A case study on mathematics anxiety for mathematics of finance course[*]

Rabiatul Alawiyah Zainal Abidin[1], Fatimah Alwi[2], Noor Faiza M. Jaafar[3]

(1. Faculty of Business Management (Finance), Universiti Teknologi MARA (UiTM), Johor 85009, Malaysia;

2. Faculty of Accountancy, Universiti Teknologi MARA (UiTM), Johor 85009, Malaysia;

3. Faculty of Accountancy, Universiti Teknologi MARA (UiTM), Melaka 75300, Malaysia)

Abstract: The DIIA (Diploma in Investment Analysis) students from the FBM (Faculty of Business Management) were required to undertake several MOF (Mathematic of Finance) courses. The passing rates for all of the MOF courses were good except for one course. There are many factors for this low passing rate phenomenon for this particular MOF course. One of the factors is mathematics anxiety as suggested by Richardson in 1971. As a result, this paper is carried out in order to measure the undergraduates' level of mathematics anxiety in general and between genders in this one particular course. The outcome is expected to fill in the gap as study of anxiety in MOF is still lacking. A 30-item MARS (Mathematics Anxiety Rating Scale) is adapted and used in this study, because this course is predominant by complex computations. The Ss (samples) of the study are 119 students who undertook this MOF course during the study semester of December 2008 to April 2009 in UiTM (Universiti Teknologi MARA). It is expected that the findings will show that the Ss have a considerably high mean for mathematics anxiety; and female students have a higher mean of mathematics anxiety as compared to their male counterparts. The study confirms the expectation of the researchers. In terms of the final and overall results, it was expected that the passing percentage be dominated by the male students. However, at the end of the study, the overall performance of the female students was much better compared to their male counterparts.

Key words: mathematics; anxiety; students; performance

1. Introduction

Each person encounters sad or worried from time to time. Repugnant feelings are a normal part of life. Nevertheless, when desperation or anxiety interferes with daily activities, it is time to combat. Many people suffer from anxiety when dealing with mathematics. A survey done by Richardson (1971) exhibited about 28% from the 400 graduates suffer extreme levels of tension related to mathematics or number manipulations. The DIIA (Diploma in Investment Analysis) students have to complete certain levels of mathematics related to finance in order to receive their diploma certificate. The duration of this program is 6 semesters and each semester has only 14 study weeks.

This MOF (Mathematics of Finance) courses is one of the many compulsory papers for the students to fulfill the requirement of DIIA. This course is only offered to final year graduating DIIA students. These students in general face mathematics anxiety throughout this program at semester 1-6 and which might extend to semester 8 in order to graduate. The extension is mainly due to the fact that the students did not manage to pass this course on time. Due to this, the students named this course as the "killer subject".

1.1 Problem statement

Previously, no mathematics on finance anxiety research has been done. The expected result for this study would be that, the higher the level of anxiety, the lower the students would perform. Ma (1999) found that the relationship between mathematics anxiety and mathematics achievement is significant. A high level of anxiety is associated with a low level of performance. Studies by Campbell and Evans (1997), Baloglu and Kocak (2006) and Frenzel, Pekrun and Goetz (2007) found that, there was a significant level of anxiety among females. On the other hand, Catlioglu, Birgin, Costu and Gurbuz (2009) found that, gender is not significant in the study of mathematics anxiety. But the ultimate result for this was still uncertain until the actual results from the recent examination were announced.

The purpose of this study was to investigate whether there was a statistical difference between anxiety levels based on gender of DIIA students. This study will also reveal the skewness of the respondent answers and the skewness of the actual performance for this course at the end of the semester, as the students will not be able to graduate on time if they fail to pass this course at the end of their final semester.

1.2 Objectives of the study

The objective of this study is to measure the level of anxiety based on students' gender enrolled into this program and registered for this MOF course. This course requires the students to apply and evaluate some complex mathematics on finance regarding fixed income securities. The purpose of the present study is to adapt the MARS (Mathematics Anxiety Rating Scale) (Richardson & Suinn, 1972) into mathematics on finance. The students that registered into this MOF course were Ss (samples) utilized in this study. The original scale was a 98-item scale. This study adapted a shorter version of the MARS to a 30-item version (Suinn & Winston, 2003), revised for finance. Students in this group completed the MARS and an information questionnaire in the middle of the semester during the class. The information questionnaire obtained information from the students concerning age, gender and status of registering to this course. At the end of the semester, the exam grades for each student will be obtained.

