

Mathematics Anxiety among Male and Female Students

Wern Lin Yeo, Choo Kim Tan, Sook Ling Lew

Abstract—The purpose of this study is to determine the relationship of anxiety level between male and female undergraduates at a private university in Malaysia. Convenient sampling method used in this study in which the students were selected based on the grouping assigned by the faculty. There were 214 undergraduates who registered the probability courses had participated in this study. Mathematics Anxiety Rating Scale (MARS) was the instrument used in study which used to determine students' anxiety level towards probability. Reliability and validity of instrument was done before the major study was conducted. In the major study, students were given briefing about the study conducted. Participation of this study was voluntary. Students were given consent form to determine whether they agree to participate in the study. Duration of two weeks was given for students to complete the given online questionnaire. The data collected will be analyzed using Statistical Package for the Social Sciences (SPSS) to determine the level of anxiety. There were three anxiety level, i.e., low, average and high. Students' anxiety level was determined based on their scores obtained compared with the mean and standard deviation. If the scores obtained were below mean and standard deviation, the anxiety level was low. If the scores were at below and above the mean and between one standard deviation, the anxiety level was average. If the scores were above the mean and greater than one standard deviation, the anxiety level was high. Results showed that both of genders were having average anxiety level. Among low, average and high anxiety level, frequency of males were found to be higher as compared to females. Hence, the mean values obtained for males ($M = 3.62$) was higher than females ($M = 3.42$). In order to be significant of anxiety level among the gender, the p -value should be less than .05. The p -value obtained in this study was .117. However, this value was greater than .05. Thus, there was no significant difference of anxiety level among the gender. In other words, there was no relationship of anxiety level with the gender.

Keywords—Anxiety level, gender, mathematics anxiety, probability and statistics.

I. INTRODUCTION

MATHEMATICS anxiety refers to the feeling of anxious when one is having difficulties in solving mathematical problem. Mathematics anxiety is the most common type of anxiety among other types of anxiety which occurs among the students [13]. However, level of anxiety among males and females are different. There were few past study were conducted to determine the relationship of anxiety and gender but there were still did not have an exact results [2], [14], [16], [22], [24], [26], [27], [38], [39].

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Mathematics anxiety is also the most ordinary type of mental illness among the undergraduates [8] in which it can affect the emotional, mental and physical that is related to mathematical thinking [3]. It usually occurred in at least 1 among 10 people [13]. It is the feeling of tension and anxiety when individuals are interfered with the numbers manipulation and mathematical problem solving when they are in an ordinary and academic situation [13]. Students that are suffering from mathematics anxiety will have the feeling of discomfort when they are involved in mathematical tasks in which their self-esteem is being threatening and thus causing them to have negative attitude towards mathematics [40].

Symptoms of mathematics anxiety can be classified into three forms which are physical, psychological and behavioral. In the form of physical symptoms, students will suffer from increased heart rate and sweating hands. In the form of psychological symptoms, students are unable to concentrate in class whereas behavioral symptoms refer to students who are avoiding mathematics lessons [25].

Students who are having mathematics anxiety will also have the symptoms of avoiding from having face-to-face meetings with lecturers or they reject to consult with lecturers when they were facing difficulties in mathematics learning. They even feel panic when they are being called by their lecturers to solve the mathematical problems in front of their course-mates. The reason is because they afraid that they will be embarrassed when they solved the problem incorrectly [3].

Students are having mathematics anxiety is due to they have uncomfortable past experience towards mathematics, negative self-talk, social pressure as well as parents' and lecturers' high expectation towards them [3]. The major causes of mathematics anxiety are classified into two factors which are dispositional situational and environmental factors. Dispositional situational is about individual's feelings towards mathematics. Environmental factors will affect students regarding to their mathematics experience, mathematics course and age [5]. Socioeconomic background such as parental education level, parental income is also the main cause of students having mathematics anxiety [17].

There were researches showed that lecturers and parents play the important role in determining students' anxiety level [21], [39]. Lecturers will caused students to have mathematics anxiety was due to several reasons such as treat the students unfair due to gender or race, embarrassing them in front of their course-mates, unwillingness to teach students when students consult them, and assigned many assignments for students. Parents' attitude was also important as their thinking

and perceptions towards mathematics will have an effect towards the students. [21], [39].

