



## Influence of Demographic Factors on Students' Beliefs in Learning Mathematics

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### Abstract

Learning mathematics has been recognized by many as important. It does not only develop students' ability to think in quantitative terms but can also enhance skills such as analytical and problem solving skills. However, to enable us to tell our students how important mathematics is we have to understand students' beliefs in learning mathematics so as to find ways to improve students' performance in mathematics. The aim of this study is to examine the relationship between business students' beliefs in learning mathematics and demographic factors. Data were collected from three hundred and seventy six students in three higher learning institutions enrolled in business mathematics class. Descriptive statistics will be used to describe the sample and Pearson chi-square test will be used to test students' beliefs and the relationship between students' beliefs and demographic factors (gender, institutions, previous mathematics grade, secondary education and major). Our results suggest that students' beliefs are positive and significant in learning mathematics. Using Pearson chi-square test, generally the results suggest that there are significant differences in means between students' beliefs based on institutions and mathematics grade. In addition, we find that overall there are no significant differences in means between beliefs based on gender, secondary education and major.

**Keywords:** Beliefs, Mathematics, Business Students

### 1. Introduction

As everyone agrees, learning mathematics is beneficial. Accordingly, one is able to develop abilities to think in quantitative terms and enhance students' skills in analysis and problem solving. Yet, nobody really bothers what makes people believe that mathematics is one of the difficult and uninteresting subjects. With the help of technical ways and means as well as innovative approaches in teaching mathematics, we believe that mathematics can be of interest and creative as well. However, to enable us to develop the right approach, we first have to investigate what are the students' beliefs in learning mathematics and what are the factors that affect their beliefs.

Therefore, we take this initiative to investigate students' beliefs in learning mathematics and whether demographic factors do influence their beliefs.

The paper is structured as follows. The next section, Section 2 outlines the literature review, while Sections 3 and 4 discuss the data and methodology used in the study. Section 5 presents the findings and Section 6 concludes.

### 2. Literature Review

A positive attitude is considered as one of the most valuable tools in learning mathematics because any task attempted is vastly influenced by one's attitude towards it. A person who believes that performing a given behavior will lead to mostly positive outcomes will hold a favorable attitude towards performing the behavior where as a person who believes that performing the behavior will lead to mostly negative outcomes will hold an unfavorable attitude (Ajzen, 1988).

Kloosterman and Stage (1992) measure beliefs about mathematical problem solving using five beliefs scales; I can solve time-consuming mathematics problems, there are word problems that cannot be solved with simple, step-by-step procedures, understanding concept is important in mathematics, word problems are important in mathematics, and effort

can increase mathematical ability. They found that these scales were useful tools for researchers and instructors. Consistent with this, as reported by Ajzen (1988) in McLeod (1992) has suggested that positive affect might lead to positive achievement. McLeod has categorized beliefs towards mathematics into four categories; beliefs about the nature of mathematics, beliefs about self in learning mathematics, beliefs about the role of teachers in learning mathematics and beliefs about socio context.

Beliefs are also seen to be closely related to learning (Kloosterman and Stage, 1992) and also academic achievement (Purvis, 2000). Kloosterman, Raymond and Emenaker (1996) reported that increasing a student's belief that mathematics is useful will often increase motivation and thus achievement. They indicated that certain beliefs result in high motivation where as other beliefs diminish motivation. To explain how motivation improves learning is not an easy task. But there is a considerable amount of research done on understanding how motivation relates to academic achievement (see for example, Tahir and Nor Mazlina, 2005).

Most studies on students' beliefs focus on students at elementary level (for example, Kloosterman, Raymond and Emenaker 1996; Vanayan, White, Yuen and Teper 1997) middle school (Purvis, 2000). and secondary level (Lazim Abu Osman and Wan Salihin 2004; Kadriye, 2005), but very little on students at tertiary level (McLemore, 2004). As a result of the shift in teaching and learning mathematics and the use of technology in mathematics instruction at lower levels of education (primary and secondary), it is an important concern to investigate the university students' beliefs towards mathematics.

