

# Examining the Gender and Grade Level Differences in Mathematics Anxiety

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## Abstract

Globally, mathematics has always been perceived as a challenging subject, thus students across schooling levels have disliked mathematics leading to the feeling of anxiety towards the subject. This study investigated students' mathematics anxiety levels across gender and grade (Grade 6 of elementary school and 4th Year of High School) in the south central part of the Philippines. The Fennema-Sherman Mathematics Anxiety Scale (FSMAS) was employed to examine the levels of mathematics anxiety of 6,672 elementary and secondary students from the seven school divisions in Region XII. The data were analysed by independent-sample t-test using SPSS 20. The results showed that there was a significant gender difference in terms of their anxiety towards mathematics. The results also indicated a significant difference on the anxiety levels between grade 6 and 4<sup>th</sup> Year of High School students, with grade 6 having the higher anxiety level compared to 4th year high school students. It is recommended to extend the study to different groups of students in different school levels using a more complex modelling and statistical methods.

**Keywords:** Mathematics Anxiety, Gender, Grade/School Level.

## Introduction

Mathematics is one of the most important subjects because of its use in industrial development and advancement in technology (Bamidele, 2005) making this subject a necessity in the society. With this, schools, especially in the Philippines make mathematics a compulsory subject from kindergarten to tertiary levels. Despite of its importance, mathematics is greatly disliked by students due to its perceived difficulty. People of all races and all walks of life are concern of mathematics (Zaslavsky, 1994) and a large number of students have apprehensions for it. Consistent with this, Marilyn Burns (1998, cited in Arigbabu et al., 2012) states that almost two-thirds of American adults 'have hatred for and deep fear of mathematics.' This extreme feeling of hatred and fear leads to mathematics anxiety.

Studies have shown that mathematics anxiety could occur as early as primary education years (Harper & Daane, 1998) and may continue to prevail in the secondary and tertiary years if not addressed. Research has shown several factors that can be attributed to the development of anxiety among students. These factors can be personal, social, psychological or environmental. This study has looked into the personal attributes of the students that may have contributed to their anxiety levels.

### **Mathematics Anxiety**

Several researchers have offered several definitions for Mathematics anxiety. Some researchers define mathematics anxiety based on its perceived difficulty and its requirement for success. Others define mathematics anxiety based on the emotional, mental and physical disorders that would manifest once they encounter mathematics problems or tasks. For instance, Hembree (1990) defined mathematics anxiety as “a general fear of contact with mathematics, including classes, homework and tests” (p. 34). On the other hand, Tobias and Weissbrod (1980) define mathematics anxiety as “the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve mathematical problems.” On a similar note, Arem (2009) put forward that mathematics anxiety is an emotional, mental, and physical act related to the mathematical thinking and problem-solving process and resulting from uncomfortable past experiences related to mathematics. As Luo, Wang and Luo (2009) point out, mathematics anxiety is a kind of disease which refers to unhealthy mood responses such as being panicky and “losing one’s head”. They also describe the physical reactions that come with mathematics anxiety, such as perspiration of the palms, holding tight the fists, being sick, vomiting, dry lips, and pale face.

A number of factors contributing to mathematics anxiety were presented in existing literature. According to Arigbabu and colleagues (2012) several variables have taken the part of causing mathematics anxiety among people. Puteh (2002) considers that the perception that mathematics is difficult causes anxiety to students. Alternatively, Arem (2009) finds that unpleasant experiences in mathematics would lead to anxiety. He added that social pressure, the expectation to perform well, gender stereotypes are also among the contributory factors. Jackson and Leffingwell (1999) added that mathematics anxiety can be caused by gender bias and insensitive instructors. Moreover, Stuart (2000) contends that students who lack confidence with numbers and any mathematical activities are most likely to suffer from mathematics anxiety. This study, however, does not look at the possible causes of mathematics anxiety. The study focuses on the gender and grade level differences in mathematics anxiety.

### **Mathematics Anxiety and Gender**

The association between mathematics anxiety and gender has been widely published in mathematics education. However, no consensus has been made regarding the relationship between mathematics anxiety and gender as the studies conducted show differing results. Most of these studies involve students from middle school to tertiary levels. A few involve students in the primary and elementary levels. Different survey questionnaires were used to assess the anxiety levels of students in different levels.

