



ISSN: 3049-3978 (Online)

Interdisciplinary Perspectives of Education

Contents available at: <https://www.swamivivekanandauniversity.ac.in/ipe/>

EXPLORING MATHEMATICS ANXIETY AMONG SECONDARY LEVEL STUDENTS OF ANGLO-INDIAN SCHOOLS

Sukanta Koner¹ & Dr. Rumti Das²

¹Research Scholar, Department of Education, Swami Vivekananda University, West Bengal, India

²Assistant Professor, Department of Education, Swami Vivekananda University, West Bengal, India,
Email: rumtid@svu.ac.in [Corresponding Author]

Abstract

Mathematics anxiety (MA) is a construct that prevents student success especially in areas where stakes are high. This case-study will attempt to reveal the nature of the lived experience of students with MA, by constructing the interactive forces of socio-cultural, linguistic, pedagogical, and familial factors that contribute to their anxiety. The data were gathered using a semi-structured interview with twelve students (6 boys and 6 girls) from class IX and X selected by purposive sampling technique. The thematic analysis of data performed with NVivo 12 software gave eight general themes that describe the flavor of the student experiences. The themes indicate that MA is a multi-layered phenomenon that is caused by schooling based on exams, fear of negative assessment, language barriers in English-medium instruction, strict teaching, and parental pressure that is aggravated by peer comparison. The results reveal that MA is a socio-academic nexus - a lived experience which influences the self-concept of students, body reactions, and attitude towards mathematics. To cope with MA, remedial teaching is not enough, but changes in pedagogy, the design of assessment, parental education, and school-based mental health programs are necessary. The research suggests context-dependent interventions and teacher education, which make mathematics learning humanized and create emotional safety in classrooms.

Keywords: Mathematics Anxiety, Secondary School, Anglo-Indian School, Socio-Cultural Context, English-Medium Instruction.

1. Introduction

Mathematics is the base of contemporary education, which is a necessity of science and critical thinking. However, in the minds of many students, it will not be associated with curiosity but a debilitating fear called mathematics anxiety, which is a well-researched phenomenon that can be defined as a sense of tension and anxiety that disrupts the manipulation of numbers and solving mathematical problems (Richardson and Suinn, 1972). This anxiety is a vicious cycle, individual becomes more afraid and avoids math and this avoidance causes them to develop poor skills and this strengthens the original anxiety (Ashcraft, 2002).

The Anglo-Indian system of schooling is a distinct environment within the diverse Indian educational environment. Their unique atmosphere of Eastern and Western pedagogy develops a particular academic atmosphere in these institutions. The current literature of mathematics anxiety in India is however mostly quantitative in nature and centered in mainstream schools thus there is a significant gap in qualitative and context specific knowledge.

There is a lack of information on a detailed qualitative investigation into mathematics anxiety in Anglo-Indian secondary schools. It goes beyond quantitative indicators and explores the first-hand experiences of students posing the question: How do they describe their anxiety? What are the perceived primary sources in this unique context in regard to classroom or social factors? This study would produce subtle information that can be used to facilitate pedagogical practices that will enable changing the mathematical experience, which would be a nightmare to confidence.

During the last several years, the field of mathematics anxiety (MA) studies has increased significantly. It does not just examine the relationship between anxiety and performance, but it also examines the underlying factors in the cause of it, and the brain, emotions, and social factors are all considered to contribute to mathematical phobia or anxiety. The modern definitions present MA as an individual, unpleasant response that not only leads to emotional discomfort but also disrupts the working memory resources which are needed to solve the problem cognitively (Ramirez, Shaw, & Maloney, 2018). Such interference forms an established negative feedback loop, with its effects including avoidance and worse performance that cause further anxiety in the future (Dowker, Sarkar, & Looi, 2016).