Kloosterman, Raymond and Emenaker (1996) did a three year study involving students at elementary level to examine changes in their beliefs in learning and doing mathematics. They found out that students have a narrow conception of the usefulness of mathematics, their perspectives on the value of group versus individual work reflected the variety of classrooms environments to which they had been exposed, and they had fairly accurate conceptions of their own achievement, and most had a tendency to like mathematics more as it became harder.

Carter and Norwood (1997) examined the relationship between teachers' and students' beliefs about mathematics. Results from the study indicated that the students of the teachers whose beliefs were in alignment with the NCTM Standards had significantly different beliefs about factors that lead to success in mathematics than did other students. Students felt that interest, effort and striving for understanding would help one to do well in mathematics. It is evident that what the teacher does in classroom influences students' beliefs about mathematics. It is also evident that what teachers believe about mathematics influence what they do in the classroom and that their beliefs may be translated into students' beliefs.

Purvis (2000) looked at the relationship between students' attitude towards mathematics and their performance. By grouping students (middle school) according to response towards mathematics (negative, neutral or positive) and calculating the academic average for each group, a positive relationship is found between self-perceived academic performance and academic average. A positive relationship is also found between student's self perceived academic performance and their liking for mathematics.

A survey on students' habits was conducted by Cerrito (2000), using a cluster sampling of all entry level courses. Students were asked to write a one week diary listing times of study, work and leisure activities. The diary results were compared to results of the survey and found to correlate highly. It was found that students have tremendous leeway in their leisure activities, and do have sufficient time available to study mathematics. However, students are choosing not to utilize their time. In addition, it was determined that regular collection and grading of homework is highly correlated with increased study time in mathematics. In another study by Lazim Abu Osman and Wan Salihin (2004), four factors were identified; teacher and learning, usefulness, competency and excellence, in the components of beliefs. Students hold strong beliefs that the teachers play a major role in contributing to their interest in mathematics. They also found that 'drill and practice' is a very important element in learning mathematics.

A study by McLemore (2004) analysed students' perspectives on their learning and mathematics anxiety by using notebooks in a mathematics classroom. Students responded with overwhelmingly positive comments on the use of the notebooks, demonstrating an ability to use the journal as a productive instrument in a problem-oriented classroom. They used the journal as means of discourse with themselves and the teacher, and in so doing recreated their own understanding of the nature of mathematics. The positive results demonstrate that reflection is a valuable way to enhance students' understanding of and appreciation for mathematics.

Leedy, Lalonde and Runk (2003) found persistence in the belief that mathematics is a male domain. Even in a sample of students chosen for their interest and aptitude in mathematics, the girls have less confidence in their abilities and view their mothers as having lower expectations of their success in mathematics. Also, parental differences were noted, with the mothers frequently focusing on the use of mathematics for computational task, while the fathers more frequently discuss. Skaalvik and Skaalvik (2004) explored gender differences in self-perceived abilities and motivation in mathematics and verbal arts. In all samples male students had significantly higher math self-concept than female

students did. Male students also had significantly higher performance expectations and intrinsic motivation interest for mathematics than female students in the grade and among adult students.

Kadriye (2005) used an exploratory study examining factors that might be associated with achievement in mathematics and participation in advanced courses in various countries. Confidence in mathematics was the strongest predictor of achievement for students from Canada and Norway, where as for the students from the USA, parents' highest education level was the highest predictor of achievement. Schommer-Aikins, Duell and Hutter (2005) examined the structure of middle school students' general epistemological beliefs and domain-specific mathematical problem-solving beliefs to 1,269 students in the Midwest of US. They found that epistemological beliefs are linked to mathematical problem-solving beliefs.

