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Factors Affecting Mathematical Anxiety and Its Affect on Mathematical Achievement in Secondary School Students

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ABSTRACT

Mathematical anxiety influences the ingredients of teaching and learning mathematics. The goal of this study is to compare mathematical anxiety and its effect on performance concerning gender, habitat, board of school, and language of curriculum of secondary school students in West Bengal. Mathematical anxiety and academic achievement in mathematics were measured by self-made five-point Likert scales of 16 items and annual examination numbers respectively. t-test result shows that those students who receive the Bengali language as a medium of curriculum have a higher mean(65.39) than those who receive English as a medium of curriculum. The finding also divulged that mathematical anxiety and academic achievement negatively correlated($r=-0.96$) but significant ($p<0.05$) and scatter plot indicate that mathematical anxiety negatively highly impacts academic achievement. Studies show that the academic achievement of mathematics is highly dependent on mathematical anxiety($R^2=0.936$).

Keywords: Mathematical anxiety, Academic achievement, Not parents support(NPS), Not participating in classroom activity(NPC), Not supported book design(NBD), not solving mathematical calculation in time(NMC), Not comforted by homework (NHW).

INRTODUCTION:

Mathematics education is an important part of secondary school students. It is very helpful and necessary in our life. Mathematics anxiety is a psychological barrier in learning as well as in identifying a perfect educator identity. It is a phenomenon that is often considered when examining students' problems in mathematics (https.//en.m.wikipedia.org). Dreger and Aiken defined mathematical anxiety as an emotional reactions syndrome displayed towards mathematics and arithmetic (Baloglu, 2001). In the other hand, Buxton (1981) said that mathematics anxiety is a panic state which keeps one's thoughts under control. In another study, Morris (1981) defined mathematics anxiety as a phenomenon which is "s illogical fear that when one thinks of mathematics this fear causes one to freeze up, prevents one's learning and performance, and causes distress. Mark. H. Ashraf define Mathematics anxiety as "a feeling of tension apprehension or fear that inference with math performance"(2002,p.1). Mathematical anxiety creates a lack of confidence fear of getting negative thoughts, feeling of helplessness (www.sheffied.ac. UK). Mathematics 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 (Miller and Mitchell, 1994). Mathematics anxiety is a crucial factor that can affect an individual, professional life, personality as well and behavior. On the contrary Bursal & Paznokas state that mathematics anxiety is a "state of discomfort that occurs in response to situations involving mathematical that are threatening to self-esteem" and" the panic helplessness, paralysis and mental disorganization arising among some people when they are required to solve a mathematical problem"(2006).There are many factors such as environment, mental States, the teaching style of the teacher, parent support, peer group support this directly or indirectly affects student mathematics anxiety by researchers. Academic achievement for performance is the extent to which is student-teacher or institution has active they are short or long term educational goal (www.wikipedia.org). Academic achievement referred to the percentage of students At a School whose learning currently meets or exceeds their grade-level standard (Minnesota department of education, 2017). Considering this definition is seen that there is a need to investigate the factor of mathematical anxiety and is there any difference in mathematical anxiety concerning gender, parents status parents support, habitat, and is there has any relation between mathematical and anxiety and their academic achievement.

OBJECTIVE:

- To find out the factors affecting mathematical performance(anxiety) and overall impact on their mathematical achievement in respect to parents supports, classroom participation ,book design, mathematical calculation speed, home work.
- To study the difference between male and female in respect to parents supports, classroom participation, book design, mathematical calculation speed, home work.
- To find out the mean differences between urban-rural students in their mathematical anxiety level.
- To compare the mean differences of mathematical anxiety between the students those are take Bengali as language of curriculum and those are take English as a language of curriculum.
- To study the difference of mathematical anxiety between west Bengal board students and others boards students.

HYPOTHESIS:

H01- There is no significant difference in mathematics anxiety of male and female students in Secondary class.

H02- There is no significant difference in mathematics anxiety of Urban and rural student in Secondary class.

H03- There is no significant difference between boards of school and mathematics anxiety.

H04 -There is no significant difference between language of school curriculum and mathematics anxiety.

H05- There is no significant relation of in mathematical anxiety and parental support.

H06- There is no significant relation between classroom participation and mathematical anxiety.

H07- There is no significant relation of design of mathematics text book and mathematics anxiety.

