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PREDICTION OF MATHEMATICS ANXIETYON THE BASIS OF STUDENT CHARACTERISTICS

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ABSTRACT

Mathematics anxiety continues to be an issue of importance to mathematics teachers and educators across the globe. While literature on mathematics anxiety is abundant, previous studies are limited in explaining the predictive effect of factors such as effortful control measures and types of schools. The current study examined contributions of effortful control, gender and types of schools in the prediction of mathematics anxiety. The participants were 195 class IX students selected by cluster sampling technique. The participants varied by gender (male = 107 and female = 88) and types of schools (government = 100 and private = 95). Participants completed measures of mathematics anxiety and effortful control developed by Sharma & Sansanwal and Lonigan & Phillips, respectively. Regression analyses indicated that effortful control, gender and types of schools were predictive of mathematics anxiety. The findings may provide guidance for teachers and researchers to design improved prevention and intervention programmes for mathematics anxiety..

KEYWORDS: *Mathematics Anxietyon*

INTRODUCTION

Of all the subjects taught in schools, none seems to elicit as much anxiety for as many students as mathematics (Ormrod, 2012) and some children are so overwhelmed by fear that they become intellectually and emotionally paralyzed by mathematics (Baroody, 1987). Due to this, mathematics anxiety continues to be an issue of importance to mathematics teachers and educators across the globe. Mathematics anxiety has been conceptualized as feelings of tension, apprehension, or even dread that interferes with the ordinary manipulation of number and the solving of mathematical problems (Ashcraft & Faust, 1994), while Sharma and Sansanwal (2011) defined mathematics anxiety as a learned phenomenon on account of which an individual has negative cognito-affective reactions (worry-fear/tension/physiological reactions) towards mathematics.

Although, inverse relationship between mathematics anxiety and mathematics performance is well established in the literature, Ho et al. (2000) found that affective, rather than cognitive, mathematics anxiety is a debilitator to mathematics performance. Studies have shown that females exhibit higher mathematics anxiety than males (Karimi and Venkatesan, 2009; Khatoon and Mahmood,2010; Yüksel-Şahin, 2008), though, the higher levels of mathematics anxiety do not seem to translate into more depressed performance or to greater mathematics avoidance on the part of female students and at precollege levels mathematics anxiety effects seem more pronounced than female students (Hembree, 1990). Further, Keshavarzi & Ahmadi (2013) found no statistical significant difference between girls and boys in respect to

mathematics anxiety. This shows that with respect to gender, mathematics anxiety needs to be further explored. Also, previous studies are limited in explaining the predictive effect of student characteristics like effortful control and types of schools. Keeping this in view, it was thought to examine the contributions of student characteristics namely, effortful control, gender, and types of schools in the prediction of mathematics anxiety. The following research question formulated the basis of the research:

Do effortful control, gender, and types of schools predicts mathematics anxiety among secondary school students?

METHOD

Participants

The universe from which the sample was selected was class IX and X students of Jalandhar district of Punjab state. The participants were 195 class IX and X students selected by cluster sampling technique. The participants varied by gender (male = 107 and female = 88) and types of schools (government = 100 and private = 95). The students belonged to different socioeconomic strata.

Instrumentation

Mathematics Anxiety Scale. The mathematics anxiety scale developed by Sharma and Sansanwal (2011) was used as a measure of mathematics anxiety. The mathematics anxiety scale comprises 44 items pertaining to cognitive and affective dimensions. There was no time limit but generally students took 25 minutes. Moreover, there were 22 positive items and 22 negative items. The positive items were scored as 1, 2 and 3 for yes, undecided and no, while the reverse items were scored as 3, 2 and 1 for yes, undecided and no. The test-retest reliability and split-half reliability coefficients were reported as .80 and .82 respectively. They also reported criterion validity (the mathematics achievement test developed by L.N. Dubey was used as a measure of mathematics achievement) as –.74.

Effortful Control Scale (ECS). For assessing effortful control of students, ECS (Lonigan & Phillips, 2001) was used. The ECS is a 24-items self-report questionnaire with a 5-point rating scale, tapping persistened/Low Distractibility and Impulsivity (12 items each). The sum of score is the total effortful control score. Verstraeten, Vasey, Claes and Bijttebier (2010) supported the construct validity of ECS and found it more appropriate for use in broader age ranges.

