

MATHEMATICS ANXIETY AMONG FORM FOUR SCIENCE STUDENTS IN KUCHING SECONDARY SCHOOLS

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ABSTRACT

This study attempted to describe the mathematics anxiety level of the Form 4 Science student. In addition to that, this study aimed to test whether there exist significance gender differences in mathematics anxiety. The samples consisted of 204 form four science students from eight secondary schools in Kuching. The study was conducted in two phases. The first phase involved the selection and preparation of appropriate instruments to measure mathematics anxiety level. The second phase included the administration of the test, the collection and the analysis of the data to answer the research questions. The findings in general, indicated that the students exhibited a low and moderate level of mathematics anxiety. There was no significant gender difference in mathematics anxiety ($t = -0.99$).

Introduction

Malaysia aspires to become a fully developed and industrialized nation by the year 2020. All efforts are fully channeled by the government to establish a scientific and progressive society as envisioned by the sixth challenge in Malaysian's vision 2020. The aim is to develop a society which acts as a contributor to the scientific and technological civilization of the future instead of a mere consumer or an end-user of technology (Vision 2020, 1997).

In order to attain this vision, our education system needs to produce knowledge workers with a sufficiently high literacy in mathematics. Literacy in mathematics is a must in this context as it is the language of science and technology (National Research Council, 1989) and the foundation for democracy in the technological age. Besides, industries expect school graduates to be able to use wide varieties of mathematical

methods to solve problems when they join the workforce (Mathematical Science Educational Board, 1993).

To have a sufficiently high literacy in mathematics, students need to have high mathematics performance and high mathematics achievement. Research on mathematics anxiety and achievement has showed that high mathematics achievement is related to low mathematics anxiety and vice versa for students from elementary school to college (e.g., Betz, 1978; Clute, 1984; Foong, 1984; Satake and Amato, 1995; Swetman, Munday, & Windham, 1993 as cited in Teo, 1997). Hence, it is crucial to alleviate mathematics anxiety so that achievements in mathematics can be improved. Producing high mathematics achievers with low mathematics anxiety seems to be a crucial task and responsibility of the schools. The success of the nation's effort in realizing vision 2020 will largely depend on the ability of Malaysian schools to educate young Malaysians and groom them into the required knowledge workers. These knowledge workers are the basis of the nation's advanced workforce in science and technology.

Background of the study.

To cater for the urgent need of mathematical expertise in Malaysia, students should be prepared to have high mathematical literacy and competency. However, in spite of the importance of mathematics in this technological age, many intellectually capable students avoid taking mathematics courses in high school and in college and consequently restrict the range of future careers that need mathematics expertise (Betz, 1978). This would form a distinct barrier for them to have desirable career opportunities (Richardson & Woolfolk, 1980).

Statement of the problem

Poor mathematics performance and mathematics avoidance are best explained by mathematics anxiety (Betz, 1978). This phenomenon of mathematics anxiety should be relatively low among the science students since they were selected based on the excellent mathematics achievement in *Penilaian Menengah Rendah*. According to Lussier (1996), students with a strong mathematical background should be less anxious than the ones with a weak mathematical background. Lupkowski and Schumacker (1991) in their study on mathematically talented college students, also agreed that the groups of talented students were less mathematics anxious than most unselected college students. Applying this findings in Malaysian context, the form four science students with strong mathematical background should have better mathematics performance. Hence, it is essential for this study to identify the level of mathematics anxiety among the form four science students to determine whether the findings by Lussier (1996), Lupkowski and Schumacker (1991) will agree with Malaysian students.

Research questions and hypothesis

This study examines the following research questions:

- i. i. What is the mathematics anxiety level of form four science students?
- ii. ii. Is there a significant difference between male and female students in mathematics anxiety?

and the following hypothesis:

Ho₁: There is no significant difference in mathematics anxiety level between male and female students.

Significance of the study

Findings in investigating the mathematics anxiety level among form four science students might help in determining the percentage of students who were highly affected by mathematics anxiety so that appropriate action could be taken to moderate the anxiety level.

