

Obstacles of Mathematics Learning: A Contextual Study on Learners' Perspective

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Abstract: *Mathematics is agreed as an essential subject for the 21st century learners who need to have sufficient skills to pursue their higher study and will ultimately become competent for career path. Bangladesh Government has recognized the fact and emphasized to improve the situation in the latest National Education Policy 2010. However, there is decreasing trend in number of science students in Bangladesh. Previously, researchers identified that Mathematics is the most difficult subject in students' perception, which is a major reason behind such decreasing trend in Science study. By accepting this fact, these researchers investigated the probable reasons of Mathematics anxiety among 630 respondents including 551 undergraduate students who were studying various Mathematics courses and 79 professionals who studied Mathematics in their student lives from different districts of Bangladesh. Earlier, the researchers were guided with preparing questionnaire and design of this study through an experts' opinion meeting. This was a mixed method research, which analyzed the quantitative findings and also respondents' comments in qualitative manner. Based on the discussions on findings a set of recommendations is formulated that may improve the present situation of Mathematics anxiety in Bangladesh for ensuring effective learning of Mathematics without fear or Mathematics phobia.*

Keywords: 21st Century Learner, Effective Learning, Mathematics Anxiety, National Education policy

1. Introduction

Mathematics is fundamental to national prosperity in providing tools for science, engineering, technology, economics and other advanced fields. Many a times, students' prejudice makes significant discomforts in learning the subject [1]. Mathematics anxiety is an intense emotional feeling of anxiety that people have regarding Mathematics learning. People who suffer from Mathematics anxiety feel they are incapable of doing activities and classes that involve Mathematics. Sometimes, the anxiety can be turned into Mathematics phobia. Many students never really developed a solid foundation in basic Mathematics. Because Mathematics is an accumulative discipline dealing with complex concepts that are built cumulatively on more simple concepts, a student who has not developed a solid Mathematics foundation will have trouble learning advanced Mathematics. Mathematics is often considered as difficult subject. Results of the research report "The State of Secondary Education: Quality and Equity Challenges" showed that the students performed lowest in Mathematics comparing to other three subjects; General Science, Bengali and English. Students also identified Mathematics as the most difficult subject [2]. Another research has shown that many students have learning difficulties and show poor performance in Mathematics [3]. These researchers conducted a view-exchange meeting with a good number of experts in Mathematics regarding the present scenario of Mathematics in Bangladesh. The experts on the meeting mentioned Mathematics is a difficult subject to most of the students. The expert body also assumed that, perception of Mathematics as a difficult subject is associated strongly to lower self-efficacy than disliking of the subject. One of the main challenges to a Mathematics teacher is to make a positive attitude in students toward learning Mathematics. Followed by the discussions and the decision taken by the experts, the researchers have tried to investigate about the possible reasons behind the hardness of Mathematics and

find out some way to get rid of the Mathematics phobia. Tobias and Weissbrod (1980), and Fiore (1999) define Mathematics anxiety as "the panic, helplessness, paralysis and mental disorganization that arises among some people when they are required to solve Mathematics problem [1], [4]. Mathematics anxiety affects student's achievement and attitude towards Mathematics. It may lead to poor performance and avoidance of Mathematics. Many people think of Mathematics as a punishment of something that indicates stress [5]. Research showed that many of students with Mathematics anxiety have revealed an over-reliance on mathematical procedures as opposed to actually understanding the Mathematics concept [6]. When students resort to memorizing procedures, rules and routines without much understanding, the concept is forgotten and panic sets in. Parents' past failure experience in Mathematics and fear were also identified as major contributing factors to Mathematics related anxiety and phobia to present students. Many Mathematics textbooks, workbooks and resources unjustifiably reinforce memorization methodology. It is apparent that radical changes are needed in teaching of Mathematics. In addition, many fear and dislike Mathematics as they feel unable to use in their everyday lives. Within this perspective, Mathematics teaching should be a subject that needs to be continuously questioned, evaluated and developed. According to statistical estimations, roughly more than 20% of the populations suffer from severe psychological and physiological symptom related to feeling of anxiety when confronted tasks that require the manipulation of numerical and mathematical information [7]. Students who are competent in Mathematics have more self-confidence in real life problem-solving situations, are better prepared to make decisions and to live in a world of changing technology. Today, Mathematics has permeated every field of scientific endeavor and plays an invaluable role in the fields ranging from science to technology, from modeling ecological disasters and the

spread of diseases to understanding the architecture of human brain and workplace.

