

MATHEMATICS ANXIETY AND ACADEMIC ACHIEVEMENT OF JUNIOR PRE-SERVICE TEACHER EDUCATION STUDENTS

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Abstract

The study found out the correlation of the level of mathematics anxiety to the academic achievement of junior Bachelor of Elementary Education students in the University of Eastern Philippines taking a course in Problem Solving in the second semester of SY 2012-2013. It also tried to determine the difference in the level of mathematics anxiety and academic achievement among the male and female respondents. Using a 24-item Mathematics Anxiety Inventory, majority of the respondents have Moderate to High anxiety levels. Females have higher level of mathematics anxiety. There was a significant difference in the math anxiety levels of male and female students. The respondents had the top five highest levels of anxiety in items relating to tests, homework and the rudiments of mathematics, particularly algebra. Majority of the respondents have Average to Low academic achievement. There was no significant difference in the math achievement of the two groups. A significant negative relationship was found between anxiety level and mathematics achievement.

Keywords: mathematics anxiety, academic achievement, teacher education students

INTRODUCTION

No subject is avoided and labeled negatively the way mathematics has been. Probably, a person experiencing the situation has mathematics anxiety. Mathematics anxiety involves feelings of tension that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary and academic situations (Richardson and Suinn, 1972). It was also described as a "sudden death" (Tobias, 1978), any situation when one experiences anxiety "when confronted with mathematics in any way" (Byrd, 1982), an irrational phobia (Hodges, 1983), and a rational fear rooted in real experience of failure and inadequacy (Perry, 2004). While mathematics anxiety could be seen as early as in elementary pupils (Lazarus, 1974; Jackson and Leffingwell, 1999; Steele and Arth, 1998), it is disturbing that even pre-service teachers exhibit mathematics anxiety (Hembree, 1990; Jackson, 2008; Rayner, et al., 2009). The main purpose of the study was to find out the correlation of the level of mathematics anxiety to the academic achievement of junior students taking up Bachelor of Elementary Education. Specifically, the study tried to determine the level of mathematics anxiety and academic achievement in mathematics and ascertain their relationship. It also determined the significant differences between male and female anxiety level and math achievement.

METHODS

Junior students in the College of Education of University of Eastern Philippines taking Problem Solving in SY 2012-2013 were selected as population of the study. A total of 88 respondents were made to answer a 24-item revised Mathematics Anxiety Inventory (Plake and Parker, 1982). The respondents answered the level of anxiety that they experience on the items in the test along five levels (Very High, High, Moderate, Low and Very Low) scored as 5, 4, 3, 2, and 1 respectively. The academic achievement in mathematics was the average of the grades of the respondents in the five mathematics courses that they finished in the curriculum. Pearson product moment coefficient of correlation was computed to determine the relationship of anxiety and achievement at 5% margin of error. T-test for independent samples was used to determine significant differences between anxiety and achievement of the two groups. Interviews were conducted to selected representatives of respondents grouped into three levels of math anxiety to validate the responses.

RESULTS

Mathematics anxiety level of respondents

Majority of the respondents have Moderate to High anxiety levels. Percentage wise, there are more females who have high level of mathematics anxiety while more males have low to very low mathematics anxiety levels. To test the significant difference of the mathematics anxiety level of male and female respondents, t-test for independent samples was used. With $p < 0.05$, the null hypothesis that there was no difference in the anxiety levels of male and female respondents was rejected. The study confirmed the results of difference in anxiety levels of males and females (Hembree, 1990; Bernstein, Reilly and Cote-Bonanno, 1992; Campbell and Evans, 1997; Karimi and Venkatesan, 2009; Wigfield, 2009; Gotz and Bieg, et al, 2013).

Table 1. Comparative result of mathematics anxiety of male and female respondents

Level	Male	%	Female	%	Total	%
Very High	0	0.00	1	1.43	1	1.18
High	5	33.33	35	50.00	40	47.06
Moderate	4	26.67	32	45.71	36	42.35
Low	5	33.33	2	2.86	7	8.24
Very Low	1	6.67	0	0.00	1	1.18
Total	15	100.00	70	100.00	85	100.00