Students' anxiety level can negatively affect their performance level. Thus, students should learn some of the strategies in order to reduce anxiety level in order to have better performance level. The recommended strategies for students were they should have practicing mathematical problem solving often in order to build their confidence level [12]. Positive self talk were also important as positive self talk will improved their attitude in mathematics whereas negative self talk will have negative effect in mathematics performance [18]. Several relaxation techniques such as meditation will also help students in relieve tension when they were having anxious in solving mathematical problem [18]. In addition, there was a quote which were "study smart not study hard". Thus, students should understand the mathematical concepts and not just memorized those mathematical formulas without understand it [19]. Group studying was better than studying alone as students can exchange their ideas among themselves as well as they may feel to ask questions instead with lecturers [12]. Researcher suggested that lecturers should guide students when they having difficulties in problem solving [30]. Lecturers should also give some encouragement and motivation to students so that students can build up their confidence level when facing mathematics [25]. Embarrassing students in front of their course-mates should be avoided as they may easily feel anxious and have the negative thinking which will affect their confidence level in mathematical problem solving [21], [39]. Parents were the modelling role for students. Hence, their thinking and experiences towards mathematics will affect students' attitudes in mathematics [29]. Researchers suggested that parents should avoid from expressing their negative thinking to students as these will cause them to have negative perceptions towards mathematics, negative attitudes towards mathematics as well as increase anxiety level towards mathematics [9]. Parents' supportive and motivation were also important in determining students' success in mathematics performance. Parents' motivation was important for students especially when they were facing difficulties in mathematics [30]. Another strategy that could be employed in the computer-based learning environment was to incorporate pedagogical agent in the mathematics learning. This method was widely used by researchers for the purpose of students to have new learning environment in which they will found that learning mathematics was interesting. This will indirectly build up their interests towards mathematics, confidence level increased; anxiety level would be reduced [34]. Research found that gender is one of the factors cause the existence of anxiety among students. There were findings showed that the relationship between mathematics anxiety and gender is significant [2], [14], [16], [22], [27], [38]. Negative attitudes normally existed mostly in females as they are having the characteristic which is shy whereas males are considered to be more active [14], [22], [26]. Thus, females' learning in mathematics will be affected as well as their anxiety level is increasing [14], [26]. There were also findings showed that

there is no significant difference between mathematics anxiety and gender [24], [26], [39].

Students with mathematics anxiety will have the feeling of helplessness, anxious and panic in mathematics [37]. Past research showed that students with mathematics anxiety will start to avoid from mathematics and in the long-term outcomes is their performance being affected [33] and they will not work in those careers which are related to mathematics in the future [11]. Thus, it is important that students have the interest towards mathematics and the reason of students who have anxiety towards mathematics is because of they had suffering the failure before in mathematics [38]. Students who have mathematics anxiety especially females seem to enjoy less in learning mathematics process and they will lack of confidence with their abilities in mathematics [4]. Therefore, this study aims to examine the gender difference in mathematics anxiety in order to provide better understandings to educations in their teaching.

II. MEASUREMENT OF MATHEMATICS ANXIETY

The first published measurement for measuring mathematics anxiety was Mathematics Anxiety Rating Scale (MARS) developed by [28] in which the items were in Likert format with 5 points scale. Studies which were related to mathematics anxiety would mostly use MARS as it was known as a pioneer instrument for measuring the mathematics anxiety [36]. In addition, this instrument has the highest validity and reliability in which the reliability ranges was from 0.78 to 0.96 and high validity in order to support its effectiveness in measuring students' mathematics anxiety level [6]. A study conducted by [32] was to compare the anxiety level of the participants before and after attending mathematics class using manipulative. In order to determine the anxiety level, MARS was used as the quantitative instrument in the study. To compare the scores in pre-test and post-test, *t*-test and group means were used. The results revealed that the mathematics anxiety of most of the participants was significantly reduced ($p < 0.05$). Another study was conducted by [31] in which MARS was used to determine undergraduates' anxiety level towards mathematics. MARS that was used in this study consisted of 15 items on mathematics related tasks. Students were required to rate their levels of anxiety on the tasks in which the dimensions used in the MARS are "not at all", "a little", "a fair amount", "much", or "very much". The minimum score for MARS was 15 and the maximum score was 75. Thus, students who obtained lower scores will be having low anxiety level whereas students who obtained higher scores will be having high anxiety level. The results revealed that mean scores obtained by the students was 48.9 with standard deviation of 12.1. This meant that students had moderate level of anxiety. Another study done by [23] was to determine the effect of cooperative learning on students' mathematics anxiety. The instrument used in this study was MARS which consisted of 18 questions with four choices for each question. The scores in the MARS ranged from 0-45, that is, students who obtain higher scores will have high level of mathematics anxiety whereas those students with

lower scores will have low level of MA. MANCOVA was used to investigate the difference of mean scores between the pre-test and post-test. The results revealed that cooperative learning method significantly reduced students' mathematics anxiety level.