2. Literature Review

Researchers have studied the relevant literature on this issue about previous research articles, journals, books and various reports that are described in the following sections.

2.1. General Perception

The negative effects of Mathematics anxiety on students' achievement in Mathematics have attracted researchers' interest for several years. Richardson and Woolfolk (1980) discussed how certain features of Mathematics, such as its precision, logic and emphasize on problem solving, make it particularly anxiety provoking some individuals [8]. A number of scholars attempted to emphasize on Mathematics as an actually hard subject. Tsanwani (2009) also views this so-called hardness as an irrational and impedimental dread of Mathematics [9]. Hlalele (2012) coined Mathematics hardship as a term used to describe the panic, helplessness, mental paralysis and disorganization that arise among some individuals when they are required to solve a problem of mathematical nature [10]. Literature further indicates that Mathematics anxiety refers to person's feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary academic settings [11], [12]. Therefore, this study investigated Mathematics' hardness as some form of discomfort observed while working on mathematical problems, which is usually associated with fear and nervousness to engage in specific Mathematics related situation. Lyons (2012) reported that anxiety is a fairly insubstantial obstacle. Therefore, it makes one to question why it appears to have a crippling effect on some students' ability to do Mathematics. This gives a neutral explanation of why some students avoid Mathematics-related subjects. It is commonly known that anxiety will influence students' decisions about what classes to take, often leading to avoiding of Mathematics [13]. Geist (2010), a proponent of new teaching methods that take student thinking into account, also recognize that gender issues and parental Education can play a part of Mathematics anxiety. However, he emphasizes the prominent role that teachers play in creating concussive learning atmospheres and setting realistic target for the students. He noted that high risk test that value rote learning and memorization are the main source of the Mathematics anxiety [14]. According to Traxler, it appears that there are three primary causes of Mathematics dread. These are beliefs, learning environment and an anticipatory response. These three variables are intertwined and strengthen one another. Belief might include negative stereotypes about one's gender or race. The other suggested causes include teachers' anxiety, innate characteristics of Mathematics, failure and the influence of early school experience of Mathematics [11]. Brown *et al.* (1988) mentioned students believe that Mathematics is important, difficult, and based on rules. Kenny and Silver (1997) mentioned that one out of every two students thinks that learning Mathematics should be above all memorization as cited in [15]. In this study, the researchers focused on aspects of mathematical anxiety such as student's uneasiness

behavior when doing Mathematics, a failure to complete tasks on time and lack of confidence when handling mathematical tasks.