Recent research has closely examined the causes of mathematics anxiety, especially within the classroom setting. One of the dominant themes recognizes traditional, performance-based classes, where testing is timed, publicly compared, and the excessive use of rote memory, as

important factors in the emergence of anxiety (Wang et al., 2020). Conversely, the approaches to pedagogy that support the development of a growth mindset, learn through errors, and incorporate collaborative and inquiry-based tasks have been reported to reduce MA (Boaler, 2016). Moreover, the teacher factor should not be underestimated; their own mathematics anxiety and teaching methods could also have a significant impact on affective responses of students (Beeson & Williams, 2020).

Social ecology of learner has also been given more attention. Child MA has a strong connection with parental attitudes and behaviours (especially those that push or convey negative attitudes towards math) (Maloney, Ramirez, & Gunderson, 2015). It is identified that the particular cultural context is now considered a crucial variable, and it determines the experience, expression, and continuation of anxiety (Zhang et al., 2019).

In India, it has been proven that MA is rather prevalent, usually due to the great competitive academic culture (Bhardwaj, 2014). Nevertheless, there are two important gaps that are found in a systematic review. To start with, the Indian research space is still very overwhelmingly quantitative, which is based on rating scales to determine whether or not students are anxious but does not explain the why and how of their lived experience in a very rich and qualitative manner. Second, the majority of the studies have been generalizing the system of Indian education not taking into consideration the impact that nationwide policies have on the local social and teaching conditions in the subsystems such as the Anglo-Indian schools. These unique ethos, pedagogical approaches and student-teacher relations in these institutions might provide a rare set of risk and protective factors to MA that have never been studied in the literature at all.

2. Research Gap

Although the current state of research on the topic of mathematics anxiety (MA) has evidently displayed the prevalence of the problem and the factors that are intertwined with it, it leaves a significant gap in the context and insight of the problem itself. In India, the data available in most of the studies is centered on the numbers and the education system is one large entity with the same findings used to generalize the entire education system. Such an approach lacks the peculiarities of other school systems such as Anglo-Indian schools that have their own culture of teaching. Consequently, even personal experiences and coping of students in these schools with MA have not been researched in detail. The research will fill

this gap by examining the causes and experiences of MA in Anglo-Indian secondary schools, which has never been researched.

Through this, it provides context-based information on the manner in which MA is produced, sustained and guided in the Anglo-Indian schools hence, resulting in the derivation of theoretical and practical interventions.

3. Research Questions

- i) What are the forms of mathematics anxiety of secondary students of Anglo-Indian schools?
- ii) How do school-related factors -- such as exam systems, teaching methods, and use of English as the language of instruction influence the development and persistence of mathematics anxiety?
- iii) How do students deal with mathematics anxiety?
- iv) What could be the useful ways to dealing with it?

4. Research Objectives

This study is aimed to know about the actual experiences faced due to mathematics anxiety (MA) among secondary level students in Anglo-Indian schools. The specific objectives are:

- i) To understand mathematics anxiety experienced by students in their everyday school life.
- ii) To know the factors causing mathematics anxiety, with special focus on methods of teaching in the classroom, examination pressure, language issues and parental expectations.
- iii) To investigate the ways in which students attempt to deal with mathematics anxiety and their approach to dealing with it.
- iv) To propose strategies to reduce mathematics anxiety by developing useful ideas.

5. Method

This qualitative study tries to find out mathematics anxiety among 12 students studying in class IX and X in Anglo-Indian schools through case-study. The data were collected by employing semi structured interviews and focus group discussions. Each session was audio-recorded and transcribed verbatim to make sure that all the nuances were recorded.

Analysis was based on the reflexive thematic approach of Braun and Clarke that used an inductive position to allow the patterns to emerge out of the data. The transcripts, coded passages and themes were repeatedly read and refined by the researchers. The process has shown a lot about the lived experiences of the students, the coping mechanisms that they adopt, and the situational issues that influence their mathematics anxiety.

- **Population**

Secondary level students of Anglo-Indian schools (affiliated by ICSE board) in Hooghly district of West Bengal was the population of the study.

- **Sample**

Through purposive sampling technique researchers selected 12 participants (6 boys and 6 girls) of class IX and X, who have self-reported worrying or being frightened with mathematics.

