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Dr. Md. Billal Hossain
Senior Teacher, Department of Mathematics, Ideal School and College, Dhaka, Bangladesh

Corresponding Author:
Dr. Md. Billal Hossain
Senior Teacher, Department of Mathematics, Ideal School and College, Dhaka, Bangladesh

Relation between personal mathematics anxiety and mathematics teaching anxiety at secondary level in Bangladesh

Dr. Md. Billal Hossain

Abstract
The participants in this 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 a tool 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. To check the validity and reliability of the tool, piloting was done. Exploratory factor analysis was used to determine if the constructs for mathematics teaching anxiety and personal mathematics anxiety were valid. Pearson's Correlation Coefficient was used to determine the relation between personal mathematics anxiety and mathematics teaching anxiety. Regression analysis was done to know the model that means the dependency of mathematics teaching anxiety on personal mathematics anxiety. The factors personal mathematics anxiety and mathematics teaching anxiety were highly and positively correlated. It was also found that mathematics teaching anxiety is 79% depended on personal mathematics anxiety and which was statistically significant at 99% confidence level. It can be concluded that if personal mathematics anxiety will increase then mathematics teaching anxiety will increase.

Keywords: personal mathematics anxiety, mathematics teaching anxiety, secondary mathematics teachers

1. Introduction
Ali (1999) considers the secondary level as preparatory stage of life of any student. Secondary education is the 'gateway to life' according to the report of International Education Commission formed for the education of 21st century (National Curriculum 2012, NCTB) [7]. One of the purposes of secondary education is to prepare quality students for tertiary education (Education watch, 2007) [2]. Mathematics is one of the important subjects among other compulsory subjects at secondary level. So students' weakness in this subject is not expected. But Bangladesh is backward in respect of mathematics education and the standard of teachers than many other countries in the world (International organization report as cited in The Daily Ittefaq 27.02.15). According to the report of world economic forum (2013) [12] the standard of mathematics education of Bangladesh is 113th out of 144 countries. The same committee suggested that today's world is the world of science and technology and to keep pace with the present world we have to build up our expertise in mathematics. Mathematics can consider as a gatekeeper for better employment (Haciomeroglu, 2014) [4]. The final report of the National Mathematics Advisory Panel, U.S. Department of Education, (NMAP, 2008) cited as Reed (2014) [9] impasses to improve mathematics education are needed for the safety of a nation and quality of life and even the prosperity of a nation.

According to the Merriam Webster Learner's Dictionary the meaning of anxiety is fear or nervousness about what might happen. On the other hand according to the Oxford Dictionary, anxiety is a feeling of worry, nervousness or uneasy about something with an uncertain outcome. Richardson and Suinn (1972) cited by McAnallen (2010) [6] who

developed the Mathematical Anxiety Rating Scale (MARS), stated that mathematics anxiety may include dislike of mathematics, worry, and fear with specific behavioral manifestations that include tension, frustration, distress, helplessness, and mental disorganization. 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) [4]. He noted that mathematics anxiety is a kind of problem faced by students and teachers where the main cause of mathematics anxiety is the teacher himself. On the other hand the greatest prevention of mathematics anxiety is the teacher himself (Smith, 2004) [10].

Researchers (Sloan, 2010; Vinson, 2001 cited as Haciomeroglu, 2014) [4] claimed that highly anxious mathematics 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 mathematics anxiety of teachers affected the mathematics performance and beliefs about their personal mathematics ability of their students (Sparks, 2011, cited as Reed, 2014) [9]. On the other hand only 35 % students achieved relevant competencies in class 8 (DSHE report 2014). How enjoyable or painful mathematics is mainly depending on suitable teacher (Editorial column, The Daily Ittefaq, 27.02.15). McAnallen (2010) [6] claimed that mathematics teachers need to understand all concepts deeply to reduce their own anxiety and not to transmit any anxiety to their students. Smith (2004) [10] told that if the teacher has a bad attitude about mathematics, his students most likely will as well. Therefore the more a teacher understands mathematics the more he will be able to remove anxiety from the students. Improving the quality of mathematics teaching and learning, teachers has a key role. McAnallen (2010) [6] also found that mathematics teachers reported about their previous experiences that negative interactions of teachers regarded as embarrassing, humiliating, hurtful and as such contributed to their mathematics anxiety. Fiore (1999) [3] told that the roots of mathematics anxiety is in the teachers and teaching of mathematics then he suggested that mathematics anxiety results more from the way the subjects is presented than the subjects matter itself. Therefore the intent of the study was to measure the dependency of mathematics teaching anxiety on personal mathematics anxiety.

2. Purpose of the study

The main objective of this study was to investigate the relation between personal mathematics anxiety and mathematics teaching anxiety. To achieve the objective the following research questions were generated.

3. Research Question

1. What is the relation between personal mathematics anxiety and mathematics teaching anxiety?
2. How much mathematics teaching anxiety is depended on personal mathematics anxiety?