The aim of this study is to develop students' knowledge and interest in the course area. As cited from Effandi and Norazah (2008) a study on the first year engineering students from matriculation found that, students have negative attitudes towards mathematic. From the authors' observation, some students did well during this course and assignments yet failed to perform well in the final examination. Despite the fact that there are many reasons for the poor performance in this course, one prevailing variable worth considering is mathematics anxiety. Since no research has been done in this area of mathematics on finance anxiety of diploma student, this study was undertaken to add to the body of knowledge.

The study has never been done before specifically for this course. Therefore, the expected findings are female students will perform lower grades compared to male students since this course applied complex mathematics. As a conclusion, this paper provides better understanding on the level of mathematics anxiety between gender and the performance of the graduating diploma students. Adapting the MARS is the first method adapted in making this research a success, as no research have been specifically done on students taking MOF previously.

2. Literature review

2.1 Mathematics anxiety

Mathematics is being used in almost every aspect of life. However, several studies showed that a number of individuals suffer from MA (mathematics anxiety) (Suinn, et al., 1972; Campbell & Evans, 1997; Baloglu & Kocak, 2006; Joyce, Hassal, Montano & Anes, 2006; Frenzel, Pekrun & Goetz, 2007). MA can be defined as "feelings tension and apprehension surrounding the manipulation of numbers and the solving of mathematical problems in academic, private and social settings" (Richardson & Suinn, 1972, p. 551). There are many factors inducing MA among students, such as self-perceptions and self-domain (Frenzel, Pekrun & Goetz, 2007), and quality of instructions (Wadlington, E. & Wadlington, P. L., 2008). Overall, instructors/teachers were the key factor in cultivating or preventing MA within their students (Unglaub, 1995; Jackson & Leffingwell, 1999; Catlioglu, Birgin, Costu & Gurbuz, 2009).

There are many multiple scales to measure MA, such as MARS and FSMAS (Fennema-Sherman Mathematics Anxiety Scale). However, only MARS had a normative, reliability and validity data (Richardson & Suinn, 1972). Originally, MARS consists of 98-item scale that measure MA using 5-Likert scale by Suinn and Edwards (1982): 1 represented "Not at all" anxious while 5 represented for "Very much" anxious. Suinn invented MARS using 119 university undergraduates as Ss in 1972. Later, Suinn and Edwards (1982) revised MARS, resulting a shorter version of scale known as MARS-A (Mathematics Anxiety Rating Scale for Adolescent). It is a widely used measurement, which various researches adapt to measure MA for various groups of Ss of different ages. For instance, Campbell and Evans (1997) used high school female students as their Ss while Hopko, McNeil, Gleason and Rabalais (2002) used undergraduate psychology students. On the other hand, Baloglu and Kocak (2006) studied MA on college students. MARS is also used to study MA in different geographical settings. While the aforementioned researches were carried out in the USA, Catlioglu, Birgin, Costu and Gurbuz (2009) used MARS to study MA on 207 pre-service elementary school teachers in Turkey.

A number of studies have been carried out on MA and gender. Most findings showed that MA among females was higher than their male counterparts significantly (Campbell & Evans, 1997; Baloglu & Kocak, 2006; Joyce, Hassal, Montano & Anes, 2006; Frenzel, Pekrun & Goetz, 2007). These studies used students in secondary and tertiary levels as their Ss. Interestingly, the presence of male peers leads to a higher MA among females. Campbell and Evans (1997) performed a study on MA among students in single-sex and co-ed classes in a high school. The Ss were given a mathematics test and MA was measured before and after the event. The researchers found that post-test MA among females was lower than the pre-test MA in single-sex classes. However, the post-test MA was higher than its pre-test MA among females from co-ed classes. Findings of Campbell and Evans (1997) supported Cramer (1989) who explained that males' superior attitude negatively impacts the mathematics self-concept of females. The higher MA among females can be explained by negative self-perception on capabilities and self-domain within themselves. Gender as such did not affect different level of MA. Instead of that, it was the lower competence beliefs and domain values in mathematics among females (Frenzel, Pekrun & Goetz, 2007) that caused them to have a higher MA than male peers. Both studies discussed that, females tend to believe that they were less capable in mathematics, thus they had a lower self-confidence in any numerical task. The same studies also discussed that females believed that mathematics was better suited to males, thus would feel more anxious to perform numerical task because of their own gender.