- **Protocols and Data Handling of the Case Study**

A case study protocol was created to provide methodological consistency amongst cases, including semi-structured interview guide with open-ended, narrative eliciting questions, audio recordings and verbatim transcription standard procedures, and NVivo 12 project structure to code and develop themes.

- **Procedure of Data Collection**

The interviews took place in the school setting (semi-structured, 50-60 minutes with each case), and the open-ended questions were used to elicit the stories of the participants in a free manner. Although most of the interviews were conducted in English, students were allowed to change to their favourite language to ensure that there was good understanding. All the sessions were audio-taped and word to word transcribed.

The data analysis was done using NVivo 12 with the help of a six-step thematic analysis described by Braun and Clarke (2006). Reliability was facilitated through member checking, peer debriefing and reflexive journaling. The twelfth interview had reached the saturation point, and no additional codes came up.

The thematic analysis produced six thematic themes which are interconnected and have student quotations that reflected the main points of their experiences in mathematics anxiety.

- **Procedure of Data Analysis**

The thematic analysis was performed in accordance with the six phases of the process described by Braun and Clarke (2006) which are (i) familiarization with data, (ii) generation

of initial codes, (iii) searching for themes, (iv) reviewing themes, (v) defining and naming themes, and (vi) producing the report. NVivo 12 software facilitated the systematic coding and theme development.

The analysis of the cases was done on a case-by-case (within-case analysis) basis followed by a synthesis across the cases to discern common patterns of meaning (cross-case analysis). The interpretative process was cyclical in nature and codes & emerging themes were interchanged constantly in line with hermeneutic phenomenological practice.

- **Ethical Considerations**

The research was conducted within the stipulated ethical standards of research in education. School management of the schools gave consent to carry out the study. Parents/guardians of all the participants gave written informed consent, and students themselves gave assent, prior to data collection. They were all voluntary and the students were told that they had the right to drop out any time without incurring any fine.

6. Analysis and Interpretation

The following themes emerged through analysis

- **Embodied Anxiety**

Students complain of physical symptoms (sweaty palms, racing heart berries and stomach aches) when doing mathematics exams and in the classrooms. The classroom is often perceived as something threatening causing one to feel entrapped and hyper-vigilant.

- **Emotional Impact**

Mathematics is often linked to apprehension, humiliation and low self-esteem. The avoidance behaviours are caused by emotional alienation to mathematics and increase anxiety.

- **Examination Culture**

The stress to get high grades brings about an atmosphere of unceasing judgment. The students expect to be judged by the teachers, parents and peers, resulting in survival-oriented learning experiences and not growth.

- **Pedagogical Practices**

Rapid delivery of information, inability to question, and open criticism contribute to the development of passive and silent engagement. The classroom is transformed into an acting field where the errors lead to humiliation.

- **English-Medium Constraint**

The inability to convey mathematical knowledge in English has become a struggle to many students, which results in a rise in anxiety and impacts the academic confidence of students.

- **Tuition as Coping**

The classroom is a stressful environment, whereas under private tuition, a student will have a conducive environment, which serves as a safe place to learn. Tuition is a solution in relation to school anxiety.

- **Avoidance and Self-Strategies**

The techniques of coping may be positive self-talk and practice to avoidance. Some of them enhance resilience but avoidance shut out participation and continues underachievement.

- **Parental and Peer Pressure**

Student identity is highly related to the performance in mathematics and this corresponds to emotional strain because family expectations and social comparisons increase MA.

The research indicates that the fear of mathematics among these students is very emotional and physical. Numerous students are either terrified or stressed at maths classes or tests. They complain of such symptoms as sweaty palms, increased heartbeat, blank stares, or stomach aches. On the emotional plane, they are afraid, helpless or ashamed of doing maths. Therefore, they tend to view the classroom as a frightening environment rather than a learning and exploration space. This fear and self-consciousness make maths experience as a threat instead of an exciting topic.

