.2% A) were agreed that mathematics should be taught as a collection of concepts, skills and algorithms.

Best Practices Adopted in Ideal Mathematics Classrooms

The data found from the participants showed that they were understood the philosophy behind the best practices adopted in ideal mathematics classrooms to eradicate mathematics phobia and anxiety among learners. According to most of the participants in an ideal mathematics classrooms teacher should try to connect mathematical concept with real world. An ideal mathematical classroom should be well equipped with mathematical tools. The different learning needs of the learners must be cater in the classroom process. The classroom management and transaction of content should be in such a way that every student will get the equal opportunity to clear his/her doubts. In the classroom process teacher must use different approaches and strategies and utilize different learning resources to teaching the mathematics. The relationship between teacher and taught must be healthy in nature. Students should give full freedom to

express their ideas and thoughts. All above data showed that participants were sensitive the issues related with mathematics phobia and anxiety among learners.

Discussion of Result

The major findings of the study have been presented above. This study showed that mathematics teachers were aware and sensitive towards the mathematics phobia and anxiety among learners. They understood that mathematics phobia and anxiety were the serious issues for mathematics teaching learning process. Mathematics anxiety like other phobias is a condition that students deal with daily. The first step in helping students overcome mathematics phobia and anxiety is to identify which students experience a high level of mathematics anxiety. From there, teachers can select the appropriate instructional strategies to decrease mathematics phobia and anxiety or change the classroom environment. Math teachers need to spend more time during a class period and even other than class to discuss students' feelings. The participants of this study expressed that if mathematics teachers can successfully create joyful learning environment among learners in mathematics instruction and utilize learners' prior experiences to teaching the content, then the mathematics phobia and anxiety will automatically reduce among learners and learner will effectively participate the mathematics teaching learning process.

Educational Implications

This study has significance to motivate mathematics teachers to know about mathematics phobia and anxiety among learners. It has potential to help to raise educational standard of Mathematics teaching by enlightening the importance of knowing the factors affecting fear of mathematics among learners and incorporating different remedial to eradicate the phobia and anxiety of mathematics among learners. The present study will helpful to sensitize the mathematics teachers to identify the learners who are affected with mathematics phobia and anxiety, and teachers would take appropriate action to reduce fear of mathematics among learners. This study will also benefited to the administrators, principals, students, parents and the whole educational system for identifying mathematics phobia and anxiety among secondary stage learners. They would also understand the causes of mathematics phobia and anxiety and factors affecting fear of mathematics among learners. The present study would provide a base for further research to know the more about mathematics phobia and anxiety among learners.

Conclusion

Developing children's abilities for mathematisation is the main goal of mathematics education. A sound knowledge of mathematics is accepted to be a studying almost every branch of knowledge, particularly so in the learning of science and different branches of technology. A majority of children have a sense of fear and failure regarding Mathematics. Hence, they give up early on, and drop out of serious mathematical learning. This negative attitude stops them from focusing on the subject/problem which they are tackling. Just before tests or exams they start to get nervous as they are not prepared. Some even learn and understand math 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 math is too tough for them. The present study was focused on this

regard. The study found that majority of mathematics teachers were aware about the different issues related with mathematics phobia and anxiety among learners. The participants were sensitive towards fear of mathematics among learners, they had suggested different measures to tackle such issues within learners. The study concluded that with the effective use of community as well as learning resources, relating maths with learners' prior knowledge and experiences, transacting maths in a joyful manner within students etc. in that way teacher can reduce mathematics phobia and anxiety among learners.

References

Aseidu-Addo, S. K. and Yidana I, (2000). "Mathematics Teachers Knowledge of the subject Content and the Methodology". *Journal of the Mathematical Association of Ghana*, Volume 12, University of Cape Coast. MAG Secretariat.

Ashcraft, Mark H. and Krause, Jeremy A. (2007). Working Memory, Math Performance, and Math Anxiety, *Psychonomic Bulletin & Review, 14*(2), 243-248.

Beilock, S. L., and Carr, T. H. (2005). When High-Powered People Fail: Working Memory and "Choking Under Pressure" in Math. *Psychological Science, 16*(2), 101-105.

Beilock, S. L., Gunderson, E. A., Ramirez, G. and Levine, S. C. (2010). Female teachers' math anxiety affects girl's math achievement. Proceedings of the National Academy of Sciences in the United States of America, 107(5), 1860-1863.

Cavanaugh, S. (2007). Understanding 'Math Anxiety.' Education Week, February 21, 2007. Retrieved from http://www.edweek.org.Cemen, P. B. (1987). The Nature of Mathematics Anxiety, Stillwater, OK, Oklahoma State

University (ERIC Document Reproduction Service No. ED 287 729)

Dossel, S. (1993). Maths anxiety. *Australian Teacher, 49*(11), 4-8.

Furner, J. M. and Gonzalez-DeHass, A. (2011). How do students' mastery and performance goals relate to math anxiety?. *EURASIA Journal of Mathematics, Science & Technology Education, 7*(4), 227-242.

Hadfield, O. D. and McNeil K. (1994). The Relationship between Myers-Briggs Personality Type and Mathematics Anxiety among Pre-service Elementary Teachers, Journal of Psychology, 21(41), 375-384.

Hellum-Alexander, A. (2010). Effective Teaching Strategies for Alleviating Math Anxiety and Increasing Self-Efficacy in Secondary Students. Master's Thesis, The Evergreen State College, Olympia, WA. Retrieved from http://archives.evergreen.edu/masterstheses/Accession89-10MIT/Hellum

Jackson, E. (2008). Mathematics Anxiety in Student Teachers. *Practitioner Research in Higher Education, 2*(1), 36-42.

Legg, A. M. and Locker, L. (2009). Math Performance and its Relationship to Math Anxiety and Metacognition. North American Journal of Psychology, 11(3). Retrieved from http://findarticles.com/p/articles/mi_6894/is_3_11/ai_n42379449/?tag=rel.res2.

Miller, D. and Mitchell, C. (1994). Mathematics anxiety alternative methods of evaluation.

Journal of Instructional Psychology, 21(4), 353-358.

Mission College. (2009). Overcoming Math Anxiety. Santa Clara, CA. Retrieved from http://salsa.missioncollege.org/mss/stories/storyReader$9.

NCERT (2005). National Curriculum Framework, New Delhi.

Plaisance, D. V. (2009). A Teacher's Quick Guide to Understanding Mathematics Anxiety.

Louisiana Association of Teachers of Mathematics Journal, 6(1). Retrieved from http://www.lamath.org/journal/vol6no1/anxiety_guide.pdf.

Sparks, S. D. (2011). Researchers Probe Causes of Math Anxiety. Education Week, 30(31). Retrieved from http://www.edweek.org.

Tsui, J. M. and Mazzocco, M. M. M. (2007). Effects of Math Anxiety and Perfectionism on Timed versus Untimed Math Testing in Mathematically Gifted Sixth Graders. *Roeper Review, 29*(2), 132-139.

Woodard, T. (2004). The Effects of Math Anxiety on Post-Secondary Development Students as Related to Achievement, Gender, and Age. Inquiry, 9(1). ERIC Document Reproduction Service No. EJ876845.