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Gender difference in mathematics anxiety at secondary school teachers of Bangladesh

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Abstract
The purpose of this study was to investigate the impact of gender of secondary teachers on mathematics anxiety. The participants in the study were 242 in-service secondary school teachers who taught mathematics at secondary level where 193 (79.8%) of them were male teachers and 49 (20.2%) were female teachers. McAnallen Anxiety in Mathematics Teaching Survey (MAMTS, 2010) was used as the instrument containing 25 items where 13 items were related to the professional mathematics anxiety and 12 items were related to the personal mathematics anxiety. Out of 25 items of MAMTS, 12 items were positively worded and 13 items were negatively worded. The positive and negative items were not arranged in the original scale serially. Piloting was done to ensure the validity and reliability of the tools for data collection. There was a significant difference of personal math anxiety scores between male and female teachers where females had more anxiety levels than males in mathematics. But there was no enough evidence in favor of difference between male and female teachers in math teaching anxiety. Specifically females were more anxious than males in the category of high level but males were more anxious than females at moderate level for both personal mathematics anxiety and in mathematics teaching anxiety. It can be concluded that females were not always behind from males in respect of mathematics anxiety. We need to consider females equally as males for training in mathematics. Girls should be encouraged to take mathematics at every level.

Keywords: Gender difference, mathematics anxiety, secondary school, bangladesh

1. Introduction
Anxiety is a feeling of worry, nervousness or uneasy about something with an uncertain outcome (Oxford Dictionary, 2020) [9]. The meaning of anxiety is fear or nervousness about what might happen (Merriam Webster Learner's Dictionary, 2020) [6]. Mathematics anxiety may include dislike of mathematics, worry, and fear with specific behavioral manifestations that include tension, frustration, distress, helplessness, and mental disorganization (Richardson and Suinn, 1972 cited by McAnallen, 2010) [8]. Mathematics anxiety has been an important and also a common problem in learning and teaching from elementary through university levels for the last three decades (Uusimaki & Nason, 2004; Vinson, 2001 cited as Haciomeroglu, 2014). Smith (2004) [12] noted that math anxiety is a kind of problem facing by students and teachers where the main cause of math anxiety is the teacher himself. On the other hand the greatest prevention of math anxiety is the teacher himself (Smith, 2004) [12]. Researchers (Sloan, 2010; Vinson, 2001 cited as Haciomeroglu, 2014) [3] claimed that highly anxious math teachers might unintentionally transfer their negative feelings, avoidance and fear of mathematics to students since mathematics anxiety is related to how one teaches mathematics. High math anxiety of teachers affected the math performance and beliefs of the personal math ability of their students (Sparks, 2011, cited as Reed Kara L. 2014) [11]. How enjoyable or painful mathematics to the students is mainly depended on suitable teacher (The Daily Ittefaq, 27.02.15). McAnallen (2010) [8] claimed that math teachers need to understand all concepts deeply to reduce their own anxiety and not to transmit any anxiety to their students. McAnallen (2010) [8] also found that math teachers reported about their previous experiences that negative interactions of teachers regarded as embarrassing, humiliating, hurtful and as such contributed to their mathematics anxiety. Smith (2004) [12] told that if the teacher has a bad attitude about mathematics, his students most likely will as well.
Researchers have found different result about the impact of gender on mathematics anxiety in different countries of the world. Yeo, Tan & Lew (2015) [17] showed that there was no

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significant difference of anxiety level among male and female of undergraduate students in Malaysia. Devine *et al*. (2012) [2] found that gender difference was not emerged for mathematics performance but levels of math anxieties were higher for girls than for boys. They also revealed that math anxiety was a significant predictor of performance for girls but not for boys. Khatoon & Mahmood (2010) [4] mentioned that females display more anxiety toward math than males at secondary level in India. Luo, Wang & Luo (2009) [5] told that the significant difference between male students and female students in mathematics anxiety where female students' anxiety level was higher than male students in China. Pourmoslemi, Erfani & Firoozfar (2013) [10] claimed that there was no significant difference between male and female students at undergraduate level in their mathematics learning anxiety in Iran. Females had more anxiety levels than males in mathematics in India (Srivastava, Imam & Singh, 2016) [14]. Beilock *et al*. (2010) [1] found that female teachers' math anxiety negatively relates to girls' math achievement and also to girls' gender ability beliefs as highly math-anxious female teacher pushes girls to confirm the stereotype that they are not as good as boys at math, which in turn, affects girls' math achievement.

Mathematics is one of the important subjects among other compulsory subjects at secondary level in Bangladesh. So students' weakness in this subject is not expected. According to the report of WEF (2013) [16] the standard of mathematics education of Bangladesh is 113th out of 144 countries. Mathematics can consider as a gatekeeper for better employment (Haciomeroglu, 2014) [3]. So it is equally needed for both boys and girls. Today's world is the world of science and technology. So it is needed to improve mathematics education in Bangladesh for the prosperity of our nation. Therefore the intent of the study was to examine the impact of gender on mathematics anxiety even mathematics teaching anxiety at secondary teachers of Bangladesh.