### 3. Data

This study is conducted to examine students' beliefs in learning mathematics. The research was undertaken at three different higher institutions in the East Coast of Malaysia and was done under the university grant. Questionnaires were distributed among the students from Business Mathematics classes enrolling in May session 2005 and November session 2005/06. Students were randomly selected using the convenience sampling method. A total of 376 students (100 male and 276 female) participated. Students were from KUSZA (42 percent), Kolej Yayasan Terengganu (KYT) (53.3 percent) and University Technology MARA (UiTM) (44.7 percent). The majority of students (52.4 percent) reported obtain grade A, 30 percent with grade B, 15.2 percent with grade C and the rest, 2.4 percent with grade D, in mathematics at secondary level. The majority of students (68.4 percent) had a secondary education at National secondary schools, 18.4 percent from Islamic schools, 5.6 percent from Chinese secondary schools and 7.7 percent from schools with technical background. Of these, 27.7 percent are majoring in Accounting and the rest 73.3 percent are business related course (non-accounting).

### 4. Methodology

The questionnaire was adopted from Lazim, Abu Osman and Wan Salihin (2004). Instead of taking all the 19 items as suggested by Lazim, Abu Osman and Wan Salihin (2004), we selected only 17 statements pertaining to students' beliefs towards learning mathematics. These items were measured using a 5-point, Likert-type format with the following anchors: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree and 5 = strongly disagree.

A frequency distribution was used to describe the items used in the survey. Mean was used to describe the level of agreement among the statements asked. Finally, Pearson  $\chi^2$  tests procedures were applied to the data set to test whether the mean of the students' beliefs differ by gender, institutions, mathematics grade at secondary level, secondary education and major.

### 5. Findings

#### 5.1 Descriptive Statistics

Table 1 presents the descriptive statistics for all the items under investigation.. The results showed that all the items are positive and significant at  $<0.01$ . This finding is consistent to Lazim Abu Osman and Wan Salihin (2004).

#### 5.2 Level of Agreement

The respondents were asked to express the extent of their agreement with the statements about students' beliefs in learning mathematics. A summary of their level of agreement is presented in Table 2 below.

Looking from Table 2 below, 89 percent of the students agreed or strongly agreed that "I believe 'drills and practice' is one of the best ways of learning mathematics" was a key factor in their beliefs while 87 percent agreed or strongly agreed that "good mathematics teachers spark my interest in mathematics" and "mathematics is a challenging subject", were important. This is followed by 86 percent of those believed that "teacher gives encouragement to work harder". A total of 85 percent of the respondents believed that "mathematics is important in real life". Statements like "mathematics is considered as one of the difficult subjects", showed 62 percent and "I have been doing well in mathematics" showed the least important (52 percent).

#### 5.3 Students' Beliefs and Demographic Factors

To examine the relationship between students' beliefs and demographic factors of the respondents (gender, institutions, mathematics grade, secondary education and major),  $\chi^2$  was computed. This test was used to see whether there were any significant differences in response, since there were different groups involved in the study. The results are shown in Table 3.

The reported  $\chi^2$  showed that as an overall, there were significant differences in means between students' beliefs based on institutions and mathematics grade. However, our results indicated that there were no significant differences in means between students' beliefs based on gender, secondary education and major.

## 6. Conclusion

Based on the work of Lazim, Abu Osman and Wan Salihin (2004), this study was undertaken to examine business students' beliefs in learning mathematics.

Our study indicates that business students hold positive beliefs in learning mathematics. This is consistent to that found by Lazim, Abu Osman and Wan Salihin (2004). We conclude that students appreciate the subjects and hold positive beliefs in learning mathematics. This implies that teachers could think of the various ways so as to make their teaching approach innovative and interesting.

Analysis of variance and  $\chi^2$  were also performed to test whether the mean of the students' beliefs differ by gender, institutions, mathematics grade, secondary education and major. Our results indicated that there were significant differences in means between students' beliefs based on institutions and mathematics grade and there were no significant differences in means between beliefs based on gender, secondary education and major. This would imply that students coming from the same institutions and mathematics grade do differ in terms of their beliefs toward mathematics.

Further research is recommended to study these differences in details how far these beliefs differ among students.