III. PREVIOUS RESEARCH ON MATHEMATICS ANXIETY

Study conducted by [1] was to examine whether there was significant difference of mathematics anxiety among males and females. Simple random sampling method was used in the study in which there were 32 females and 116 males. Mathematics Anxiety Scale was the instrument used for the purpose of data collection for the study. The instrument consisted of 14 items for the purpose of determining the level of mathematics anxiety among the students. The method to determine students' anxiety level was calculated by their score obtained in the Mathematics Anxiety Scale. The higher the score students were obtained, the higher the anxiety level students were having. In the opposite, the lower the scores students were obtained; students were having low anxiety level. 5 point Likert Scale was used in the Mathematics Anxiety Scale. The instrument was reliable as the Cronbach's alpha value was higher than .70 which was .87. In order to determine whether there was significant difference of mathematics anxiety among the gender, independent sample *t*-test was conducted. The findings showed that there were gender difference in mathematics anxiety between males and females. Among the gender, females exhibit higher anxiety level as compared to males.

Reference [17] had conducted a study to investigate the mathematics anxiety level between males and females. There were 275 undergraduates (162 females, 113 males) participated in this study. Instruments used in the study were Revised Mathematics Anxiety Rating Scale, which was the shortened version of Rating Scale as compared to Mathematics Anxiety Rating Scale. There were 5 points Likert Scale with 24 items included in the instrument. There was a high reliability of the instrument with the value of .9368. *T*-test was used to determine the output of the study. Results of the study showed that there were significant difference of anxiety level between males and females in which females obtained higher scores as compared to males.

Reference [7]'s study was to determine the gender differences in mathematics anxiety. Number of secondary students included in the study was 433 which consisted of 165 females and 268 males. Type of instrument used in the study was Abbreviated Mathematics Anxiety Scale. This type of instrument was the shortest Mathematics Anxiety Rating Scale which consisted of only 9 items with 5 points Likert Scale. Findings of the study showed that there were gender differences in mathematics anxiety in which females had higher anxiety level compared to males. There were relationship between mathematics anxiety and mathematics performance. Reference [7] opined that females can have better mathematics performance than males. However, the anxiety level being an obstacles for the success in mathematics

and thus caused females to have lower performance level as compared to males.

Reference [10] had conducted the study to examine the mathematics anxiety in gender differences among undergraduates. Instrument used for the study was 5 points rating scale with 18 items. Scores that obtained above 45 points can considered as high anxiety level whereas those scores that were below 45 points can considered as low anxiety level. Results showed that there were no relationship of mathematics anxiety and the gender. It showed that males and females in the study had similar anxiety level as they had obtained the same mathematics anxiety scores in the instrument.

IV. METHODOLOGY

A. Participants

This study was conducted at a faculty of a private university in Malaysia. The sampling technique used in this study was convenient sampling method in which the number of students would be selected based on the grouping assigned by the faculty. The participants of this study were 214 undergraduates who had registered for probability and statistics course. The age range for students was from 19 to 27 years old. Most of the participants in this study were males in which the sample comprised of 171 (79.9%) whereas females were 43 (20.1%).

B. Instruments

An adapted questionnaire was used in this study. There were two sections included in the questionnaire in which the first section was to collect students' general information which included age, gender, nationality, race, course, mathematics achievement, and others. Second section is the Mathematics Anxiety Rating Scale (MARS) which was used to determine students' anxiety level towards probability. The items in MARS were adapted from [15], [21], [34] and some self-designed questions. There were 31 items in the questionnaire in which there were 21 questions with negative statements whereas 10 questions with positive statements. Seven points Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree) were used in MARS. MARS had been checked for its validity and changes were made to the items in the instrument by two English experts in the faculty to ensure that the instrument was error free. In addition, the instrument had been piloted to 36 undergraduates. It was to ensure that the students understood the items in the instrument and error free involved in the instrument.

Reliability is defined as the consistency for the instrument in which it was used to measure the instrument. Cronbach's alpha coefficient was used to measure the internal consistency of items [20]. In order for the Cronbach's alpha coefficient to be acceptable, the value should be at .70 or higher [35]. Cronbach's Alpha value of .90, an acceptable value, was obtained. Thus, the instrument in this study was reliable.

C. Sample of Some Items in MARS

TABLE I
 SAMPLE OF SOME ITEMS IN MARS

1. I feel ashamed when there is class discussion about probability.
2. I feel tension when I cannot understand the questions that lecturers are solving.
3. I feel confident when I am able to solve problem individually.
4. I feel confident to teach others in solving probability problems.
5. I feel nervous when being asked by my lecturers to solve probability problems on the board.
6. I will try hard and seek for help to solve the probability questions even though it is hard and will not directly looking for the answer.