Table 2. Test of difference of male and female anxiety levels

Gender category	Mean	T	p
Male (n=15)	2.95		
Female (n=70)	3.43	3.50**	0.0007

**significant difference at 0.05 level

Level of anxiety per MAI items

Ranking the levels of anxiety of the respondents as a group, the respondents had the top five highest levels of anxiety in items “waiting for the result of a math test returned in which you’re expected to do well” (M=4.63), “thinking about an upcoming mathematics test one day before” (M=4.56), “working on a mathematical problem such as if $x = \text{bills}$ and $y = \text{total income}$, calculate how much have you left for expenditure” (M=4.44), “taking a major exam in mathematics” (M=4.41), “being given a homework of many difficult problems” (M=4.40). These five items are interpreted as Very High level of math anxiety. The five lowest levels of anxiety are on items “having to use the table at the back of a math book” (M=2.08), “reading the word math” (M=2.13), “buying a mathematics textbook” (M=2.44), “entering into a math classroom” (M=2.49) and “reading a formula in math” (M=2.72).

Both males and females rated the “waiting for the result of a math test returned in which you’re expected to do well” as the item with the highest level of anxiety. There are 21 items where the females had higher mathematical anxiety

than the males. However, the males were more anxious on “being given a surprise quiz”, “reading the word math” and “buying a math textbook” than the females.

In an interview with representatives of the high (group A), middle (group B) and low (group C) anxiety groups of respondents, only group C said they felt they were good in math while the two other groups said they were not. Majority of those interviewed traced back their liking/disliking math from their elementary and high school years. When asked on their study habits, only group C identified good study habits such as constant review and working immediately on tasks while the two other groups had no definite study habits and would exert lesser effort to study math. The three groups were consistent in saying that the teacher is the primary factor for their liking/disliking of mathematics. A group said motivation of teachers and even the grades given are factors for their being motivated to learn. While group C enjoyed board work and other enjoyable activities which provided spirit of competition in the class, the two other groups disliked a lot of problem solving, memorization of equations and formulas and long computations in their mathematics class.

Table 3. Level of anxiety per MAI item

MAI Item	Mean		Interpret	Femal		Interpret	Ave	Ran	Interpret
	Male (n=15)	Ran k		Ran k	(n=70)				
Watching a teacher work an algebraic equation on the blackboard	2.60	17.5	L	3.29	14	A	3.17	14	A
Buying a mathematics textbook	2.60	17.5	L	2.41	22	L	2.44	22	L
Reading and interpreting graphs and charts	2.93	10	A	3.49	10	H	3.40	9	A
Enrolling a course in math	2.73	14.5	A	3.52	8	H	3.39	10	A
Listening to a student explain a math formula	2.80	12.5	A	3.07	15	A	3.02	15	A
Entering a math classroom	1.80	23	L	2.63	21	A	2.49	21	L
Looking through a pages in a math textbook	2.33	20.5	L	2.97	17	A	2.86	18	A
Starting a new chapter in a math book	2.80	12.5	A	2.92	18	A	2.90	17	A
Walking around the campus and thinking about a math class	2.73	14.5	A	3.40	11	A	3.36	11	A
Picking up a math textbook to begin working a homework	2.67	16	A	3.37	12	A	3.25	13	A
Reading the word math	2.26	22	L	2.10	24	L	2.13	23	L
Working on a mathematical problem such as if $x =$ bills and $y =$ total income, calculate how much have you left for expenditure	3.80	6	VH	4.58	3	VH	4.44	3	VH
Reading a formula in math	2.33	20.5	L	2.79	20	A	2.72	20	A
Listening to a lecture in a math class	2.40	19	L	2.88	19	A	2.85	19	A
Having to use the table at the back of a math book	1.60	24	VL	2.18	23	L	2.08	24	L
Being told how to work a problem in quadratic equation	3.20	8	A	3.32	13	A	3.30	12	A
Being given homework of many difficult problems	3.73	7	H	4.53	4	VH	4.40	5	VH
Thinking about an upcoming mathematics test one day before	3.93	3.5	H	4.68	2	VH	4.56	2	VH

Solving square root problems	3.07	9	A	3.56	7	H	3.48	8	H
Taking a major exam in mathematics	3.93	3.5	A	4.51	5	VH	4.41	4	VH
Getting ready to study for a math test	2.87	11	A	3.04	16	A	2.98	16	A
Being given a surprise quiz in math	4.00	2	H	3.51	9	H	3.59	7	H
Waiting for the result of a math test returned in which you're expected to do well	4.27	1	VH	4.70	1	VH	4.63	1	VH
Taking a final exam in math	3.87	5	H	4.27	6	VH	4.20	6	H

Legend: VL – Very Low; L – Low; A – Average; H – High; VH – Very High

Academic Achievement

Majority of the respondents have Average to Low academic achievement in the past five subjects that they have enrolled in. To test the significant difference of the academic achievement of male and female respondents, t-test for independent samples was used. With $p > 0.05$, the null hypothesis that there was no difference in the math achievement of the male and female respondents was accepted. This confirmed the findings of Karimi and Venkatesan (2009).