Design and Procedure

To answer the general research question, a standard multiple linear regression was conducted. The linear regression model used was:

$$Y_{\text{Mathematics Anxiety}} = \beta_0 + \beta_{1(\text{Effortful Control})} + \beta_{2(\text{Gender})} + \beta_{3(\text{Types of Schools})} + e_{\text{Mathematics Anxiety}}$$

After getting permission from the schools selected, instruments, namely, MAS (Sharma & Sansanwal, 2011) and ECS (Lonigan & Phillips, 2001) were administered on participants. The scores on MAS and ECS constituted mathematics anxiety and effortful control of secondary school students, respectively.

RESULTS

Bivariate Correlations

Descriptive statistics and inter correlations for all measures are reported in Table 1. As can be seen, mathematics anxiety was significantly correlated with effortful control and types of schools. Though, mathematics anxiety was not significantly correlated with gender. It is noteworthy that despite the significant correlations of gender with effortful control and types of schools, these correlations were not high and did not pose any problem of multi collinearity.

Multiple Regressions

Next, a series of hierarchical regression using the SPSS enter method was performed on the data to test the extent to which effortful control, gender and types of institutions, could predict differences in mathematics anxiety. Dummy variable, types of schools, was a better predictor of mathematics anxiety than was effortful control and gender. The amount of variance explained in mathematics anxiety increased when gender was added to the equation. Moreover, the model that included scores from all three variable, namely, effortful control, gender and types of schools scores, was most successful at predicting differences in mathematics anxiety. The significant individual predictors of mathematics anxiety were (in decreasing order): types of schools, effortful control, and gender (see Table 2). More specifically, the standardized beta weights, presented in Table 2, suggest that having low effortful control, being in a private school, and that being male, contribute to this prediction. Further, the regression equation thus established is given in the Table 3. This regression equation can be used for the prediction of mathematics anxiety of secondary school students provided the scores of the students in respect of effortful control and information about students gender and type of school is available. Indeed, together they account for 19% of the variance.

Table 1: Descriptive Statistics and Inter-Correlations for All Measures

	M	SD	1	2	3
Mathematics Anxiety	70.46	14.66	-.27**	.07	.34**
1. Effortful Control	83.06	10.61	-	.12*	-.08
2. Gender				-	-.16**
3. Types of Schools					-

Note. N = 195. Gender coded: 0 = male, 1 = female. Types of Schools coded: 0 = government schools, 1 = private schools. *p<.05. **p<.01.

Table 2: Hierarchical Regression: Effortful Control, Gender, and Types of Schools as Predictors of Mathematics Anxiety

Model		St. β #1	St. β #2	St. β #3	t
#1	Effortful Control $F(1, 193) = 15.46^{**}$	-.27 Adj.R^2 = .07			3.93**
#2	Effortful Control Gender $F(2, 192) = 8.86^{**}$		-.29 .10 Adj.R^2 = .08		4.09** 1.47
#3	Effortful Control Gender Types of Schools $F(3, 191) = 15.67^{**}$			-.26 .15 .34 Adj.R^2 = .19	4.03** 2.35* 5.19**

Note. N = 195. Gender coded: 0 = male, 1 = female. Types of Schools coded: 0 = government schools, 1 = private schools.*p<.05. **p<.01.

Table 3: Regression Equation for the Prediction of Mathematics Anxiety

$$Y_{\text{Mathematics Anxiety}} = 93.78 - .36_{(\text{Effortful Control})} + 4.56_{(\text{Gender})} + 9.99_{(\text{Types of Schools})}$$

DISCUSSION

This study demonstrated that effortful control, gender, and types of schools were systematically related to mathematics anxiety of secondary school students. Thus, regression model can be used for predicting mathematics anxiety of secondary school students. The information gained from the regression model may help in designing as well as improving the intervention programs for preventing and/or reducing mathematics anxiety. The identified predictors of mathematics anxiety in students might encourage teachers to reduce mathematics anxiety, thus, helping teachers in encouraging students to do mathematics without any fear. Moreover, the study throws open a question, why private school students exhibited more mathematics anxiety than government school students, which needs to be addressed in the further studies.

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