2. Purpose of the study
The main objective of this study was to investigate the impact of gender on math anxiety. To achieve the objective the following research questions were generated.

3. Research questions
1. What are the effects of gender on personal mathematics anxiety in secondary mathematics teachers?
2. What are the effects of gender on mathematics teaching anxiety in secondary mathematics teachers?

4. Methodology
There are different types of secondary schools in Bangladesh such as government high school, non-government high schools, boys' school, girls' school, pilot high school etc. All in-service secondary schools teachers who taught mathematics of Bangladesh were the targeted population of this study. The 4 divisions-Dhaka, Chittagong and Rajshahi and Barisal were selected considering regional variations. From these 4 divisions, 8 districts were chosen conveniently where 2 districts were chosen from each division. From each district 2 upazillas were selected conveniently. Three schools were selected from each upazila. Thus 48 schools were selected from 16 upzillas. All of the teachers who taught mathematics of 48 schools were considered as sample. Totally 242 teachers were selected as

sample where 193 were male and 49 were female. McAnallen Anxiety in Mathematics Teaching Survey (MAMTS, 2010) was used as tool. Finally the instrument MAMTS contained 25 items. 13 items with Cronbach's Alpha of.923 were related to the professional mathematics anxiety and 12 items with Cronbach's Alpha.952 were related to personal mathematics anxiety. McAnallen was used exploratory factor analysis to determine the factors. In this study the researcher named the factor with 13 items as math teaching anxiety and another factor with 12 items as personal math anxiety. Out of 25 items of MAMTS, 12 items were positively worded and 13 items were negatively worded. The positive and negative items were not arranged in the original scale serially. Permission was obtained from the author of MAMTS to use this instrument. The second section of the revised tools has contained items about educational qualification, professional qualification and subject based training.

The purpose of piloting was to ensure the validity and reliability of the tools for data collection. The original scale was in English and its validity and reliability was declared. But in this study the original tools (MAMTS) was translated into Bangla named MAMTS-B. Therefore it was needed to check the validity of Bangla version of MAMTS named MAMTS-B. The tools were pre-tested at 2 high schools in Dhaka city area which were not included in the actual study. The respondents were 30 secondary teachers (who taught math at secondary level). Then correlation was performed and found r =0.918 which was highly satisfactory. Then to check reliability MAMTS-B was administered to another 30 respondents. Again after 7 days the same questionnaire was administered to the same respondents. To minimize the impact of memory factor 2nd time all the statements were reversely arranged. The correlation between two mean scores for test and retest was.926 which was highly satisfactory. So the tools were revised on the basis of the experience of pilot testing. Data were collected from January to March in 2018. After piloting, MAMTS-B was used to collect data. The respondents have got the opportunity of using nick name. Descriptive statistics were carried out for various categorical variables to get frequencies and percentages. Data were analyzed using computer program, Statistical Package for Social Sciences (SPSS). Scores for each participant were computed by adding the item values on the MAMTS-B.The negative items (13) on MAMTS-B were reversely coded before the total scores for participants were calculated. Participants' scores on MAMTS-B and the overall means and standard deviations of their scores were used to assign them into anxiety groups such as low, moderate, high. That is, participants whose scores on MAMTS-B were at least one standard deviation below the overall mean were categorized as possessing low mathematics anxiety level, while those with scores that were at least one standard deviation above the overall mean were considered as having high mathematics anxiety level. Moderate mathematics anxiety level was assigned to participants whose scores were not up to one standard deviation below or above the overall mean. Analysis of variance (ANOVA) was performed to compare the different level of math anxiety scores and math teaching anxiety scores. T-test was performed to compare anxiety scores for different category of teachers such as gender.

5. Findings

5.1 Teachers' gender status: The participants in the study were 242 in-service secondary school teachers who taught mathematics at secondary level (class six to ten) where 193 (79.8%) of them were males, 49 (20.2%) were females.

Table 1: Respondents' gender status

Gender	N(242)	Percentage	Cumulative percentage
Male	193	79.8	79.8
Female	49	20.2	100.0

5.2 Teachers professional education and subject (mathematics) based training

There were 73.6% teachers had B.Ed. or M.Ed. degree and 26.4% teacher who did not have any professional degree where gender difference was not mentionable as 73.1% were male and 75.5% were female. Again majority (54.1%) of the teachers did not have any training in mathematics. Because many teachers were not actually appointed math teacher as they did not have mathematics as a subject at graduation level. So they were not considered for subject training. Out of trained teachers 48.7% were male and 34.7% were female where gender difference is mentionable. Again out of non trained teachers female portion (65.3%) was higher than male portion.