Table 4. Academic achievement in mathematics of respondents

Level of Academic Achievement in Math	N	%
High	13	15.29
Average	42	49.41
Low	27	31.76
Very Low	3	3.53
Total	85	100.00

Table 5. Test of difference of male and female math achievement

Gender category	Mean	T	P
Male (n=15)	2.03		
Female (n=70)	2.1221	1.65	0.1023

Correlation of math anxiety level and academic achievement

Using Pearson Product moment of correlation coefficient, $p < 0.05$. The null hypothesis of no correlation between the variables was disconfirmed. There was a highly significant negative relationship between anxiety level and mathematics achievement. This confirmed the findings of relationships between the two variables (Betz, 1978; Ma, 1999; Hembree, 1990; Woodardudyconfer, 2004; Zakaria and Nordin, 2007; Rayner, 2009; Karimi and Venkatesan, 2009; Catlioglu, et al., 2009; Pradeep, 2011; Zakaria, et al., 2012; Pourmoslemi, et al., 2013).

Table 6. Pearson product moment correlation between math anxiety and math achievement

Group	N	R	P
Male/female	85	0.457**	0.000

**correlation significant at 0.05 level

CONCLUSION

The study revealed that a significant level of mathematical anxiety is manifested on the respondents, particularly females. This is an alarming case in as much as the pre-service teachers are generalists by nature, hence, they are expected to teach all the subjects in the curriculum, including mathematics. It will be a sad plight for a teacher to be teaching a subject which s/he is not comfortable with. There is a need for teachers, especially those teaching basic mathematics courses in the teacher education institutions, to identify causes of math anxiety to address it as early as the freshman year in college.

There was a significant difference in the mathematics anxiety level of the males and females. There is a need for teachers to encourage female students to strive to learn math. This could be done by explaining to students to do away with the usual stereotyping issues that mathematics learning is best done by males (Gotz and Bieg, et al, 2013).

The per item analysis of the math anxiety level revealed that the top five anxiety-provoking situations are those relating to tests, homework and the rudiments of mathematics, particularly algebra. Many students fear the learning of math, more so, when their abilities are already tested. There is a need for teachers to devise ways of assessing mathematics concepts through alternative ways which will not give the total impression that mathematics tests are like punishments. The respondents were also anxious about rudiments of mathematics, particularly algebra, which is considered a highly difficult subject because of its abstraction. The anxiety items revealed that other than the usual tests and difficult concepts in mathematics, students are not that anxious with math-related things. In the interviews with selected respondents, the respondents with high level of math anxiety revealed that they do not necessarily hate math. They just feel at times that they could not just do math without others helping them. Lee (1995) calls it Type I math anxiety. It was found out that teachers were considered the main factor in the students' harboring a positive or negative outlook on mathematics (Nur, Tan, Hong, & Usop, 2012; Yenilmez, Girginer, & Uzun, 2007). There is a need for teachers to reflect and revisit teaching strategies to optimize the success of the teaching-learning process.

There was no significant difference in the math achievement of the respondents. This means both groups can perform equally well in mathematics courses. This indicates that the mathematics anxiety level manifested in the females may be triggered by only selected aspects of mathematics teaching, and did not in any way, hampered their studying hard to get good grades.

A significant negative correlation was found out between anxiety and achievement. A higher mathematical anxiety level may mean lower academic achievement of the respondents. This could further mean that academic achievement may be affected by the kind of disposition a student has towards mathematics. Whether the anxiety caused the achievement or the achievement caused the anxiety, there is a dire need for mathematics teachers to exhaust all efforts to make mathematics learning a pleasurable experience for students.

BIOGRAPHY OF AUTHOR

Ronato S. Ballado earned a Bachelor of Secondary Education major in Mathematics and Master of Arts in Teaching Mathematics from the University of Eastern Philippines and a Doctorate degree in Education major in Instructional Systems and Resources Management from the University of San Jose Recoletos, Cebu City, Philippines. He has handled basic and major subjects in Mathematics, professional education courses and general education subjects. Aside from research, he also authored two textbooks – Functions: A Text for Advanced Algebra and Basic Concepts of Educational Technology. Currently, he serves as the Dean of Student Affairs of the University of Eastern Philippines.

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