On the other hand, Catlioglu, Birgin, Costu and Gurbuz (2009) had a slightly different finding. In their study

on elementary school teachers, two findings were worth to discuss. Firstly, the MA level was low generally. Secondly, although female MA was higher than male, the difference was insignificant. However, they reported a significant difference of MA between classes (freshman/senior), perceived ability and perceived success level. A higher level of MA was reported among juniors and Ss that had a lower level of perceived ability and perceived success level.

2.2 The impacts of MA

MA has an impact on the duration to complete a numerical task. Normally, individuals with higher MA will take longer time to do so, as anxiety deviates their focus from performing the primary task. This is known as the processing efficiency theory, which posits that anxiety reduces the storage and processing capacity of the working memory system (Eysenck & Calvo, 1992). Faust, Ashcraft and Fleck (1996) performed a study on simple and complex addition that required carrying operation between high and low MA Ss. The experiment on complex addition was further divided into two segments: timed and not. One of the findings showed that Ss with high MA took longer time to complete the task, and time consumed was differed significantly between the two groups. A similar finding was reported by Hopko, McNeil, Gleason and Rabalais (2002), who also performed a study on MA using a Stroop-like card task that involved the counting of numerals and letters between Ss with high and low MA. Again, Ss with higher MA took longer time to complete both tasks. Therefore, it can be concluded that higher MA individuals find it more difficult to perform a task due to their split attention between the task itself and anxiety towards numbers.

Performance also declines when MA arises, due to anxiety and avoidance to situations involving numbers. Other findings of Faust, Ashcraft and Fleck (1996) suggested that, answers for complex addition in a timely manner among high MA group were less accurate as compared to their counterparts. In another experiment when the task was not timed, the high MA group completed the questions within the same time consumed by the Ss with low MA. However, the answers of the high MA Ss were less accurate greatly. This suggests that high MA Ss tend to avoid mathematics as fast as they can, even though the answers would be wrong. Similar findings were reported by Hopko, Ashcraft and Ashcraft (1999). High MA Ss tend to avoid numerical tasks at the expense of accuracy. This phenomenon can be explained by self-perceptions (Ashcraft, 2002) and motivation to learn (Effandi & Norazah, 2008). Both researches found a significant, negative correlation between MA and academic performance among tertiary level students. In other words, students with high MA performed poorly academically due to negative self-perceptions about their maths abilities. Their lack of confidence in mathematics would split their attention into two focuses: studying and worrying. Again, this would affect the students' storage and processing capacity of the working memory system, which supported Eysenck and Calvo (1992). Effandi and Norazah (2008) further explored the correlation between MA and motivation. Their finding showed that, the correlation between MA and motivation to learn was also significant and negative. Therefore, it can be concluded that, Ss with higher MA would be less motivated to learn, and thus, perform poorly in academic.

High MA individuals try to avoid mathematics or numerals at any cost, even though this may affect their performance or career paths. Students with high MA take fewer elective math courses in advance level (Campbell & Evans, 1997; Ashcraft, 2002), thus limiting themselves to be professionals, as qualifications in advanced mathematics courses were part of the requirement for prestigious careers. As explained by Ashcraft (2002), students with higher MA espouse negative attitude toward mathematics. Such dislike toward mathematics would lead to avoidance, both in choosing advance classes in mathematics and professions.