The school systems have significant effects in the experience of maths anxiety by students. Such emphasis on tests and grades causes students to be afraid of failing and being criticized by teachers and their parents. Too fast teaching styles that involve minimal interaction and involve public criticism can cause students to be quieter and more fearful to ask questions. It is an additional pressure also to study in English. Most students know maths concepts but they cannot articulate them in English and this reduces their confidence and alters anxiety.

Maths anxiety is dealt with through various means by the students. Others opt to do private tuition, in which they receive more personal assistance and are less stressed. Some attempt self-treatment such as positive thinking or practicing. Others evade hard issues or absent

classes which may end up increasing their fear with time. There are also social factors that are influential. Parental expectations and the constant comparison with their peers both push the pressure which influences the way students develop their attitudes towards maths and how they attempt to cope with their anxiety.

7. Discussion

The results of this research are close to the results of other researchers regarding mathematics anxiety (MA) in secondary students. This research demonstrates that maths anxiety is not only an emotional response as was the case with Ashcraft (2002). It also leads to severe physical effects like sweating; heartbeat increase and feeling frozen in exams. Whenever students were asked to explain why they go blank or feel paralyzed when they are solving maths problems, they would say so. This is in accord with Hembree (1990) who discovered that anxiety had the capacity to inhibit the performance and thinking capacity of students.

Another reason students in this study discussed was the fear, shame and low self-confidence when performing maths. These feelings contribute to the work by Ramirez et al. (2013), who demonstrated that maths anxiety may make students avoid maths, lose confidence in themselves, and become less interested in maths. Similar to the previous study, the present research concluded that the school climate has a significant impact. Students are also more anxious and reluctant to speak up because of fast teaching, teacher pressure, and being publicly criticized by teachers (Ramirez et al., 2018). However, Young, Wu, and Menon (2012) discovered that supportive and kind teaching methods may decrease maths anxiety, whereas strict or callous teaching methods may increase it.

One of the unique discoveries of the study is the anxiety that is brought about by English-medium instruction in Anglo-Indian schools. Most students know the concepts of maths but they fail to communicate them in English. This language barrier presents additional strains. According to Chiu (2017), learning in a non-native language may also lead to an increase in subject-related anxiety, particularly in situations in which the students fear to make mistakes when they speak or write.

Peer influence and family influence is also a significant factor. Students are more anxious because of high expectations by parents, as Maloney et al. (2020) noted, and comparisons with peers. The same trend was discovered in this study. A number of students are attending these classes to survive, which concurs with Mukhopadhyay and Sen (2015), who pointed out

that students tend to request additional assistance when school becomes too difficult or unhelpful. Concisely, this paper validates that maths anxiety is multifaceted and multisided, it encompasses physical, emotional, cultural, and social. The schools need to work on multiple things simultaneously to minimize it: improved instruction, more equalized tests, language help, emotional support, and open communication with parents.

8. Conclusion

This research work enables us to know the numerous facets of mathematics anxiety among secondary students in Anglo-Indian schools. It demonstrates that maths anxiety is not only an issue of thought or cognition. It is also an emotional and physical experience, which is strongly interconnected with emotions of students towards their schools, language, and social environment.

Maths anxiety manifests itself in students in physical form (sweating or increased heart rate) and emotional (fear and shame). Due to this, the classroom is usually an intimidating and tense environment rather than a learning one. The research determined that school factors which include exam pressure, teaching in a hurry and teaching in English contribute to an increase in the anxiety levels among students- particularly when they fear to ask questions or when they are singled out to be criticised. The family pressures, competition among peers and the prevalent practice of engaging in personal tuition also influence the coping behaviour and the perception of the students as students.

The results indicate that the schools require more than excellent instruction strategies in order to decrease maths anxiety. They should also establish safe, friendly and language helpful learning conditions. The teachers are expected to earn trust and offer emotional support whereas the parents are expected to be engaged in constructive and empathetic forms. The schools must observe the personal problems of the students as well as the bigger social and cultural pressures on them.

This research can provide valuable concepts to the teachers and school leaders, not to mention the families who seek to manage maths anxiety in order to hear the true stories of the Anglo-Indian students. The aim is to enhance the performance and the confidence and mental health of the students. The next step of research should be to create and test effective methods of helping students of any background to feel comfortable and self-assured when learning mathematics.