H08- There is no significant relation between speed of mathematical calculation and mathematics anxiety.

H09- There is no significant relation between Home Work and mathematics anxiety.

H10- There is no significant effect of mathematics anxiety and academic achievement of secondary school student.

REVIEW OF RELATED LITERATURES:

A literature review is a text of a research paper, which includes the present knowledge including substantive findings, future knowledge as well as theoretical and methodological contribution to a particular topic.

OBJECTIVES:

1. To establish a theoretical framework for the selected topic and to define key terms, definitions, and terminology.
2. To identify studies, models, case studies, etc. supporting the topic.

Mandal & Saha (2019) carried out a research on "mathematics anxiety and prevention strategies: an attempt to the improvement of mathematics performance of secondary school students in West Bengal ".The study determined the significant difference in the performance in mathematics of secondary school students on a gender basis with equals to t= – 2.1 7; p<0.05; df=298 and boys indicate high score than girl in mathematics anxiety and performance in mathematics. The study also determined there have significant difference of secondary student type of school with mathematics anxiety and performance of mathematics.

Kundu & kar (2018) on this study mathematical anxiety and its relationship with the achievement of secondary school ". In this article, he concluded that there is no significant difference in the mathematical anxiety level of secondary students according to the residence. Also found an inverse relationship between mathematics anxiety and mathematics achievement of a student with r=-0.667 at 0.01 level of significance.

Pourmoslem & Eerani & Firoozfar (2013) on this study "anxiety and mathematics performance and gender difference among undergraduate students". This study by using t-test shows that students had low learning mathematics anxiety with a mean of 38.7 309; t (274) =-11.580 at a level of significant p<0.05 respectively.

Abbasi & samad zadeh & shahbazzadeng (2013) on this study "study of mathematics anxiety in high school students and its relationship with the self-esteem and teacher personality character" shows that female student is higher mathematics anxiety than male students with t= 3.11; p< 0.01. Also shows that there is an inverse relationship between self-esteem and mathematics anxiety. There is no significant difference in term mathematics anxiety among different educational levels of students with F=3.126 at p<0.062.

Zakaria & Zain & Ahmad & Erlina (2012) on this study "mathematics anxiety and achievement among secondary school students" shows that there is no significant difference in mathematics anxiety between boys and girls with t=-0.09; p<0.01.

Devine & Fawcett & Szucs & Fowler (2012) carried out a research "gender difference in mathematics anxiety and the relation to mathematics performance while controlling for the Test anxiety". This report explains test anxiety is negatively correlated with mathematics performance with Pearson r = -0.207; P=0.008 and spearman R=-0.195; P< 0.001 and marginally significant for boys with r=0.108; P=0.007. The study utilities regression analysis method was conducted 842 students located in England, UK.

Keow Ng (2012) on the article he conduct a survey research on 294 secondary students in Singapore. In this article 40% students are average anxiety level and also determined a moderate strong negative correlation between mathematics achievement and mathematics anxiety with r=-0.57,P<0.05.

Mohamed & Tarmizi (2010 (2010) in their study "anxiety in mathematics learning among Secondary School learners: A comparative study between Tanzania and Malaysia" shows that there is no significant difference between male and female students in Tanzania on their overall mathematics anxiety [t(203)=-0.43]. Learning anxiety [t(217)=0.59], general anxiety [t(215)=0.4] test related anxiety [t(212)=0.90] at p<0.05.

Zakaria & Nordin (2008) carried out research on "the effect on mathematics anxiety on matriculation students as related to motivation and achievement". The study was conducted by 88 samples using ANOVA among groups whose anxiety scores fell between 33% to 67%, below 33%, upper 33% as moderate, low, high anxiety groups respective. The study determined the significant but low negative correlation between mathematics achievement and mathematical anxiety with r = - 0.32, P<0.05.

RESEARCH METHODOLOGY:

A descriptive survey method was employed. There are 100 secondary school students (47 boys and 53 girls) who are taking mathematics as a compulsory subject. For measuring students' concerns about mathematics anxiety, a five-point Likert scale was used with 16 items (0=strongly disagree to 4=strongly agree). The score of academic achievement of mathematics has been determined by the students in the annual examination. For a test of reliability, Cronbach alpha and for validity Aiken, was used, t-test was used to compare the various group of the sample, according to subscale of mathematical anxiety and academic achievement.