Fortunately, MA can be overcome. Higbee and Thomas (1999) suggested teachers/instructors to use diverse

teaching strategies, such as learning in small groups or using variety of visual stimuli other than reading a text or listening to a lecture. Additionally, instructors/teachers should assess their students in non-threatening ways, motivate the students to overcome their anxiety and encourage cooperation among them (Wadlington, E. & Wadlington, P. L., 2008). Others, such as communication and language barrier, gender bias and quality of instruction, should also be given attention (Jackson & Leffingwell, 1999; Catlioglu, Birgin, Costu & Gurbuz, 2009).

3. Methodology

The total number of students enrolled into this course during the 14 study weeks was 166 students. On the day of the final exam, only 165 students were actually sat for the final exam. One student was absent for unknown reasons. The Ss were 119 diploma students enrolled into semester 6 of UiTM (Universiti Teknologi MARA) Johor, studying in DIIA using the convenient random sampling method.

The MARS questionnaires were administered to all Ss who were asked to simply tick the most appropriate answer. The questionnaire does not ask personal questions, such as name and student identification number in order to retain anonymity. The MARS consists of 30 questions and 3 general questions: age, gender and status. The MARS uses a simple Likert scale to measure the level of anxiety for each question: 1—Not at all; 2—A little; 3—Much; and 4—Very much. The students just need to write their age, gender and the status of registering into this course.

This study will only look at the mean, mode, median and skewness of the responds. This study will also look at the performance of the respondents in the same manner. This is to look at the direction of the anxiety level among the students in regards to this course and the trend of the performance level. This study will not look into the relationship between anxiety and performance, as the questionnaire is an anonymity but the performance can be identified by each student sitting for the exam. However, the performance of the students and the gender can be further looked into.

The dependent variable in this study is the overall achievements. The independent variable on the other hand is the students' gender. Age is not one of the factors as this study only focuses on the students aged 20 years old. The number of sittings was also not taken into consideration, as each of the students enrolled into this course was a first timer for this semester.

The data were analyzed using SPSS (Statistical Package for the Social Sciences) version 17.0. Descriptive analysis was performed on the 30 questions answered by the 119 students and also the 165 students' achievement on the overall performance of this course.

The descriptive analysis looked at the mean, median, mode and skewness of the responds towards the questions asked in the questionnaire. This method also addressed on the different level of overall performance and gender of the students.

The questionnaire has 30 questions and the questions were coded by the numbers 1, 2, 3 and 4 (see Table 1).

Table 1   The 5-point Likert scales

Codes	Scales
1	Not at all
2	A little
3	Much
4	Very much

These questionnaires will be further grouped into 4 categories (see Table 2).

Table 2   The 4 categories of the questionnaire

Categories	Question numbers
(1) Class, lecturer and help	1, 2, 7, 13, 15, 21, 22, 24 and 25
(2) Test	3, 4, 5, 8, 9, 10, 11, 12, 14 and 16
(3) Self-esteem	19 and 20
(4) Exam	6, 17, 18, 13, 23, 26, 27, 28, 29 and 30

The 5-point Likert scales in Table 1 will measure the anxiety level of the Ss in regards to attending normal classes, meeting the lecturer and seeking for help. The 4 categories of the questionnaire in Table 2 will measure the anxiety level of the Ss in regards to test and related matters. The coding for respondents gender in Table 3 will concentrate on measuring the Ss anxiety on self-esteem and lastly the coding for the respondents course grades in Table 4 will measure the anxiety level of the Ss in related to the final examination. Under all of these categories, this study will further investigate the anxiety levels for the overall responds, male and female responds.

The genders of the students were coded by the numbers of 0 and 1 (see Table 3).

Table 3   The coding for respondents gender

Codes	Gender
0	Male
1	Female

As for the students' overall performance, it was coded by the number of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11 (see Table 4).

Table 4   The coding for respondents course grades

Codes	Grades
1	A+
2	A
3	A-
4	B+
5	B
6	B-
7	C+
8	C
9	D
10	E
11	F

This grades were further categorized into As, Bs, Cs and Fails. As here will cover the grades for A+, A and A-. Bs covers the grades B+, B and B-. While Cs will combine the grade C+ and C.