2.2. Bangladesh Context

Recognizing the interrelation of Mathematics and science the National Education Policy 2010 prioritizes Mathematics Education. However, in spite of this policy measure the overall performance of students in Mathematics in Bangladesh is unsatisfactory and many students have erroneous impression about Mathematics and discomfort to mathematical activities. Hostile feelings and negative attitude towards Mathematics and Science are the great barriers to the development of mathematical literacy and the number of student in Mathematics discipline is rapidly decreasing in Bangladesh and students are not eager to take Mathematics as major subjects [6]. The students' dropout rate is increasing alarmingly in Bangladesh especially in the secondary level Education due to toughness of Mathematics. The exemplary numbers of students are most at risk of dropping out before completing primary Education, and are most likely to join the informal labor market. In contrast, a student with a better foundation of skills who performs better in Mathematics at primary or secondary school is more likely to move further into higher Education with higher his/her chances of obtaining a job that requires higher skills and pays a higher wage. Teachers follow the Mathematics and Science curricula in their classrooms as it is designed, which is not always updated and rather focuses on memorizing than conceptual understanding or applying knowledge. Thus it moves the Education in an opposite direction of international norms: the acquisition of mathematical and scientific literacy. A study of the National Academy of Bangladesh for Primary Education (NAPE) and the Japan International Cooperation Agency (JICA) points out that learning Mathematics in Bangladesh is equated to knowing mathematical terms and procedures based on memorizing without understanding which leads ultimate gap between Mathematics and Science in the real context. Similarly, learning Science means accumulating as many pieces of scientific knowledge based on mathematical facts. NAPE identified this problem in 2009 that had led to a philosophical gap between Bangladesh and educationally developed countries. Most of the students in Bangladesh are mostly afraid of Mathematics. They find no pleasure in solving Mathematics problems at home or in classrooms. Due to this fear of Mathematics, the number of students in science discipline is decreasing quite alarmingly in Bangladesh. Besides student's incapability the teachers of Mathematics are, in most cases, unable to help young learners. The ICT policy (2002) stated that, "To address the issue of deficiency in English and Mathematics Education, a crash programme shall be taken up to train teachers." Initiative has been taken by the government in this regard. Mathematics teachers in practice who did not study Mathematics at their graduation and post-graduation levels do not have the capability to arouse the interest of the students in Mathematics. As a result, these limitations may lead to fundamental weakness of students about Mathematics. The latest National Education Policy 2010 of Bangladesh states that Mathematics is deeply interrelated to science and it should be prioritized [16]. Many developed

nations realized the importance and their role as leaders in the world's economy which depend directly on the ability of Education system to produce students who can compete in Mathematics and Science dominated industries of the future.

Mathematics has become a nightmare for many students. If this phenomenon continues, a time will come when good scientists and engineers will not be easily available in Bangladesh [17]. Although Bangladesh has experienced quantitative educational improvement the qualitative aspects of Education have become a cause of government concern [18]. The quality of Education in Mathematics is seriously questionable, which is a crying need now [19].

2.3. Summary of Review Findings

Studies from previous researchers indicated that the causes behind Mathematics anxiety are multifaceted. Parents send their children in educational institution with a pressure on them for obtaining good marks in Mathematics which is primary cause of making the pupil worried about Mathematics. Some main reasons of Mathematics anxiety are ineffective teaching style, less quality of reader friendly text books, improper parental guidance, lack of eagerness and unavailability of educational instruments.

Mathematics anxiety, as a whole, throws the learners into a cycle. Poor performance in exams leads to negativity to Mathematics that avoidance and ultimately the reluctance of getting appropriate preparation on Mathematics. Lack of preparation brings poor Mathematics performance, which again generates negative experience with Mathematics and brings back to the first phase. This cycle can repeat so often that the Mathematics anxious person become convinced they cannot do Mathematics and the cycle is rarely broken. According to Jones (2006), students who do poorly in Mathematics tests and examinations repeatedly claim that they become confused, are unable to focus on the task at hand, or keep thinking about how poor they are at Mathematics and why they avoid Mathematics [20]. We can draw the conclusion as learning Mathematics is a hard task. Many experts mentioned as students' belief that Mathematics is important and very difficult. It is based on rules and may be noted that one out of every two students thinks that learning Mathematics is very much hard that should be above all memorization. This study targets to access the existing challenge and shed some lights on those loopholes.

3. Design and Methodology

This was an explorative research for finding causes behind Mathematics of being a hard subject to learn. The researchers tried to dig into the prospective reasons among learners and practitioners. On the other hand, this was administered on a mixed method approach including both quantitative and qualitative research considerations. Details on design and methodology are described in following sections.

3.1. Objective of the Study

The research question was "What are the reasons behind the facts that Mathematics is a hard subject?" Thus the problem statement of this study was to find out the prospective causes so that Mathematics is being considered as a hard subject to learn. The main objective of the study was to make statements of specific reasons for being Mathematics a hard subject. The minor objective of this study was to formulate a set of recommendations for the society so that the subject of Mathematics will no more be considered hard in future as hard as it is in the present time.