The correlation was used to measure the effect of various subscales of mathematical anxiety and academic achievement. SPSS software is used to here measure normality, validity, reliability, t-test, correlation among variables. Regression line used to measure the impact of mathematical anxiety on academic achievement in secondary school students. To identify the relationship between the predictor variables, not parents' support, not participating in classroom activities, not supported mathematics book design, not solving mathematical calculations in time, not being comforted by math homework an analysis of multiple regression was conducted, and dependent variable academic achievement.

RESULT.

The study appraise mathematical anxiety ground on five sub-categories (not parents support, not participating in classroom activity, not supported book design, not solving mathematical calculation in time, not comforted by homework) and shows how mathematical anxiety affect academic achievement.

Table-1: Comparison of five subscales of mathematical anxiety, overall mathematical anxiety, and academic achievement between males and females.

Variable	Group	N	Mean	SD	SE	t-Value	Significant
NPS	Male	47	2	0.86	0.12	1.43	0.15
	Female	53	1.73	0.96	0.13		

NCP	Male	47	1.89	0.79	0.11	0.63	0.52
	Female	53	1.79	0.78	0.11		
NBD	Male	47	1.82	0.89	0.13	1.23	0.21
	Female	53	1.59	0.99	0.14		
NMC	Male	47	2.12	0.96	0.14	1.19	0.23
	Female	53	1.89	0.92	0.12		
NHW	Male	47	1.94	1.03	0.15	1.06	0.29
	Female	53	1.71	1.11	0.15		
Over all anxiety	Male	47	1.96	0.79	0.11	1.19	0.24
	Female	53	1.77	0.84	0.12		
Academic Score	Male	47	60.32	18.71	2.72	1.00	0.31
	Female	53	63.98	17.75	2.43		

Table 1 shows the impact of gender on the subscale of mathematical anxiety among learners in secondary school students. The result indicated that there is no significant difference ($p>0.05$) between male and female students on their academic achievement($t=1.00, p<0.31$ and overall mathematical anxiety due to those students don't receive parents, supports ($t=1.43$, $p<0.15$), not supported by classroom participation ($t=0.63$, $p<0.52$), not comforted by the book design ($t=1.23, p<0.21$), cannot solve mathematical calculation in time($t=1.19, p<0.23$), not comforted by homework($t=1.06, p<0.29$) and no significant difference in their academic achievement in mathematics.

Table-2: Comparison of five subscales of mathematical anxiety, overall mathematical anxiety, and academic achievement between rural and urban students

Variable	Group	N	Mean	SD	SE	t-Value	Significant
NPS	Rural	58	1.75	0.88	0.12	-1.29	0.19
	Urban	42	2.00	0.97	0.15		
NCP	Rural	58	1.75	0.78	0.10	-1.21	0.23
	Urban	42	1.94	0.78	0.12		
NBD	Rural	58	1.65	0.87	0.09	0.10	0.92
	Urban	42	1.77	0.90	0.12		
NMC	Rural	58	1.19	0.94	0.12	-0.99	0.32
	Urban	42	2.11	0.96	0.15		
NHW	Rural	58	1.78	1.03	0.14	-0.44	0.66
	Urban	42	1.88	1.15	0.17		
Over all anxiety	Rural	58	1.96	0.79	0.12	1.18	0.23
	Urban	42	1.78	0.84	0.11		
Mathematical Score	Rural	58	64.86	17.57	2.30	1.70	0.09
	Urban	42	58.67	18.67	2.88		

Table 2 shows the impact of habitat on the subscale of mathematical anxiety among learners in secondary school students. The result indicated that there is no significant difference ($p>0.05$) between rural and urban

students on their overall mathematical anxiety due to those students not receive parents supports (t=-1.29, p<0.19), not supported by classroom participation (t=-1.21, p<0.23), not comforted by book design (t=0.10,p<0.92), not comforted by homework(t=-0.44,p<0.66). Only one subscale of students who cannot solve mathematical calculation in time have a significant difference between rural and urban students (t=-0.99, p<0.04)

Table 3: Comparison of five subscales of mathematical anxiety, overall mathematical anxiety, and academic achievement between west Bengal board and others boards of secondary students.