4. Findings

First and foremost, the questionnaire fit was tested. The 30-question questionnaire was tested using the Cronbach's alpha that gave a result of 0.912 as shown in Table 5. This shows that the questions asked in the

questionnaire are relevant and reliable (Suinn, 1972).

Table 5   Reliability statistics

Cronbach's alpha	N of items
0.912	30

The findings for this study can be divided into 3 parts, namely, respondents' profiles, anxiety levels and students' performance.

4.1 Respondents' profile

The 119 respondents consist of male and female students enrolled into this MOF course. Out of these 119 respondents, 33.61% were male and the remaining were females students as shown in Figure 1. This percentage shows that the skewness of the students' gender was skewed to the left. This is due to the number of female students enrolled into this program in general, and this course specifically was female dominated.
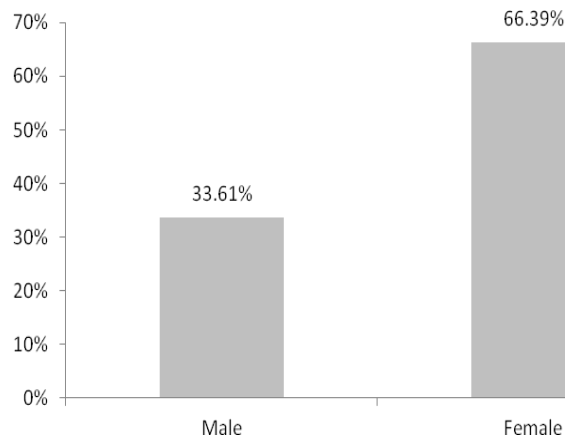
Figure 1   The male and female respondents in percentage

4.2 Anxiety levels

The overall anxiety level for the respondents was skewed to the left and the average anxiety level at 3 indicating the "Much" measures in the questionnaire distributed. This research further separated the responds according to gender and the result was surprising also at 3 for both male and female students, which means that both male and female students face the "Much" anxiety. During the initial state of this study, the researches assume that the male students would have a lower anxiety level compared to the female students. This is simply due to the understanding that male would not face a lot of anxiety when dealing with numbers or mathematics.

The 30-item questionnaire was further grouped into several categories. The 5-point Likert scales in Table 1 measure the anxiety level of the Ss in regards to attending normal classes, meeting the lecturer and seeking for help. The 4 categories of the questionnaire in Table 2 measure the anxiety level of the Ss in regards to test and related matters. The coding for respondents gender in Table 3 concentrates on measuring the Ss anxiety on self-esteem and lastly the coding for the respondents course grades in Table 4 measures the anxiety level of the Ss in related to the final examination.

The study found mixed anxiety levels for all the categories. This study looked further the results of the 3 specifications of the overall, male and female findings. Firstly, category 1 found that the overall average, mode and median anxiety levels were 2.50, 3 and 3 respectively. While the skewness for this category was at -0.02. This

means that the overall anxiety level of attending normal classes, meeting the lecturers and asking for help gives much anxiety for the respondents and is slightly skewed to the left. The male respondents have an average of 2.47 and the female 2.53. The mode and median for the male respondents was 2 while for the female respondents was 3. This means that the female faced more anxiety for this category compared to their counterparts. The skewness for the male was only 0.09, and for the female was almost a mirror to the male, which is -0.8. This indicates that the boys have less anxiety for this category.

Secondly, category 2 asked the respondents about their anxiety things related to their tests for this MOF. The respondents' anxiety levels for both male and female and also the overall responds were almost at much feeling of anxiety. The skewness was to the left at about -0.5, which indicates that there are quite a number of Ss that feel not much of anxiety in concerning matters related to test.

Subsequently, category 3 of the questionnaire concentrates on the level of the respondents' anxiety towards their self-esteem on understanding and applying the MOF. The research surprisingly found that the respondents have much anxiety in regards to their self-esteem compared to category 2 when asked about things related to tests. This is when the respondents were asked about their results by their friends and also when the respondents need higher grades to maintain their CGPA (cumulative grade points average).

Finally, category 4 focuses on the final examination anxiety level of the respondents. All of the respondents faced very much anxiety when it comes to the questions about the final examination. This portrays that the respondents have a very high anxiety level only for the final examination, which they presume as the most important part of the whole MOF course.