Moderating mathematics anxiety might improve mathematics performance and achievement. This is essential in preparing the future workforce, who must have high literacy and competency in mathematics. Although it is natural to feel anxious during the mathematical learning process, too much anxiety may be a hindrance in learning as high mathematics anxiety is a very intense and debilitating phenomenon (Sherard, 1981 as cited in Wood, 1988). The findings of the study might be able to determine whether mathematics anxiety is at the level of debilitating the learning process or not

Limitations of the study

The respondents in this study were form four science students. Considering the fact that these students were chosen from a selected group, the result of the study might not be representative of the entire population of form four students.

Defining Mathematics Anxiety

Tobias (1976) had adopted a very simple definition of mathematics anxiety as "I can't" syndrome. Kelly and Tomhave (1985) regarded mathematics anxiety as the feeling of fear, avoidance and dislike when dealing with mathematical situations. According to Cemen and Byrd (1987), mathematics anxiety is defined as a state of anxiety in response to situations involving mathematics which are perceived as

threatening to self-esteem. If self-esteem is basically strong and there is a certain level of task-related confidence, the individual may be able to control the anxiety and channel it into the task. When this occurs the anxiety might facilitate performance. However, if the individual is unable to control the anxiety, it can debilitate the performance .

Perhaps the most widely used and accepted definitions of anxiety is “feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations,” (Richardson and Suinn, 1972, p. 551).

Research Design

This study utilized the survey method because it is a useful methodology for the study of attitudes and other psychological constructs such as behaviors and beliefs (Schumacher & McMillan, 1993; Thorndike, Cunningham, Thorndike & Hagen, 1991 as cited in Koh, 1998).

Description of the sample

The population of this study was form four science students in Malaysian secondary schools. Kuching city was chosen to be the location of the study and random samples were chosen from this city.

Selection of schools

Kuching is the capital city of Sarawak. There are 34 secondary schools in the Kuching city. From this total number of schools, eight schools that have form four science

classes were randomly selected by balloting. The selected schools were representative of various categories such as co-educational, single sexed, non-boarding, boarding schools, fully government-aided and partially government-aided schools. The eight schools were SMK Sungai Tapang, SMK Sains, Kolej DPAH Abdillah, SMK St Joseph, SMK St Teresa, SMK Green Road, SMK Batu Lintang and SMK Petra Jaya.

Selection of respondents

The total number of form four science students in these eight schools was 1020. From all the respective schools, approximately twenty percent (204 students) of the form four science students with equal number of female and male students were selected. The selected sample consisted of 101 male and 103 female students.

Instrumentation

The instrument used in this study was Modified Revised Mathematics Anxiety Rating Scale (MRMARS). Revised Mathematics Anxiety Rating Scale (RMARS) had total of 25 items that were derived from a factor analysis on Mathematics Anxiety Rating Scale (MARS) by Alexander and Martray (1989). In modifying RMARS, the researcher had removed five from the 25 items, added two related items and one item was rephrased to suit the student's academic background in the Malaysian Educational System. The final and modified version of Modified Revised Mathematics Anxiety Rating Scale (MRMARS) consisted of 22 items to measure the mathematics anxiety level of the respondent when different situations were given. These items used a 5-point Likert scale which range from "1" as "not at all anxious" to "5" as "very much anxious". The 22 items in MRMARS were initially grouped into 3 factors:

mathematics test anxiety, numerical anxiety and mathematics course anxiety. After pilot testing, factor analysis was done and three new factors were extracted. These factors were renamed as Mathematics Task Anxiety, Mathematics Test Anxiety and Mathematics Comprehension Anxiety

Validity

The original English version of this inventory was translated into Malay by the researcher. The translated version was also verified by a Malay Language lecturer and then translated back to the English by an English lecturer without referring to the original English version. This English version was compared with the original RMARS and if differing context arose, the Malay version was edited by both the Malay and English lecturer. The final inventory in Malay version (MRMARS-BM) was then administered to 38 form four science students in SMK Datuk Patinggi Haji Abdul Gapor for the pilot test.

Reliability Test

The reliability indices for MRMARS-BM based on pilot test data were 0.89 for overall MRMARS, 0.94 for Mathematics Task anxiety, 0.80 for Mathematics test anxiety and 0.67 for Mathematics Comprehension anxiety.