Variable	Group	N	Mean	SD	SE	t-Value	Significant
NPS	West Bengal Board	64	1.77	0.95	0.12	-1.21	0.23
	Other Boards	36	2.00	0.86	0.14		
NCP	West Bengal Board	64	1.78	0.79	0.09	-0.93	0.35
	Other Boards	36	1.93	0.78	0.13		
NBD	West Bengal Board	64	1.63	0.92	0.11	-1.01	0.31
	Other Boards	36	1.83	1.00	0.17		
NMC	West Bengal Board	64	1.96	0.98	0.12	-0.69	0.48
	Other Boards	36	2.09	0.88	0.14		
NHW	West Bengal Board	64	1.75	1.11	0.13	-0.83	0.40
	Other Boards	36	1.94	1.00	0.16		
Over all anxiety	West Bengal Board	64	1.80	0.84	0.11	1.01	0.31
	Other Boards	36	1.97	0.78	0.13		

Academic Score	West Bengal Board	64	63.77	18.35	2.29	1.10	0.27
	Other Boards	36	59.58	17.88	2.98		

Table 3 shows the impact of the West Bengal board and other boards of secondary students on the subscale of mathematical anxiety among learners in secondary school students. The result indicated that there is no significant difference($p>0.05$)between west Bengal board students and other board students on their overall mathematical anxiety due to those students not receive parents supports ($t=-1.21, p<0.23$),not supported by classroom participation($t=-0.93, p<0.35$), not comforted by book design ($t=-1.01, p<0.31$), cannot solve mathematical calculation in time($t=-0.69, p<0.48$),not comforted by homework($t=-0.83, p<0.40$) and their academic achievement($t=1.10, p<0.27$)

Table 4: Comparison of five subscales of mathematical anxiety, overall mathematical anxiety, and academic achievement between the medium of the curriculum of Bengali and English medium of secondary school students.

Variable	Group	N	Mean	SD	SE	t-Value	Significant
NPS	Bengali	57	1.72	0.85	0.11	-1.69	0.09
	English	43	2.03	0.98	0.15		
NCP	Bengali	57	1.72	0.72	0.09	-1.57	0.12
	English	43	1.53	0.84	0.13		
NBD	Bengali	57	1.58	0.86	0.11	1.43	0.16
	English	43	1.87	1.04	0.16		
NMC	Bengali	57	1.83	0.92	0.12	2.04	0.04
	English	43	2.22	0.94	0.14		
NHW	Bengali	57	1.67	1.01	0.34	1.61	0.11
	English	43	2.02	1.13	0.73		
Over all anxiety	Bengali	57	1.73	0.75	0.10	1.88	0.06
	English	43	2.04	0.88	0.13		
Academic Score	Bengali	57	65.39	16.79	2.22	2.01	0.04
	English	43	58.12	19.35	2.95		

Table 4 shows the impact of language of the curriculum of secondary students on the subscale of mathematical anxiety among learners in secondary school students. The result indicated that there is no significant difference($p>0.05$)between those students receive Bengali and English language of curriculum students on their overall mathematical anxiety due to those students not receive parents supports ($t=-1.69, p<0.39$),not supported by classroom participation($t=-1.57, p<0.12$), not comforted by book design ($t=1.43, p<0.16$), have significant difference those cannot solve mathematical calculation in time($t=2.04, p>0.04$),have significant

of their academic achievement(t=2.10,p>0.04). Have no significant their not comforted by homework (t=1.16,p<0.39).

Table 5: Correlation of academic score of mathematics and subscale of mathematical anxiety and its subscales.

variables	Variables(items)	validity	Correlation with math anxiety	Correlation With academic achievement	Correlation with academic achievement
Students not receive parents support (NPS)	If my parents rebuke to do solve math problem feel stress.	.930	0.75	-0.72	
	My parents do not like, if I practice mathematics more than other subject.	.931	0.72	-0.	-0.92
	My father punished me, If I got low score in mathematics.	.928	0.86	-0.89	
Not supported by class room participation (NCP)	If, I have to tell teacher that I do not understand my math work, I feel uncomfortable.	.928	0.82	-0.81	
	When my teacher asks me a mathematics question, I feel tensed.	.928	0.81	-0.81	-0.89
	I feel stressed , when I watch my teacher solve algebraic equation on black board	.928	0.84	-0.79	
	Questions related mathematics makes me confused.	.934	0.57	-0.56	
	When I listen to another student explain math formula, I feel trouble.	.940	0.34	-0.31	
Not comforted by book design(NBD)	When I see a page with rule, formula, about mathematics, I feel stress.	.934	0.58	-0.62	
	If the similar type math example as the questionnaire is given, I fell trouble.	.938	0.45	-0.63	-0.72
Cannot solve mathematical calculation	I feel scared when, I can't do math in time.	.932	0.66	-0.75	
	Feel stress, when I can't do	.932	0.67	-0.72	