Though the respondents have to sit for tests and submit assignments as part of their ongoing assessment, the overall anxiety level for category 2 was lower than category 3 but a bit higher than category 1. Tables 6-9 summarize the findings by category from the questionnaire distributed.

Table 6   Findings by category 1

	Mean	Mode	Median	Skew
All	2.50	3	3	-0.02
Male	2.47	2	2	0.088
Female	2.52	3	3	-0.08

Table 7   Findings by category 2

	Mean	Mode	Median	Skew
All	2.88	3	3	-0.42
Male	2.95	3	3	-0.55
Female	2.76	3	3	-0.17

Table 8   Findings by category 3

	Mean	Mode	Median	Skew
All	3.05	3	3	-0.68
Male	2.95	3	3	-0.33
Female	3.09	3	3	-0.88

Table 9   Findings by category 4

	Mean	Mode	Median	Skew
All	3.05	4	3	-0.61
Male	2.96	4	3	-0.39
Female	3.10	4	3	-0.73

4.3 Students' performance

Just by looking at the graph in Figures 2 and 3 below, this research found that the female students have a higher number of passes compared to the male students. The greater number of female students enrolled and sat for this course influenced this passing numbers. This research further looked into the percentage of male and female students grades by dividing the grades into groups of As, Bs, Cs and Fails.
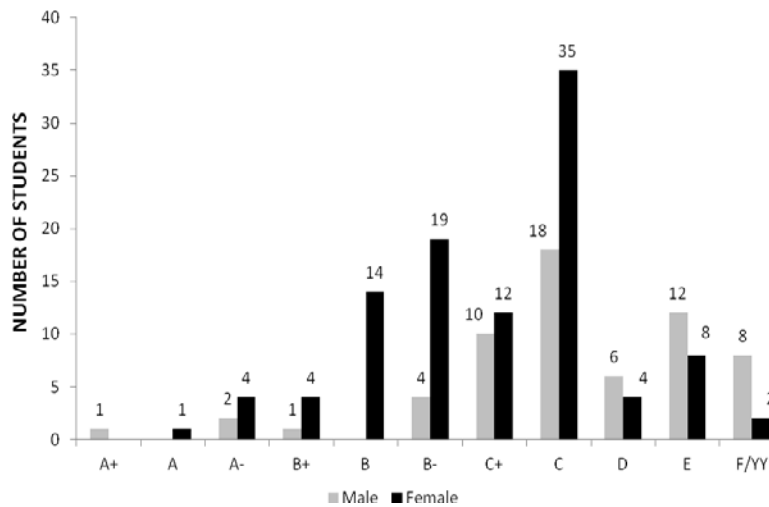
Figure 2   The students grades by gender
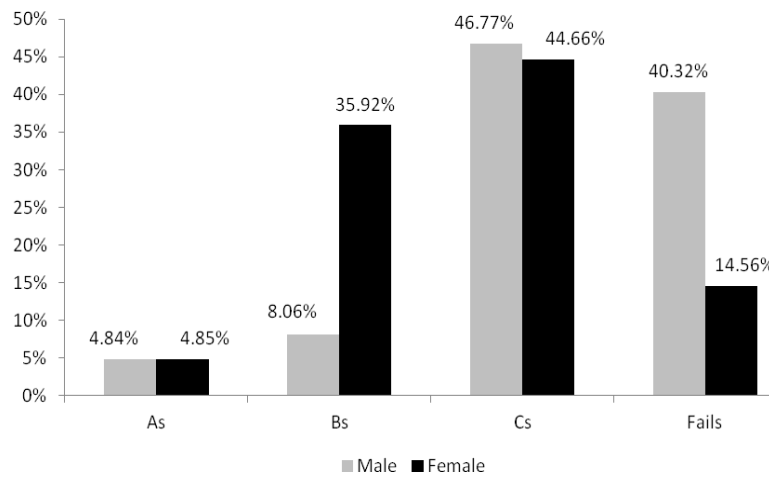
Figure 3   The students grades by gender in percentage

The grade group As has about the same percentage between the males and their counterparts, 4.84% and 4.85% respectively. However, there is a significant difference in the percentage of males and females achieving the Bs. Only 8.06% of the male students manage to score the Bs while the female students really nailed it by 35.92%. There is a slight difference between the male and female students grades for the Cs, which is 46.77% and

44.68% respectively. There is a significant high percentage of 40.32% of male students failed to pass, compared female students which is only 14.56%. The overall students' performance is illustrated in the Figures 2 and 3.