Data Collection Procedures

The researcher conducted the study from 16th September 1999 until 24th September 1999 in eight selected schools; SMK Batu Lintang, SMK Sungai Tapang, SMK Green Road, SMK Petra Jaya, SMK St Joseph, SMK St. Teresa, SMK Sains and Kolej Datuk Patinggi Abang Hj Abdillah.

MRMARS score analysis procedures

The types of scoring, score percentage and the score interpretation for MRMARS and the three factors, mathematics task anxiety, mathematics test anxiety and mathematics comprehension anxiety are shown in the table below.

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Scoring Table for MRMARS and the three factors

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Types of score	Score percentage (from raw score)	Score Interpretation			
		Overall Math Anxiety comprehension anxiety	Math Task anxiety	Math Test anxiety	Math anxiety
Low score	lower 20%				low anxiety
Moderate score	middle 60%				moderate anxiety
High score	higher 20%				high anxiety

Types of analyses

To answer the research questions and to test the hypothesis, the data was then subjected to different statistical analyses. Frequency, percentage and mean standard deviation were used to describe the mathematics anxiety of the students. To

determine whether there is gender differences in mathematics anxiety, t-test was used.

Findings on mathematics anxiety level

The findings that described the mathematics anxiety level of form four Science students was summarized in the table below.

Mean scores and percentage of students from various levels of mathematics anxiety and the respective factors

High	Possible % range	Mean	SD	Low		Moderate		
				Anxiety		Anxiety		
				N	%	N	%	N
Factors								
Overall	22-110	54.2	16.8	43	21.1	153	75.0	8
3.9 Mathematics Anxiety								
Mathematics 2.9 Task Anxiety	9-45	18.7	8.9	105	51.5	93	45.6	6
Mathematics 6.9 Test Anxiety	8-40	22.2	6.7	34	6.7	156	76.5	14
Mathematics 8.3 Comprehension	5-25	13.3	4.7	46	22.5	141	69.1	17

Anxiety

N= 204

Note:

Low anxiety: The lower 20% of the total raw score

Moderate anxiety: The middle 60% of the total raw score

High anxiety: The upper 20% of the total raw score.

The mean score and standard deviation for overall mathematics anxiety were 54.2 and 16.8, respectively. These values suggested that form four science students had low and moderate levels of mathematics anxiety. The number of students who had low mathematics anxiety (43, 21.1%) was higher than the number of those who had high mathematics anxiety (8, 3.9%). The majority of the students had moderate mathematics anxiety (153, 75.0%).

In comparing the three factors in mathematics anxiety, it seemed to show that a relatively low percentage (34, 16.7%) of the total respondents had low anxiety while doing mathematics tests, quizzes and examinations. Indirectly, this implied that students were more anxious in doing mathematics tests, quizzes and examinations than doing other mathematical tasks and assignments. This findings seemed to agree with Suinn *et.al.*, (1988),who believed that primary mathematics anxiety was related to taking mathematics tests for Anglo, Asian and Hispanic American students. A study by Furner (1996) also reported that much of student mathematics anxiety was due to test anxiety.

Mathematics task anxiety reported the largest number of students (105, 51.5%) as having low anxiety and the least number of students (6, 2.9%) as having high anxiety. This implied that slightly more than half of total respondents exhibited low anxiety in

doing everyday mathematical tasks such as completing routine assignments, listening to the teachers' explanations, and doing exercises either in the classroom or at home.

Mathematics comprehension indicated the largest number of students (17, 8.3%) with high mathematics anxiety compared to mathematics test (14, 6.9%) and mathematics task (6, 2.9%). Mathematics comprehension involved the evaluation of the students' understanding and comprehension in certain topics such as in problem solving. The students needed to make judgements and decisions to solve problems and also to face uncertainties. This implied that students would be more anxious when they face uncertain situations compared to the situations when they are sure of themselves.

Findings on the gender differences in mathematics anxiety

To test whether there is no significant difference in mathematics anxiety level between male and female students, the following result was being obtained.