4. Methodology

All in-service secondary schools teachers who taught mathematics of Bangladesh were the targeted population of this study. The 4 divisions were selected considering regional variations as Dhaka, Chittagong, Rajshahi and Barisal. Two districts were chosen conveniently from each division then 2 upazillas were selected from each district 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. Thus 242 teachers were selected as sample. McAnallen Anxiety in Mathematics Teaching Survey (MAMTS, 2010) was used as tool. It was contained 25 items. 13 items were related to the Professional Mathematics Anxiety and 12 items were related to Personal Mathematics Anxiety. Factor number one (13 items) had a Cronbach's Alpha of .923 and factor number two had a Cronbach's Alpha (12 items) of .952. She was used exploratory factor analysis to determine the factors. Factor one was professional mathematics anxiety and factor two was 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 check the validity and reliability of the tool. The original scale was in English and its validity and reliability was declared. But in this study the original tool (MAMTS) was translated into Bangla named MAMTS-B. Permission was taken from the author of MAMTS to use this instrument. The tool was 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 of MAMTS-B, it was administered 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. Data were analyzed using Statistical Package for Social Science (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. The exploratory factor analysis was used to determine if the constructs for mathematics teaching anxiety and personal mathematics anxiety were valid. Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were used to determine whether the data were suitable for factor analysis or not. The KMO value for this study is .934, indicated that factor analysis was appropriate with principal component analysis. In this study, the Chronbach's Alpha for the 12 items named personal mathematics anxiety was .866 and for the 13 items named mathematics teaching anxiety was .868 indicating that the items were appropriately clustered together in both cases. Pearson's Correlation Coefficient was used to determine the relation between personal mathematics anxiety and mathematics teaching anxiety. Regression analysis was done to know the model that means the dependency of mathematics teaching anxiety on personal mathematics anxiety. Different ethical issues were maintained.

5. Findings

5.1 Correlation analysis

The researcher ran a pair wise correlation analysis between the two factors personal mathematics anxiety and mathematics teaching anxiety where all the coefficients

were analyzed with significance level. The analysis reflected significant correlations. Both the factors personal mathematics anxiety and mathematics teaching anxiety were highly and positively correlated ($r = .890$, $p < .001$) and significant at the level 0.01. The correlations and the significance level are shown in the table 1.

Table 1: Pair wise correlation of two variables

Variable	Personal mathematics anxiety	Mathematics teaching anxiety
personal math anxiety sig. level	1	.890 .000
math teaching anxiety sig. level	.890 .000	1

5.2. Regression analysis

In regression analysis mathematics teaching anxiety was consider as dependent variable and personal mathematics anxiety as independent variable. The value of r (.89) between personal mathematics anxiety score and mathematics teaching anxiety score was highly and positively correlated. Here adjusted R square (Coefficient of determination) = .79 that is mathematics teaching anxiety is 79% depended on personal mathematics anxiety and $p < .01$ which was statistically significant at 99% confidence level. Here r is positive therefore if the personal mathematics anxiety score of any teacher is high then his/her mathematics teaching anxiety score will be high. The result has shown in the table 2 and 3 below.

Table 2: The value of R, R square and adjusted R square

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.890	.792	.791	.28987

Table 3: Sum of squares for Regression and Residual

ANOVA					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	76.883	1	76.883	915.021	.000
Residual	20.166	240	.084		
Total	97.048	241			

The estimated value of alpha is .384, which implies that on average increase in mathematics teaching anxiety (%) is .384 when increase in personal mathematics anxiety (%) = 0. Again the estimated value of beta is .875, which implies that for 1% increase in personal mathematics anxiety the average amount of increase in mathematics teaching anxiety is .875%. Here beta is positive so if personal mathematics anxiety will increase then mathematics teaching anxiety will increase. The result has shown in the table 4.

Table 4: The value of the coefficient of alpha and beta

Coefficients of alpha and beta					
	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	Beta	Beta		
(Constant)	.384	.066		5.081	.000
PMA score	.875	.029	.890	30.249	.000

The P-value for alpha is .000. So we may conclude that the intercept coefficient is not equal to 0. Again the P-value for beta is .000. So it was concluded that beta was not equal to 0 which was significant at 1% level. That means mathematics teaching anxiety changes as the personal mathematics anxiety changes. Therefore the regression model can write as $Y = .384 + .875 X$ that is MTA = .384 + .875 PMA. Here MTA means mathematics teaching anxiety and PMA means personal mathematics anxiety.

6. Conclusion

Two categories of mathematics anxiety were discussed in the study. One is anxiety for subject mathematics named personal mathematics anxiety and another one is anxiety for teaching mathematics. According to the findings of the study mathematics teaching anxiety and personal mathematics anxiety were positively and highly correlated. At the same time it was also found that mathematics teaching anxiety was depended on personal mathematics anxiety. Mathematics teaching anxiety was 79% depended on personal mathematics anxiety which was statistically significant. Those who are highly experienced in personal mathematics anxiety are also highly experienced in mathematics teaching anxiety. Mathematics teaching anxiety may reduce the performance of mathematics teacher. Quality training may improve this situation. So we need to develop different reducing techniques by another research. Another research can be investigated about the impact of mathematics teaching anxiety on student achievement.

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