9. Recommendations

To decrease mathematics anxiety schools and teachers ought to provide a nurturing and encouraging classroom setting in which students feel free to share their ideas and to commit errors. This can be accomplished by listening with empathy and open discussion and using mistakes as learning opportunities. There should also be changes in the practices of assessment-schools can balance the role of exams with frequent feedback which is aimed at improvement rather than competition. The rate at which the lessons are conducted should ensure that all students learn with active learning and regular formations of whether they understand. Most of the students have problems in learning English and as such, schools ought to provide assistance like, bilingual materials, peer support and special language sessions to facilitate easier learning of maths. Families are also important; schools are supposed to meet parents halfway on what is realistic and why excessive pressure is negative. Workshops can be used to train parents on how to establish a good home atmosphere. Healthy coping skills such as self-regulation and positive thinking should be taught to the students so that they do not rely excessively on private tuition. Negative comparisons and fostering peer learning and encouraging teamwork may also be mitigated to make students feel more connected. Lastly, educators should be trained on a regular basis on how to recognize mathematics anxiety and how to apply sensitive, inclusive, and trauma-informed approaches in their classrooms.

References

- Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science*, 11(5), 181–185. <https://doi.org/10.1111/1467-8721.00196>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Beeson, H. V., & Williams, T. O. (2020). Math anxiety in primary and secondary school students: The impact of teacher and parental attitudes. *International Electronic Journal of Mathematics Education*, 15(2), 1–16. <https://doi.org/10.29333/iejme/6264>
- Bhardwaj, V. (2014). Mathematics anxiety: Causes, symptoms and remedial measures. *International Journal of Research in Humanities, Arts and Literature*, 2(6), 66–72.
- Boaler, J. (2016). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching*. San Francisco, CA: Jossey-Bass.

- Chiu, M. M. (2017). Language and mathematics anxiety: Differences between monolingual and bilingual students. *Learning and Individual Differences*, 60, 45-58.
- Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? *Frontiers in Psychology*, 7, 508. <https://doi.org/10.3389/fpsyg.2016.00508>
- Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education*, 21(1), 33-46.
- Maloney, E. A., Ramirez, G., & Gunderson, E. A. (2015). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. *Psychological Science*, 26(9), 1480–1488. <https://doi.org/10.1177/0956797615592630>
- Maloney, E. A., Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2020). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. *Psychological Science*, 31(2), 187-197.
- Mukhopadhyay, S., & Sen, S. (2015). Private tuition and its impact on quality of secondary education in India. *International Journal of Research in Economics and Social Sciences*, 5(1), 63-71.
- Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development*, 14(2), 187-202.
- Ramirez, G., Shaw, S. T., & Maloney, E. A. (2018). Mathematics anxiety: Past research, promising interventions, and a new interpretation framework. *Educational Psychologist*, 53(3), 145–164. <https://doi.org/10.1080/00461520.2018.1447384>
- Richardson, F. C., & Suinn, R. M. (1972). The mathematics anxiety rating scale: Psychometric data. *Journal of Counseling Psychology*, 19(6), 551–554. <https://doi.org/10.1037/h0033456>
- Wang, Z., Hart, S. A., Kovas, Y., Lukowski, S., Soden, B., Thompson, L. A., ... & Petrill, S. A. (2020). Who is afraid of math? Two sources of genetic variance for mathematical anxiety. *Journal of Child Psychology and Psychiatry*, 61(5), 567–575. <https://doi.org/10.1111/jcpp.13103>
- Young, C. B., Wu, S. S., & Menon, V. (2012). The neuro-developmental basis of math anxiety. *Psychological Science*, 23(5), 492-501.
- Zhang, Q., Zhao, X., Kong, Q., & Wang, Y. (2019). Cross-cultural comparison of mathematics anxiety among Chinese and English-speaking students. *International Journal of Psychology*, 54(5), 679–687. <https://doi.org/10.1002/ijop.12511>