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## Students' Attitude Toward Mathematics: The Use of Factor Analysis in Determining the Criteria

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### Abstract

The purpose of this study is to determine the criteria and subcriteria that considered important in measuring students' attitude toward mathematics. Factor analysis was carried out to identify the groups among criterion. There were 746 respondents involved in the survey at UiTM Johor. The targeted respondents are first semester diploma students taking various programs related to business studies. Finding shows that there were five criterion that influenced students attitude toward mathematics namely interest in mathematics, 6 subcriteria for anxiety toward mathematics, 5 subcriteria for self efficacy, 3 subcriteria for extrinsic motivation and 2 subcriteria for students' self concept. From the analysis, it shows that total percentage of variation explained is 58.28% and with 0.888 Cronbach's Alpha reliability test.

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**Keywords:** Factor analysis; Attitudes towards mathematics

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### 1. Introduction

Business Mathematics is a compulsory course for business students in UiTM Johor and taken during the first semester of their academic year. If the students failed any course(s) during the first semester, the students will be burdened throughout their academic year since they have to carry the failed course(s) while continuing with other courses according to the academic planning. Based on recent statistics taken from Academic Affairs Department in UiTM Johor, in December 2008 there are 36 business students (diploma) registered as students who have to extend their study after three years. Out of the 36, 14 (40%) of them failed their Business Mathematics course during their first semester. In April 2007 there were 48 students dismissed from continuing their study. The statistic shows that 36 (75%) of them also fail their Business Mathematics course during the first semester. In October 2007 there were 67 students dismissed and 50 (75%) of them had failed their Business Mathematics course. These two groups of students can be classified as the students that are unable to graduate on time. The first group will incur extra cost as they are in the campus more than they are expected to. The students that were dismissed also incur cost as they are unable to graduate at all. It is also can be considered as time waste as well as money as the diploma students are given privileges such as hostel and food.

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Attitudes towards mathematics can be referred to a positive or negative emotional disposition towards mathematics (McLeod, 1992; Haladyna, Shaughnessy & Shaughnessy, 1983). According to Odell, & Schumacher, (1998), significant gender differences were found in several areas, and attitudes variables were found to be useful in predicting grades. From the previous study, students' achievement in mathematics is affected by several factors such as the environment of the school where it must be favorable (Creemers & Reezigt, 2005), teaching and learning process (Baumert et al., 2005; Opdenakker & Van Damme, 2005; Van de Grift & Houtveen, 2006; Wilms, 1992) and so forth. According to Papanastasiou, 2008, teaching methodology has direct effect on achievements in mathematics and also on the students' attitudes toward mathematics, on class climates, on students' mathematics self – perception, and etcetera. In other words, if it is delivered properly, the students can have a better learning environment. In addition, students whom are benefited more from high quality instruction are self regulated, have strong mathematics backgrounds and had low levels of frustration (Jones & Byrnes, 2006).

There are a lot of other factors affecting student's success in mathematics (Davut Köğçe et al, 2009). According to (Githua & Mwangi (2003), mathematics self-concept is one of the factors that influence students' achievement in mathematics and this factor related to their motivation to learn mathematics. Walter and Hart (2009) noted that students' intellectual-mathematical motivations and social-personal motivations also influence the students' attitudes in learning mathematics. Beside these, mathematics anxiety research among elementary to high school populations showed that it is an influential variable in mathematics education (Birgin et al, 2010). Patterson et al (2003) examined that there are statistically significant effect of gender, student perception of parental opinions, and amount of study time on mathematics attitudes. On the other hand, Yilmaz et al, 2010, by using semi structured interview have found that some other factors affecting students' attitudes towards mathematics are usage of different teaching materials, teachers' classroom management skills, teachers' content knowledge and personality, teaching topics with real life enriched examples, and students' opinion about mathematic courses. The purpose of this study is to determine criterion to determine the criteria and subcriteria that considered important in measuring student attitudes towards mathematics.

## **2. Methodology**

This is a quantitative research conducted using survey method. A structured questionnaire was given to all business students taking Business Mathematics course in UiTM Johor with 21 items to be rated.

### *2.1 Participants*

This research was conducted at UiTM Johor and all of the students (estimated around 1400) taking Business Mathematics have been chosen as the respondents. The respondents have been given a questionnaire through the lecturers, class by class. Out of 1400, only 746 students or 53.28% submitted the completed questionnaire to their lecturer.

### *2.2 Data Collection*

Data was collected using a set of demographic questions and agreement on statements of attitudes toward mathematics questionnaire. A set of questionnaire with twenty-one items with responses gathered on a 5 point Likert scale (see Table 1). Scale 1 is for strongly disagree, scale 2 is for disagree, scale 3 is for neutral, scale 4 is for agree and scale 5 is for strongly agree.

**Table 1: Students attitude toward mathematics questionnaire**

No	Item
1	Studying mathematics make me feel nervous
2	I am always under a terrible strain in a maths class
3	I am able to solve mathematics problem without too much difficulty
4	Mathematics is important in everyday life
5	Mathematics is one of the most important subjects for people to study
6	I have usually enjoyed studying mathematics in school
7	Mathematics is dull and boring
8	I am happier in a maths class than in any other class
9	I would like to avoid using mathematics in college
10	I am willing to take more than the required amount of mathematics
11	I plan to take as much mathematics as I can during my education
12	high school maths courses would be very helpful no matter what I decide to study
13	It would not bother me at all to take more math courses
14	I have usually been at ease during math test
15	I have usually been at ease during math course
16	I usually do not worry about my ability to solve maths problem
17	I almost never get uptight while taking maths tests
18	I get really uptight during math tests
19	I get a sinking feeling when I think of trying hard maths problems
20	My mind goes blank and I am unable to think clearly when working mathematics
21	Mathematics makes me feel uneasy and confused

### 3. Findings

The findings of this study were mainly based on the quantitative data gathered from the respondents using a developed set of questionnaires. Descriptive statistics procedures were adhered to in reporting the findings. All the data gathered were analysed using Statistics Package for Social Science (SPSS).