D. Research Procedures

Before the data collection process was being conducted, the questionnaire had been designed. After that, undergraduates were given briefing about procedure of the study and the purpose of data collection was being conducted. They were also being briefed about the questionnaire in which the questionnaire in this study was conducted through online. Before students started to fill up the questionnaire, they were given consent letter which required their permissions to participate in the data collection process. Students were given duration of two weeks to complete the online questionnaire. The data that was collected from the questionnaire was then analyzed by using Statistical Package for the Social Sciences (SPSS) version 20. The method to determine students' anxiety level was comparing the scores they obtained with the mean and standard deviation. Anxiety level is categorized as low if the scores were below the mean and less than one standard deviation. Anxiety level was categorized as medium if the scores were at below and above the mean and between one standard deviation. Meanwhile, anxiety level was categorized as high if the scores were above the mean and greater than one standard deviation.

V. RESULTS

Data collected from the study was analyzed using SPSS version 20. Data was analyzed for frequency, percentage, mean, standard deviation and independent samples *t*-test. The factor that was analyzed from the data was the gender difference in mathematics anxiety.

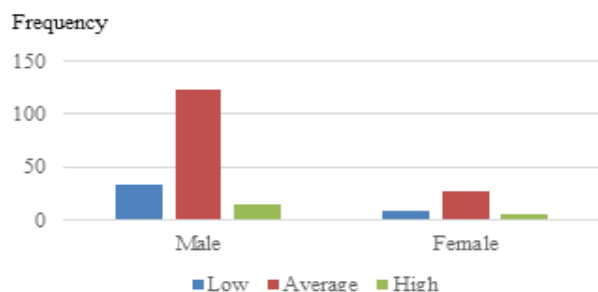


Fig. 1 Frequency and percentage of students on mathematics anxiety levels

Majority of the undergraduates were 171 males whereas there were 43 females included in this study (Table II). Fig. 1 showed that there were 33 (19.30%) males having low anxiety

level, 123 (71.93%) males having average anxiety level and 15 (8.77%) males having high anxiety level. Majority of females, 28 (65.12%), having average anxiety level, 9 (20.93%) females having low anxiety level and 6 (13.95%) females having high anxiety level. It can be said that, most of the male and female undergraduates were having average anxiety level.

TABLE II
 DIFFERENCE OF STUDENTS' ANXIETY LEVEL BASED ON GENDER

Gender	N	Mean	Standard Deviation	<i>t</i>	Sig
Male	171	3.62	.76	1.5	.117
Female	43	3.42	.65	74	

*Significant level, $p < .05$

Table II showed the difference of students' anxiety level based on the gender. For a difference of anxiety level among males and females to be significant, the *p*-value should be less than .05. The mean scores of anxiety level obtained for males was 3.62 (N = 171, SD = .76) whereas the mean scores of anxiety level obtained for females was 3.42 (N = 43, SD = .65). As seen from Table I, the mean scores of anxiety level obtained for males (M = 3.62) was slightly higher than the mean scores of anxiety level obtained for females (M = 3.42). However, there was no significant difference of anxiety level among males and females ($p = .117 > .05$).

VI. DISCUSSION

Among these students, majority of them were having average anxiety level whereas minority of them was having either low or high anxiety level. This result was supported by [2]'s study in which the findings showed that most of the students were having moderate anxiety level whereas others were having low or high anxiety level. Reference [16] stated that average anxiety level will motivate students in their learning as motivation whereas suitable strategy should be taken for students with high anxiety level. Reference [33] reported that students with moderate anxiety level have better performance as compared to those students with low anxiety level.

The result of this study further showed that there was no significant difference of anxiety level among males and females. Males and females exhibit the same level of mathematics anxiety and gender is not the factor for mathematics anxiety. This finding was consistent with the studies by [24], [26] which showed that there was no relationship between mathematics anxiety and gender. Reference [39] opined that the reason may because of students' mathematics knowledge and academic background was the same.

However, findings in this study contradicted to [14], [38] study which showed that there was significant difference between mathematics anxiety and gender where females were having higher mathematics anxiety level compared to males. Males were more involved in those leisure activities which can help them to reduce anxiety level as compared to females [22]. Stereotypical view was having great impact on mathematics anxiety. Females think that males were able to perform better

in mathematics whereas male students have the thinking that they were able to have higher achievement as compared to females. Thus, their thinking will cause females to have higher anxiety compared to males [38]. Reference [27] findings showed that most of the gender that was having mathematics anxiety level was males rather than females.

VII. CONCLUSION AND RECOMMENDATIONS

Findings of this study revealed that most of the female and male undergraduates were having average anxiety level. Mean value from the result showed that males' score were higher than females but there was no significant difference of anxiety level among male and female undergraduates.

In order to reduce anxiety level, students should have the optimistic believe towards themselves that they can successful in mathematics field [26]. Since there was no significant difference of anxiety level between males and females, teaching strategies that lecturers used can be applied equally on both genders. It is hoped that the findings in this study is significant to researchers so that they can conduct the findings in their research in the future on other area such as to determine mathematics anxiety of students on age, nationality, race, course, and other subjects.

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