Some researchers reveal that females have higher mathematics anxiety than males. A study conducted by Bowd and Brady (2003) involving student teachers, for example, reveal a significant difference between female’s and male’s anxiety levels. Using the Mathematics Anxiety Rating Scale (MARS) by Richardson and Suinn (1972), Bowd and Brady (2003) show that the females obtained higher mean MARS score of 204.3 (SD=68.41) compared with the males whose mean MARS score was 173.41 (SD=54.59). Similarly, a very recent publication by Devine, Fawcett, Szűcs, and Dowker (2012) on 430 British secondary school children shows that girls have higher levels of mathematics anxiety than boys. Moreover, Luo, Wang and Luo (2008) utilized the Mathematics Anxiety Questionnaire (MAQ) written by Wigfield and Meece (1998) and Wang and Luo (2002) to measure the anxiety levels of 311 middle school students in China. They presented that female students have statistically significantly higher anxiety levels than their male counterparts, especially in the cognitive level. Also in agreement to these results, Karimi and Venkatesan (2009) and Yüksel-Şahin (2008) reveal that female students have higher anxiety levels in mathematics as compared

to male students. These results, according to Woodard (2004) could be due to women reporting more mathematics anxiety than men.

In contrast, Olmez and Ozel (2012) divulge that males have significantly higher mathematics anxiety levels than females among the sixth and seventh grade Turkish elementary levels. Correspondingly, 450 senior secondary school students from Southwestern Nigeria were involved in the study carried out by Arigbabu et al., (2012). This study made use of the 24- item Mathematics Anxiety Rating Scale (MARS) developed by Plake and Parker (1982) using a 5-point Likert type scale. The study presents that male students are more anxious, as revealed by their mean score of 75.38, compared to their female counterparts with a mean score of 66.23. Arigbabu and colleagues (2012) contend that the results might have been influenced by the recent awareness drive in Nigeria which educates and motivates females to take more mathematics courses.

While the studies presented above reveal two contradicting results, other studies maintain that there is no significant difference between the mathematics anxiety of males and females. The very recent study carried out by (Abo Hamza & Helal, 2013) is an example of this. Their study shows that male and female students have similar mathematics anxiety levels in either the Egyptian or the American sample. Consistently, Keshavarzi and Ahmadi (2013) claim that the difference between boys' and girls' mathematics anxiety is not statistically significant. They made use of Chiu and Henry's Mathematics Anxiety Scale for Children (MASC) (1990) in comparing the mathematics anxiety among grade 2 and 3 students. Additionally, mathematics anxiety levels of secondary school students in Selangor, Malaysia were also assessed using the Fennema-Sherman Mathematics Attitudes Scale (FSMAS). This study carried out by Zakaria, Zain, Ahmad, and Erlina (2012) similarly reveal that there is no significant difference in the mathematics anxiety levels between males and females.

### **Mathematics Anxiety and Grade/School Level**

Studies reveal that mathematics anxiety is evident in elementary, high school and college/university students. Though, most of the existing research studies involve secondary and tertiary students, this study included elementary (Grade 6) level because according to Suinn, Taylor, and Edwards (1988), the foundation of attitudes is formed early. Additionally, Jackson and Leffingwell (1999) assert that mathematics anxiety stems from the elementary and secondary levels. Thus, it is important to look at the level of mathematics anxiety among elementary students as well.

Quite a few studies have involved younger children in the primary level. Results have shown that their attitudes towards mathematics are generally positive since most of them claim to like mathematics (Biatchford, 1996). However, Wigfield and Meece (1988) put forward that attitudes may fall off as the child steps up the educational ladder, especially across the secondary level.

However, some researchers disagree with Wigfield and Meece (1988) as their studies show that the level of mathematics anxiety increases with age and grade level. For example, Birgin, Baloğlu, Çatlıoğlu, and Gürbüz (2010) compare the mathematics anxiety levels among the sixth through eighth grade students in Turkey using the Mathematics Anxiety Scale for Elementary School Students (MASESS) developed by Bindak (2005). The results reveal that the sixth graders have obtained the lowest anxiety (with mean=28.32; SD=8.24) while the highest anxiety level was obtained by the eighth graders (with mean=33.49; SD=7.57). This result is in congruence with the findings of the study conducted by Arikan (2004 in Birgin et al., 2010) who also state that there is an increase in the mathematics anxiety from sixth to eighth grade.

On the other hand, a study performed by Luo, Wang and Luo (2008) involving middle school students from Grade 7 to Grade 12 showed an inconsistent result. Although, the study revealed that the difference between the mathematics anxiety of all grade levels was not statistically significant, Luo, Wang and Luo (2008) presented the erratic trends of the anxiety levels of the students. Grade 7 students obtained the lowest anxiety levels which increased until Grade 9 where the highest anxiety levels were recorded. In Grade 10, students' anxiety level slightly decreased, but rose again in Grade 11 and decreased again in Grade 12.

### **Objectives**

Literature shows that mathematics anxiety is associated to gender and grade level. However, differing results from studies have made several researchers conduct more investigations as existing results may also be contextual. Thus, the purpose of this study is to examine whether there is a significant difference on the mathematics anxiety levels with regards to gender and grade level among the elementary (Grade 6) and secondary (4th Year High School) students in Region XII, Philippines. Specifically, it seeks to answer the following questions: a.) Is there any significant difference in the mathematics anxiety levels between males and females? b.) Is there any significant difference between elementary and secondary students with respect to mathematics anxiety?