3.2. Research Design

Tsanwani (2009) depicted Mathematics a hard subject that leads to an irrational and impedimental dread to the students [9]. In the context of Bangladesh, a number of researchers including Lutfuzzaman *et. al.* described Mathematics as a hard subject [17], which is also reflected in the National Education Policy [16]. An expert opinion meeting was held to discuss in details about the present situation on Mathematics learning. A total of twenty one Mathematics teachers including the researchers, who are teaching Mathematics courses for various undergraduate programs, discussed and gave opinions from their professional experiences. Everyone present in the meeting agreed upon the fact that Mathematics is a hard subject. As a result, agreeing upon the fact that Mathematics is a hard subject, the researcher decided to look for probable causes behind this fact. To explore the realities regarding the Mathematics learning situation the researcher primarily targeted the learner population. The students who study Mathematics at their tertiary level of Education are in the best choice group since they have already experienced Mathematics-learning at their secondary and higher secondary levels. The struggling experience they also face in the tertiary Education is additional to explore. Moreover, the researcher also decided to contact with some general persons who have completed their academic lives and now engaged in professional lives. It was believed that the non-students could make important statements and share their practical observations regarding difficulties with the subject of Mathematics. Both quantitative and qualitative data were collected from the student and non-student respondents.

3.3. Instrument Development

A questionnaire was developed for all respondents with mostly the close ended questions. The researchers then sent to the subject experts for verification of the questions suggested in the questionnaire. The questions included the probable reasons of Mathematics fear among the respondents. With the comments and suggestions of the experts, the questionnaire was finalized containing twenty two probable reasons. Each of these reasons was presented in the Likert scale from one to five meaning from 'fully disagree' to 'fully agree'. One question was open to the respondents so that they can answer by their own according to the experiences and opinions. For better communication and clear understanding the original questions set was translated into Bengali, which is the local language in

Dhaka, Bangladesh. Finally the questionnaire was developed and distributed among the respondents.

3.4. Data Sample

Other than the eighteen Mathematics experts, a total of six hundred and thirty respondents were reached through the questionnaire. The sample was finalized based on the mix of stratified sampling and researchers' choice sampling techniques. The context was Bangladesh and the data collection was made during the days in the middle of the year 2017. For undergraduate level students in the sample, eighteen sections were randomly chosen among fifty sections of various Mathematics courses. Besides asking for the quantified responses, the respondents were requested to write personal comments or opinions on the questionnaire so that the qualitative analysis could be done properly and a set of recommendations can be made at the end. The demographic diversities of the six hundred thirty respondents based on bivariate parameters are shown in the Table 1.

Table 1: Demographic diversities of the respondents

Gender	Occupation		Community		
Male	486	University Student	551	Divisional districts	234
Female	144	Professionals	79	Other districts	396
Total =	630	Total =	630	Total =	630

4. Analysis and Findings

After collecting the data the responses were categorized as findings of this study according to the previously planned analysis approach. Analyses and findings are described in the following sections.

4.1. Statistical Tools

The regular descriptive statistical tools are used for this study. In addition, the independent T-test for comparing means among questionnaire items is used. Also, the correlation coefficients among selective variables are analyzed to look for any prospective linear dependencies between pairs of variables. Group-wise analyses were done on the demographic diversities such as, (i) gender, (ii) occupation and (iii) community of the respondents. Two tailed analyses were taken in the confidence level of 95% for the statistical tools.

4.2. Findings of the Study

Assuming the fact of the matter that Mathematics is a hard subject, the researchers have found the reasons behind are stated in the Table 2.