in time (NMC)	math quickly than my friends.				-0.92
	Feel tensed when teacher give me mental math.	.928	0.82	-0.82	
	Feel uncomfortable, when I can't solve old math exercise quickly.	.928	0.82	-0.81	
Not comforted by home work (NHW)	When I can't solve math homework, I feel stress in beginning of class.	.928	0.80	-0.79	-0.89
	When my class teacher gives math homework, I feel tensed.	.928	0.83	-0.81	

Table 5- shows the correlation among various subscales of mathematical anxiety and the academic score of mathematics. Students who are not receiving parental support have a high negative correlation (r=-0.92) with their academic scores in mathematics. Those students who do not participate in classroom activity are highly negatively correlated (r=-0.89) with their academic score. Students who feel stressed when they see the rule, formula, and similar math test question paper in mathematics books have a low academic achievement (r=-0.72). Students who cannot do the math on time, cannot do old math quickly and who feel stressed when it comes to solving mental math have a lower academic achievement (r=-0.92). Students who do not do their homework and get scratched at the beginning of the math class have less academic achievement.

Multiple regressions was prosecuted to explore so long as Not parents support, Not participating in classroom activity, Not supported mathematics book design, not solving mathematical calculation in time, Not comforted by math homework could significantly predict participant's achievement score of mathematics. The sequel of regression recommended that the model explained 94%of the variance and that the model was a significant predictor of academic achievement of mathematics $F(5,94)= 299.695, p=<.001$.while Not parents support contributed to the model($B^1=-5.619, p<0.05$, Not participate classroom activity($B^2=-5.337, p<0.05$,Not supported mathematics book design($B^3= -1.608, p<0.05$), not solve mathematical calculation in time($B^4=5.238, p<05$), Not comforted by mathematics homework($B5=-3.702, p<0.05$). The final predictive model was

Academic achievement of mathematics in annual examination = 102.416+ B^1 *Not parents support+ B^2* Not participate classroom activity + B^3* Not supported mathematics book design+ B^4 * not solve mathematical calculation in time+ *B5* Not comforted by mathematics homework.

Conclusion:

- The studies show that secondary school students with lower mathematical anxiety score higher mathematical achievement. The framework of the mathematical anxiety scales questionnaire has been developed by researcher v Aiken validity and reliability with Cronbach alpha =.945.
- The result shows that gender status, habitat, Boards of school did not significantly impact mathematical anxiety and academic score in mathematics, only the academic score of mathematics was significantly impacted by the language of the curriculum.

- Parents scolding students for getting low marks creates fears of math if parents punish them. Students whose parents do not like their children to spend more time on math than other subjects have less academic achievement in mathematics.
- The study found that all students were more mathematical anxious when faced with teacher questions, looking at math equations on a blackboard, and feeling tense if could not understand math.
- Students who feel jealous when they see a friend explain math formulas or solve mathematical problem on boards have their academic achievement lowly correlate with mathematical anxiety.
- Students who feel the pressure of looking at rules, formulas, and mathematical tables on a page in a math book and feel the trouble of looking at the same types of math in examination papers have low academic achievement.
- Negatively strong correlate with mathematical anxiety and academic achievement those are unable to solve math in time, feel tensed by mental math.
- The mathematical anxiety in those who feel stressed at a beginning of a class as a result of not doing homework is much higher than those who do math homework.

Recommendation and limitation:

- To reduce mathematical anxiety parents need to have a friendly attitude so that students can talk about the entire problem and parents' guide to solve that problem. The teacher has to look at mathematical problems in the classroom so that the students are not scared. If necessary, a new method, strategy has to be used.
- The teacher needs to explain the mathematical problems to all confused students. If necessary, the problems need to be divided into small parts and presented to students.
- The teacher needs to focus on the math problem so that it can be solved on time and so that the student can do their homework, those who are not doing homework need to know the reason and if necessary these problems need to be solved.
- Mathematical books need to have details explaining and establishing mathematical tables, formulas, rules. If any students do not understand the teacher will explain to them.

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