### **Research Method Design**

This study employed a cross-sectional survey design, since the information was gathered on one occasion (Creswell, 2008). Cross-sectional survey design was deemed appropriate when two or more groups are compared in terms of attitudes, opinions, beliefs and practices (Creswell, 2008).

### **Participants**

In this study, the participants were 6,672 students from the schools in Region XII. There were 3,437 (51.5%) Grade 6 pupils and 3,235 (48.5%) 4th Year High School students. Among these 2,638 (39.5%) are males and 4,032 (60.4%) are females.

### **Instruments**

The Fennema-Sherman Mathematics Attitudes Scales (FSMAS) were used in collecting data about the mathematics anxiety from both the Elementary and Secondary students. This instrument was developed by Fennema and Sherman (1976) to assess students' attitudes towards mathematics. It has different sub-scales, one of which is the Mathematics Anxiety Scale, which is adapted in this study. It consists of 12 items 6 of which are positive statements and the other 6 are negative statements. A five-point Likert type scale was used, with 1 representing 'strongly disagree' and 5 'strongly agree.' The coefficient of reliability in this study is .796.

### **Data Analysis**

To analyze for the difference in the mathematics anxiety levels between males and females and between elementary (grade 6) and secondary (4th year) levels, independent sample t-test was used. The Statistical Package for the Social Sciences (SPSS) was used to perform the analysis.

### **Results**

To compare the mathematics anxiety scores between male and female, an independent t-test was conducted and the results are reported in Table 1. As shown in Table 1 there is a significant difference between the anxiety levels of male and female students despite the very small difference in their magnitude. The table further shows that the mean score of male students is 38.90 (SD = 6.49) which is slightly higher than the mean score of female students (M = 38.34, SD = 6.65).

**Table 1.** Independent t-test showing the difference on mathematics anxiety by gender

Gender	n	Mean	Std. Dev.	df	t-value	Sig.
Male	2630	38.90	6.49	6646	3.373	.001
Female	4018	38.34	6.65			

Table 2 reveals a higher mathematics anxiety mean score of the elementary students (M = 40.13, SD = 6.36) as compared to the secondary students (M = 36.89, SD = 6.43). The t-value of 20.65 and  $p < .05$  suggest that the difference on the anxiety score between the two levels is statistically significant.

**Table 2.** Results of Independent t-test in showing the difference on mathematics anxiety between elementary and secondary students.

Sch Level	n	Mean	Std. Dev.	df	t-value	Sig.
Elementary	3421	40.13	6.36	6648	20.648	.000
Secondary	3229	36.89	6.43			

## Discussion

The study found that there is a significant difference in the mathematics anxiety levels between male and female school students in Region XII, Philippines. Specifically, the study reveals that male students obtained slightly higher mathematics anxiety mean score as compared to their female counterparts. Although the difference in the means is quite small, it still came out to be significant which may be attributed to the large sample size. This result is consistent with the studies conducted by Olmez and Ozel (2012) and Arigbabu et al. (2012) who reported that males have higher anxiety levels than females among secondary school students. However, this result is opposite of the findings of Bowd and Brady (2003); Devine et al. (2012); Karimi and Venkatesan (2009); Luo, Wang and Luo (2008) and Yüksel-Şahin (2008) all of whom put forward that female students have higher levels of anxiety compared to the male students.

The study also revealed that the mathematics anxiety levels of elementary students are significantly higher than that of the secondary students. This finding is in parallel to the study of Wigfield and Meece (1988) which indicates that the attitude level of a child changes with school level. That is, the child may have developed a certain anxiety level in the elementary, but as the child reaches the secondary school, the anxiety levels may have decreased. This is probably because of the increase in the maturity and understanding levels of mathematics of the students. This could also have been brought by a number of reasons including positive experiences in mathematics. This finding, however, is contradictory to what the other researchers (Arikan, 2004 in Birgin et al., 2010) have found that the mathematics anxiety levels increase as the grade level increases. This, according to Yüksel-Şahin (2008), could be due to the increased difficulty of the topics in mathematics in the higher grade levels.

Mathematics anxiety is one of the most researched topics in mathematics education. The divergent results in the studies conducted regarding mathematics anxiety levels by gender and grade level indicate that more investigations should be carried out. Perhaps more complex modelling methods are needed to address issues inherent in the different statistical techniques in social science research. Since this is just one among the very few studies conducted in the Philippines concerning mathematics anxiety levels among male and female in the elementary and secondary levels, a similar study must be carried out in other school divisions or regions to come up with a more comprehensive pattern of results as findings may be contextual. Furthermore, studies that would examine the contributory factors to mathematics anxiety must also be conducted so that appropriate measures to alleviate this feeling can be put into policy and practice.

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