Table 2: Opinions of the respondents regarding probable reasons

#	Reason	Mean
1.	Only a good teacher can ensure a better learning of Mathematics. At present in Bangladesh, there is a scarcity of good teachers of Mathematics.	4.13
2.	Students do not practice doing Mathematics exercises at a regular basis. Regular practice is the key of the successful learning.	4.60
3.	Learning Mathematics requires previous knowledge in every step. Without having a level of knowledge one can not move to the next level.	4.06
4.	Logical perception is essential for better learning of Mathematics. Everyone does not have adequate sense of logic.	3.67
5.	Examination and evaluation system for Mathematics is not appropriate in Bangladesh. Partial mark is not given for partially correct mathematical problems.	3.56
6.	Students of developed countries are better in Mathematics. Bangladesh is not a developed country. So students here are not getting advantages.	3.64
7.	Mathematics syllabus in Bangladesh is not up to the mark and not updated. So the students do not get inspiration from such unorganized mathematical topics.	3.68
8.	The teachers are not skilled or trained on specific focus topic for ensuring better teaching of certain mathematical topics in class.	4.72
9.	There are no adequate initiatives from the Education Ministry or other Government authorities to popularize Mathematics and mitigate the fear.	4.61
10.	Students do not spend or willing to spend sufficient time for learning Mathematics. Without practicing for a certain period of time Mathematics can not be learnt.	3.92
11.	There are not enough resources on Mathematics staff that are available in the internet. Online resources are also not effective for learning.	3.69
12.	The current tendency of students is to wait for help from teachers or house-tutors rather than trying to solve a mathematical problem by themselves.	4.25
13.	Students in Bangladesh are willing to memorize the solution of a mathematical problem rather than understanding the logical process of solution.	4.17
14.	Parents are not conscious about Mathematics learning. They do not provide appropriate guidance to their children for winning the so-called Mathematics-phobia.	4.02

The 2-tailed z-test scores of these fourteen items show that the area of the normal distribution bell curve ranges from 84% through 92%. According to z-test of the study the reason #5 is the most significant one, which is followed by the reasons #2, #11 and #1. The lowest significant reason is #14.

Comparisons: Mean scores were compared with t-test statistical tool based on the sample grouped by gender, occupation and community. These three parameter items are independently tested for the comparisons. The differences of mean scores are shown by bar charts in the Figure 1. Gender-wise comparisons show that males score lower than their counterparts in almost all of the fourteen items. Exceptions are #5 and #6. Occupation-wise comparisons indicate that non-student professionals gave higher scores for the reasons #5, #6, #7 and #10 than the student respondents. Community-wise comparisons ensure smaller differences in most of the reasons except the reason #10.

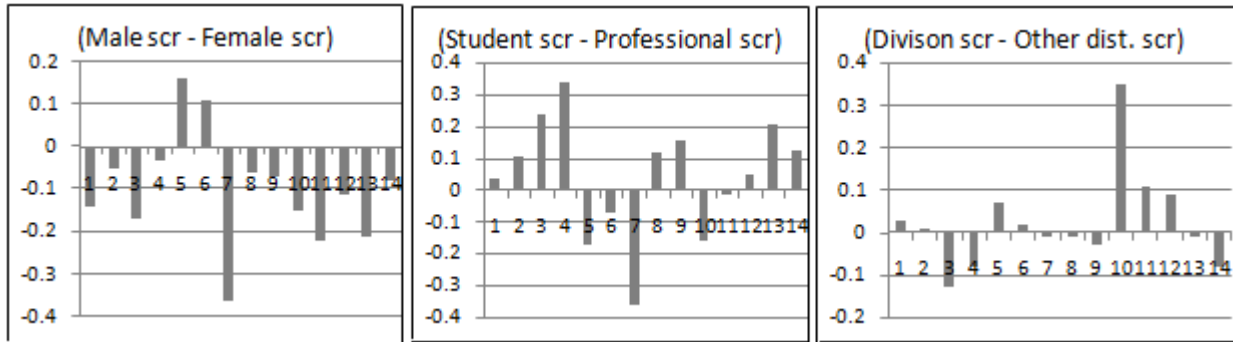


Figure 1: Differences of mean scores of two groups in each of gender, occupation, community

Correlations: Pair-wise correlation coefficients among the items indicate that there are moderate positive relationships between reasons #1 and #2 ($r=0.198$); reasons #5 and #7 ($r=0.199$); reasons #6 and #7 ($r=0.195$); reasons #7 and #11 ($r=0.244$); reasons #8 and #9 ($r=0.231$); reasons #10 and #12 ($r=0.253$); reasons #10 and #13 ($r=0.283$); reasons #12 and #13 ($r=0.413$); reasons #13 and #14 ($r=0.224$). There are no reverse directional relationships between the pairs of reasons.