Table 2: Respondents professional education and subject based training

	Male	Female	N(%)
Professional degree			
B.Ed. or M.Ed.	141(73.1%)	37(75.5%)	178(73.6%)
None	52(26.9%)	12(24.5%)	64(26.4%)
Total	193(100%)	49(100%)	242(100%)
Training in mathematics			
Yes	94(48.7%)	17(34.7%)	111(45.9)
No	99(51.3%)	32(65.3%)	131(54.1)
Total	193(100%)	49(100%)	242(100%)

5.3 Impact of gender on personal math anxiety

The mean score of personal math anxiety of males is 2.14 with standard deviation of .61 and that of females 2.39 with SD of .74 where p is equal .03 with degrees of freedom 240. The results clearly indicate that there is significant difference of personal math anxiety scores between male and female teachers at 97% confidence level. Therefore females had more anxiety levels than males for mathematics.

Table 3: Gender and personal math anxiety

Gender	N	Mean	Std. Deviation	df	Sig.
Male	193	2.14	.61	240	.03
Female	49	2.39	.74		

5.4 Impact of gender on math teaching anxiety

Again the mean score of math teaching anxiety of males is 2.26 with standard deviation of .58 and that of females 2.46 with SD of .79 where p is equal .10 with degrees of freedom 240 which was not significant at 95% confidence level. So there is no enough evidence in favor of difference between male and female teachers in math teaching anxiety.

Table 4: Gender and math teaching anxiety

Gender	N	Mean	Std. Deviation	df	Sig.
Male	193	2.26	.58	240	.10
Female	49	2.46	.79		

5.5 Gender comparison in different level of personal math anxiety

The results indicated that 8.3% participants experienced low level, 82% experienced moderate level and 9.7% experienced high level of personal mathematics anxiety in males. On the other hand 8.2% participants experienced low level, 75.5% experienced moderate level and 16.3% experienced high level of personal mathematics anxiety in females. It may be mentioned that females were more anxious than males at the category of high level anxiety (Table 5.5a). At the same time males were more anxious than females at the category of high level anxiety. One way ANOVA was performed to compare the difference between groups of low, moderate and high level. Here P <.01, for the groups of personal math anxiety levels, the difference was statistically significant at 99% confidence level. Table 5.5(b) and 5.5(c) shows the ANOVA (Analysis of variance) respectively.

Table 5(a): Means of personal math anxiety level for male & female

Personal math anxiety level	N(%)		Mean score	
	Male	**Female**	**Male**	**Female**
Low	16 (8.3%)	4(8.2%)	1.4544	1.5000
Moderate	158 (82%)	37(75.5%)	2.0268	2.1765
High	19 (9.7%)	8((16.3%)	3.7058	3.8438
Total	193(100%)	49(100%)	2.1446	2.3935

Table 5(b): One way ANOVA for personal math anxiety score (male)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	56.125	2	28.063	345.698	.000
Within Groups	15.424	190	.081		
Total	71.549	192			

Table 5(c): One way ANOVA for personal math anxiety score (Female)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.762	2	10.881	106.267	.000
Within Groups	4.710	46	.102		
Total	26.472	48			

5.6 Gender comparison in different level of math teaching anxiety

The results indicated that 7.8% participants experienced low level, 82.9% experienced moderate level and 9.3% experienced high level of mathematics teaching anxiety in males. On the other hand 10.2% participants experienced low level, 73.5% experienced moderate level and 16.3% experienced high level of mathematics teaching anxiety in females. It may be mentioned that females were more anxious than males at the category of high level but males were more anxious than females at moderate level in mathematics teaching (Table 5.6a). One way ANOVA was performed to compare the difference between groups of low, moderate and high level. Here P <.01, for the groups of math teaching anxiety levels, the difference was statistically significant at 99% confidence level. Table 5.6(b) and 5.6(c) shows the ANOVA (Analysis of variance) respectively. So, on an average, gender difference was not significant on math teaching anxiety.

Table 6(a): Means of math teaching anxiety level for male & female

Math teaching anxiety level	N(%)		Mean score	
	Male	Female	Male	Female
low	15(7.8%)	5(10.2%)	1.5282	1.4760
moderate	160(82.9%)	36(73.5%)	2.1687	2.2567
high	18(9.3%)	8(16.3%)	3.7309	3.9925
Total	193(100%)	49(100%)	2.2646	2.4604

Table 6(b): One way ANOVA for math teaching anxiety score (male)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	48.310	2	24.155	269.653	.000
Within Groups	17.020	190	.090		
Total	65.330	192			

Table 6(c): One way ANOVA for math teaching anxiety score (Female)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	25.118	2	12.559	114.226	.000
Within Groups	5.058	46	.110		
Total	30.176	48			

6.0 Conclusion

Based on the findings of the study, females were more anxious than males for personal math anxiety which was significant but the difference was not significant for math teaching anxiety. In personal math anxiety females were more anxious at high level category whereas males were slightly more anxious at moderate level. Again in math teaching anxiety females were more anxious at high level and low level category but males were slightly more anxious at moderate level. It may be mentioned that numbers of females were high at the category of high level anxiety. It can be concluded that females were not always behind from males. Sometimes males were more anxious but somewhere females were more anxious. The study also concludes that there is an effect of gender difference on training in mathematics but not on professional education. For getting anxiety free female math teachers, we need to encourage girls to take mathematics as subject at every level. Other researcher may try to find the different causes of math anxiety and its impact on student achievement. Finally reducing technique will be developed by another research.

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