Table 2 shows the mean value for the Likert scale gathered from the respondent. Based on the table, mean value which is less than 3 has been eliminated from the list of criteria in this study. There is only one criterion that has been eliminated. The mean value which is less than 3 shows that the criteria is not important and do not effect the respondents' attitudes.

**Table 2: Descriptive statistics of students' attitudes toward mathematics**

Criteria	N	Minimum	Maximum	Mean	Std. Deviation
Q1 (recode)	746	0	5	3.39	1.148
Q2 (recode)	746	0	5	3.34	1.037
Q3	746	0	5	3.10	0.890
Q4	746	0	5	4.21	0.970
Q5	746	1	5	4.27	0.918
Q6	746	0	5	3.79	1.044
Q7 (recode)	746	0	5	3.93	1.084
Q8	746	1	6	3.44	1.042
Q9 (recode)	746	0	5	3.70	1.090
Q10	746	0	5	3.13	0.910
Q11	746	0	5	3.27	0.967
Q12	746	0	5	3.65	0.888
Q13 (recode)	746	0	5	2.73	0.897

Q14	746	0	5	3.08	0.738
Q15 (recode)	746	0	5	2.94	0.864
Q16	746	0	5	3.00	0.865
Q17	746	0	5	3.01	0.781
Q18 (recode)	746	0	5	3.04	0.811
Q19 (recode)	746	0	5	3.00	0.919
Q20 (recode)	746	0	5	3.46	1.042
Q21 (recode)	746	0	5	3.58	1.078

Table 3 shows KMO and Bartlett's test. The KMO coefficient in this study is greater than 0.894 and greater than 0.5. This result shows that the factor analysis could be preceded. The Bartlett's test shows significant result too.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.894
Bartlett's Test of Sphericity	Approx. Chi-Square	5524.506
	df	210
	Sig.	.000

The reliability of the instrument had been tested using Cronbach's alpha coefficient. The Cronbach alpha's reliability coefficient for twenty items is 0.803 and greater than 0.67. Cronbach's alpha value for each criterion is 0.783, 0.794, 0.711, 0.748 and 0.790 for interest in mathematics, anxiety towards mathematics, self efficacy, extrinsic motivation and self concept respectively. All the values show this study is reliable and could be preceded.

From Table 4, there are five criteria that have been determined based on the importance of subcriteria selected by the respondents. There are four subcriteria for interest in mathematics, six subcriteria for anxiety toward mathematics, five subcriteria for self efficacy, three subcriteria for extrinsic motivation and two subcriteria for students' self concept. The weight factor 0.45 in factor analysis has been used to determine the criteria. The five identified criterion shows that the total percentage of variation explained is 58.284%.

Table 4: Criteria Analysis with VARIMAX Rotation towards Important Criteria and Reliability Coefficient

Subcriteria and Important Criteria	Weight	Eigen Values	Percentage of explanation of variation
<b>Criterion 1 – interest in mathematics</b> ( $\alpha=0.783$ )		6.609	31.471
I have usually enjoyed studying mathematics in school	0.473		
Mathematics is dull and boring	0.713		
I am happier in a maths class than in any other class	0.711		
I would like to avoid using mathematics in college	0.684		

<b>Criterion 2 - anxiety toward mathematics</b> ( $\alpha=0.794$ )	1.777	8.464
Studying mathematics make me feel nervous	0.531	
I am always under a terrible strain in a math's class	0.621	
I get really uptight during math tests	0.592	
I get a sinking feeling when I think of trying hard math's problems	0.709	
My mind goes blank and I am unable to think clearly when working mathematics	0.709	
Mathematics makes me feel uneasy and confused	0.630	
<b>Criterion 3 - self-efficacy</b> ( $\alpha=0.711$ )	1.690	8.048
I am willing to take more than the required amount of mathematics	0.685	
I plan to take as much mathematics as I can during my education	0.588	
It would not bother me at all to take more math courses	0.495	
I usually do not worry about my ability to solve math's problem	0.615	
I almost never get uptight while taking math's tests	0.538	
<b>Criterion 4 - extrinsic motivation</b> ( $\alpha=0.748$ )	1.158	5.516
Mathematics is important in everyday life	0.871	
Mathematics is one of the most important subjects for people to study	0.853	
High school maths courses would be very helpful no matter what I decide to study	0.505	
<b>Criterion 5 - self-concept</b> ( $\alpha=0.790$ )	1.005	4.784
I have usually been at ease during math test	0.814	
I have usually been at ease during math course	0.817	
<b>Total Cronbach's alpha coefficient (<math>\alpha=0.888</math>)</b>		
<b>Total percentage of variation explained is 58.284%</b>		

#### 4. Conclusion

As a conclusion, factor analysis can be used to determine the important criteria in students' attitudes towards mathematics. The determined criterion are very useful for the teachers in order to measure students' attitudes at the beginning of the semester. It can also help teachers to use variety of techniques to deal with students with negative attitudes. Further study can be conducted on how attitude toward mathematics affects students' achievement in the class and whether it can be used to predict students' performance in the course.

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