Overall, this research showed that the anxiety level for the girls was always higher than the boys. But at the end of day, the girls managed to achieve a better results compared to the boys. Although the highest grade of A+ goes to a boy but the percentage girls in the As category as very closed to the boys. However, the boys have a higher percentage of non-passes even when their anxiety towards final examination is only at 3, which indicate "Much" anxiety.

5. Conclusion and recommendations

The battle of the sexes has been a debate since forever. This triggered researchers to study more on this especially in regards to mathematics anxiety and performance. Convenient random sampling method has been adopted and the MARS have been accustomed to suite the study.

After thorough study with these Ss and years of informal in-class observations of the previous batches, the researchers conclude in the case of this particular MOF course with these Ss that, males have a lower anxiety level of anxiety due to previous findings that they do not have much trouble with calculations and mathematics in general. On the other hand, females struggle to pass this MOF course with the current anxiety level simply due to their awareness of the importance to pass.

The findings of this research found that category 4 has the highest anxiety level that is concerning the final examination. Followed by category 3 which asked on self-esteem, category 2 on test related matters and category 1.

Since this MOF course is part of the requirements for the DIIA students to pass for graduation, both male and female students have realized the importance of mathematics. The students cannot graduate if they fail to pass this course. Hence, even with a high level of anxiety dealing with this MOF, the females managed crossing over the fail, passing border and making a statement that they were also able to handle the complexity of this MOF course. Thus, this study showed that it is not impossible for females to deal with numbers or calculations as the myth of MA would presume otherwise.

Other variables should be taken into consideration for future studies on performance of mathematics. Higbee and Thomas (1999) suggested that, success in mathematics might be due to many factors and they were correlated to each other. Among variables that had significant, positive correlations with math anxiety test (pre) were career planning, tolerance and usefulness of math. On the other hand, educational involvement and healthy lifestyle were significantly and inversely correlated to math anxiety test (pre). Nevertheless, only confidence (pre and post) were significantly and negatively correlated with math anxiety (post).

Suggestions of Woodard (2004) to help students with high MA are: (1) treating students in non-threatening ways, cooperative grouping; (2) teaching at slow pace; and (3) providing extra tuition sessions (Effandi & Norazah, 2008). Wadlington, E. and Wadlington, P. L. (2008) suggested that, instructors/teachers should be aware that there are two types of learning style: quantitative and qualitative. Therefore, teaching methods should fulfill both groups' needs. Such as using deductive-inductive strategies while providing instructions. Additionally, they should use non-threatening ways, share how teachers solve their problems of eliminating MA, collaborative learning and praise. Higher MA students should be placed in the centre of instruction. Baloglu and Kocak (2006) mentioned that, mathematics instructor should pay attention that students need differ. Test-taking strategies and test-anxiety reduction techniques might help groups with higher MA.

References:

Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *American Psychological Society, 11*(5), 181-184.

Baloglu, M. & Kocak, R. (2006). A multivariate investigation of the differences in mathematics anxiety. *Personality and Individual Differences, 40,* 1325-1335.

Campbell, K. T. & Evans, C. (1997). Gender issues in the classroom: A comparison of mathematics anxiety. *Education, 117*(3), 332-338.

Catlioglu, H., Birgin, O., Costu, S. & Gurbuz, R. (2009). The level of mathematics anxiety among pre-service elementary school teachers. *Procedia Social and Behavioral Sciences, 1*(29), 1578-1581.

Charles, H. E. & Laura, L. S. (2006). *Anxiety and depression workbook for dummies*. US: Wiley Publishing, Inc..