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The result of t-test for differences in mathematics anxiety level between genders

Dependent Variable	Gender	N	Mean	SD	t	df
Overall	male	101	53.0	17.6	-0.99	202
Anxiety	female	103	55.3	15.9		
Math Task	male	101	18.6	9.1	-1.15	202

p
0.32
0.88

(two-tailed)

Anxiety	female	103	18.8	8.8		
Math Test 0.08	male	101	21.4	7.2	-1.74	202
Anxiety	female	103	23.0	6.1		
Math 0.39	male	101	13.0	4.2	-0.85	202
Comprehension Anxiety	female	103	13.5	4.2		

The result of t-test indicated that female students scored a higher mean in mathematics anxiety than male students in overall anxiety, mathematics task anxiety, mathematics test anxiety and mathematics comprehension anxiety. However the difference was not significant between male and female students in overall mathematics anxiety ($t = -0.99$), mathematics task anxiety ($t = -1.15$), mathematics test anxiety ($t = -1.74$) and mathematics comprehension anxiety ($t = -0.85$). Therefore the null hypothesis which stated that there is no significant difference in mathematics anxiety level between male and female students is not rejected.

These findings agreed with the result obtained by Teh (1996) that there is no significant difference in mathematics anxiety scores between the male and the female students although the males indicated a higher mean score than female students. Teo (1997) indicated consistent findings that the gender difference in mathematics anxiety was not significant either, in her study with preservice teachers. Another study by Kor (1997) on 154 form four students also did not indicate significant gender difference in mathematics anxiety.

The findings in this study also agreed with Richardson and Suinn (1972) who found no significant difference between the mean total MARS scores of men and women

college students in a large sample of freshmen and undergraduate education majors. This was further confirmed by Resnick, using a sampling of 1045 freshmen who exhibited a very low level of mathematics anxiety. There was no significant differences in between genders either in the whole sample or within the different courses in which the students had enrolled themselves (Resnick, Viche & Segal, 1982). This implied that students, whether they are male or female, exhibited the same level of mathematics anxiety when dealing with problems in mathematical situations.

Conclusions

The mean score of mathematics anxiety indicated that form four science students have low and moderate levels of mathematics anxiety. This implied that most of the students do not really fear and dread mathematics. This might be due to the fact that form four science students already have a good mathematical background, hence more confidence in the subject.

Students, who were more anxious in mathematics test, implied that most of them have the feeling of fear, dread and apprehension when they think of, prepare for and are involved in the process of having mathematics tests and examinations. This might be due to the fact that the students were not prepared and did not fully understand the mathematical concept. It might also be due to the fact that the students were afraid of failure in tests and in fulfilling the expectations of teachers and parents.

There was no significant difference in mathematics anxiety between male and female students. This is consistent with the earlier findings of Resnick, Viehe and Segal (1982), Richardson and Suinn (1972), Teh (1996), Kor (1997) and Teo (1997). The

narrowing of the gender gap (Meece, Wigfield & Eccles, 1990), the changing role of the female in society and the direction of mathematics anxiety towards an equal opportunity (Aksu & Sagayu, 1988) might explain these findings. Consequently, the traditional belief that mathematics is a male dominated area of study is no longer true. The current trend shows that male and female students are now competing on an equal basis for their future success.

Previous studies had found a significant correlation between mathematics anxiety and mathematics achievements. This implies that alleviating mathematics anxiety will improve mathematics achievements. Low mathematics achievements will lead to mathematics avoidance in the future.

The researcher felt that it is crucial to alleviate mathematics anxiety not only at this level but at all levels. Alleviating mathematics anxiety should begin at the elementary level because at such stage the student might have acquired a fair amount of mathematics anxiety. By the time student started secondary education, the acquisition of mathematics anxiety from elementary level might inhibit or debilitate the ability to solve mathematical problems and exert a negative influence on their attitude towards mathematics at the secondary level. If this continues, our aim to increase mathematics achievement and performance during PMR examinations will not materialize. Without excellent grades in mathematics, students will not be selected for the science classes, hence the basic platform to join certain courses like medical, accounting, engineering and other science and technological courses will be jeopardized. Eventually, our government's effort to increase and prepare a sufficient workforce and knowledgeable workers to cater to the nation's needs will be crippled.

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