4.3. Discussion on Findings

Males are stronger in their thoughts than those of females that the persons should have good logic sense to learn Mathematics better and the evaluation system for Mathematics exams is not appropriate. In all other reasons, females are comparatively stronger than their counterparts. On the highest difference by gender, it is conceived that females strongly respond that the Mathematics syllabus is not up-to-date in Bangladesh.

The non-student respondents gave comparatively lowest scores on the reason that the persons do not need to have good logic sense to learn Mathematics. On the other hand they scored high on the reasons that the Mathematics syllabus in Bangladesh is not appropriate, in addition, students do not give sufficient time for practicing Mathematics. These can be combined as students can learn Mathematics better if they study hard and the syllabus is up-to-date, natural capability of the learners is not very significant.

Divisional districts are the bigger and advanced cities in Bangladesh. Other districts are considered as the smaller towns or remote regions in this study. The big city respondents are comparatively very strong in their responses that the students do not spend sufficient time for Mathematics study. They also responded higher than the small community respondents that the internet resources for Mathematics learning are not adequate or not effective. On the other hand, the small town respondents strongly believe that successive learning is significant in Mathematics because the previous knowledge is essential to learn a next topic.

According to the full sample of the study the researcher observed that, there is same directional relationship between good teachers and regular practices are the key success of Mathematics learning. Another pair of positive relationships indicates that evaluation system and syllabus are not

appropriate in Bangladesh while the students learn Mathematics better in developed countries. Mathematics syllabus is not updated and at the same time the online resources are not effective or sufficient. Another relationship indicates that Mathematics teachers are not skilled and the Government does not take adequate initiatives to improve learning situation. The rest of the correlation coefficients ensure that the students in Bangladesh do not spend sufficient time for Mathematics practice; rather they wait for their teachers or someone to solve the Mathematics problems for them. As a result, they depend on memorizing the solution techniques. Parents have positive influence on the action of memorizing Mathematics solution steps without proper understanding.

5. Recommendations

Four major stakeholders of the Education system in Bangladesh are National Education Agencies, Institutional Authorities, Teachers, and Learners. Researchers of this study have formulated a set of recommendations for these stakeholders based on the findings and discussions.

For Education Agencies: National curricula for Mathematics at various levels need to be revised and updated. Guidelines for effective teaching are expected in the National Education Policy by recognizing the world trend of Information and Communication Technology (ICT) integration in Education. Question patterns of Mathematics need to be revised in National examinations so that the students can be evaluated by their quality of understanding on the subject.

For Institutional Authorities: Only Mathematics graduates should be recruited for teaching the subject. Training on how to ensure effective teaching is suggested for the teachers at their entry level. Institutional supports for using effective teaching tools in classroom can improve quality of teaching.

For Teachers: Teachers are requested to keep them updated with the modern tools and resources that can be used for effective teaching. Various online free resources can be studied and customized for using in classrooms for better learning.

For Learners: One of the important preconditions of effective learning is the students' mindset. Students are required to focus on acquiring knowledge by practicing and understanding Mathematics. They are not supposed to look for easy way of passing the exams by only memorizing,

without understanding the Mathematics. Guardians can also play an important role for guiding the students in a proper way.

6. Conclusion

This research investigated the factors responsible for the reluctance in Mathematics learning from the learners' perspectives. Based on the obstacles identified by the existing and previous learners a few recommendations are made in relevance with the major stakeholders. The intention of this study is to find ways to improve Mathematics learning environment in Bangladesh by removing Mathematics anxiety among existing learners. Other relevant factors, that were not taken into consideration in this research, controversial Creative Education system, shortage of qualified teachers, poor infrastructural facilities, lack of equipment and instructional materials for effective teaching, large pupil-to-teacher ratio, unimproved course curriculum, lack of real life based applications of Mathematics. Further research may be conducted for improvement of Mathematics learning situation in Bangladesh with more factors in the context.

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