Cramer, R. H. (1989). Attitudes of gifted boys and girls towards math: A qualitative study. *Roeper Review, 11*(3), 128-131.

Effandi, Z. & Norazah, M. N. (2008). The effects of mathematics anxiety on matriculation students as related to motivation and achievement. *Euro-Asia Journal of Mathematics, Science & Technology Education, 4*(1), 27-30.

Eysenck, M. W. & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition and Emotion, 6*, 409-434.

Faust, M. W., Ashcraft, M. H. & Fleck, D. E. (1996). Mathematics anxiety effects in simple and complex addition. *Mathematical Cognition, 2*(1), 25-62.

Frenzel, A. C., Pekrun, R. & Goetz, T. (2007). Girls and mathematics—A "hopeless" issue? A control-value approach to gender differences in emotions towards mathematics. *European Journal of Psychology of Education, 12*(4), 497-514.

Higbee, J. L. & Thomas, P. V. (1999). Affective and cognitive factors related to mathematics achievement. *Journal of Developmental Education, 23*(1), 8-14.

Hopko, D. R., Ashcraft, M. A. & Ashcraft, M. H. (1999). The effects of time pressure on arithmetic performance. *Journal of Anxiety Disorders, 13*(6), 591-600.

Hopko, D. R., McNeil, D. W., Gleason, P. J. & Rabalais, A. E. (2002). The emotional stoop paradigm: Performance as a function of stimulus properties and self-reported mathematics anxiety. *Cognitive Therapy and Research, 26*(2), 157-166.

Jackson, C. D. & Leffingwell, R. J. (1999). The role of instructors in creating math anxiety in students from kindergarten through college. *Mathematics Teacher, 92*(7), 583-586.

John, E. H. & Arthur, G. R. (1998). *Business forecasting (6th ed.)*. US: Prentice-Hall International, Inc..

John, S. C. (1998). *Mathematics & statistics for business (introductory) (3rd ed.)*. Australia: McGraw-Hill.

Jon, C. & Roger, S. (1996). *Quantitative methods for business decisions (4th ed.)*. United Kingdom: International Thomson Business Press.

Joyce, J., Hassal, T., Montano, J. L. A. & Anes, J. A. D. (2006). Communication apprehension and math anxiety as barriers to communication and numeracy skills development in accounting and business education. *Education and Training, 48*(6), 454-464.

Ma, X. (1999). A meta-analysis of the relationship between anxiety and toward mathematics and achievement in mathematics. *Journal for Research in Mathematics Education*, *30,* 502-540.

Peggy, T. S. (1989). *A first course in probability and statistics with applications (2nd ed.)*. US: Harcourt Brace Jovanich, Publishers.

Richardson, F. & Suinn, R. (1972). The mathematics anxiety rating scale: Psychometric data. *Journal of Counseling Psychology, 19,* 551-554.

Suinn, R. M, Edie, C. A., Nicoletti, J. & Spinelli, P. R. (1972). *The MARS, a measure of mathematics anxiety: Psychometric data*, 373-375.

Suinn, R. M. & Edwards, R. (1982). The measurement of mathematics anxiety: The mathematics anxiety rating scale for adolescents-MARS-A. *Journal of Clinical Psychology, 38*(3), 576-580.

Suinn, R. M. & Winston, E. H. (2003). The mathematics anxiety rating scale, a brief version: Psychometric data. *Psychological Reports, 92*(1), 167.

Uma, S. (2005). *Research methods for business: A skill building approach (4th ed.)*. US: John Wiley & Sons, Inc..

Unglaub, K. W. (1995). *Mathematics anxiety in preservice elementary school teachers*. (Unpublished Doctoral Dissertation, State University of new York at Buffalo)

Wadlington, E. & Wadlington, P. L. (2008). Helping students with mathematical disabilities to succeed. *Preventing School Failure, 53*(1), 2-7.

William, G. Z. (2003). *Business research methods (7th ed.)*. US: South-Western CENCAGE Learning.

Woodard, T. (2004). The effects of math's anxiety on port-secondary developmental students as related to achievement, gender and age. *Inquiry, 9*(1).

(Edited by Nicole and Sunny)