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Table 1. Descriptive Statistics of the Students' Beliefs in Learning Mathematics

Item	Mode	Mean	SD	t-test
I have been doing well in mathematics	3.00	2.407	0.865	53.94**
I have been interested in mathematics since primary school	2.00	2.197	1.009	42.24**
Good mathematics teachers spark my interest in mathematics	1.00	1.694	0.769	42.71**
I still remember well my good mathematics teachers	1.00	1.676	0.820	39.60**
Teacher gives encouragement to work harder	2.00	1.774	0.700	49.14**
My teacher contributed to my interest in mathematics	2.00	1.971	0.791	48.31**
Mathematics is a field of manipulating numbers and symbols	2.00	2.035	0.880	44.82**
Mathematics is important in real life	1.00	1.657	0.814	39.45**
Mathematics is a way of thinking using symbols and equations	2.00	1.955	0.820	46.22**
Mathematics is considered as one of the difficult subjects	2.00	2.372	1.115	41.27**
Mathematics is a challenging subject	1.00	1.678	0.817	39.85**
I believe 'drills and practice' is one of the best ways of learning mathematics	1.00	1.444	0.728	38.46**
Mathematics provide foundation for applied sciences	2.00	2.077	0.824	48.87**
I like mathematics	1.00	2.037	1.009	39.17**
Mathematics enables men to understand the world better	3.00	2.508	0.929	52.32**
My lecturer really wants us to enjoy learning	2.00	1.872	0.813	44.66**
My lecturer appreciates it when I tried hard	2.00	1.915	0.866	42.87**

**Note:** SD = standard deviations, One-sample t-test, \*\* significant at <0.01

Table 2. Beliefs in Mathematics (Level of Agreement)

Statements	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Rank
	freq	%	freq	%	freq	%	freq	%	freq	%	
I have been doing well in mathematics	58	15.4	140	37.2	149	39.6	25	6.6	4	1.1	16
I have been interested in mathematics since primary school	111	29.5	125	33.2	100	26.6	35	9.3	5	1.3	14
Good mathematics teachers spark my interest in mathematics	173	46.0	156	41.5	38	10.1	7	1.9	2	0.5	2
I still remember well my good mathematics teachers	191	50.8	129	34.3	46	12.2	7	1.9	3	0.8	6
Teacher gives encouragement to work harder	141	37.5	182	48.4	50	13.3	3	0.8	0	0	4
My teacher contributed to my interest in mathematics	108	28.7	184	48.9	73	19.4	9	2.4	2	0.5	9
Mathematics is a field of manipulating numbers and symbols	122	32.4	135	35.9	104	27.7	14	3.7	1	0.3	13
Mathematics is important in real life	195	51.9	128	34.0	43	11.4	7	1.9	3	0.8	5
Mathematics is a way of thinking using symbols and equations	121	32.2	163	43.4	82	21.8	8	2.1	2	0.5	10
Mathematics is considered as one of the difficult subjects	88	23.4	145	38.6	74	19.7	53	14.1	16	4.3	15
Mathematics is a challenging subject	185	49.2	144	38.3	33	8.8	11	2.9	3	0.8	3
I believe 'drills and practice' is one of the best ways of learning mathematics	255	67.8	81	21.5	35	9.3	4	1.1	1	0.3	1
Mathematics provide foundation for applied sciences	96	25.5	170	45.2	98	26.1	9	2.4	3	0.8	12
I like mathematics	135	35.9	134	35.6	72	19.1	28	7.4	7	1.9	11
Mathematics enables men to understand the world better	57	15.2	121	32.2	156	41.5	34	9.0	8	2.1	17
My lecturer really wants us to enjoy learning	134	35.6	171	45.5	58	15.4	11	2.9	2	0.5	7
My lecturer appreciates it when I tried hard	133	35.4	161	42.8	69	18.4	7	1.9	6	1.6	8

Table 3. Students' Beliefs and Demographic Factors (Pearson one-way ANOVA)

Items	Gender		Institutions		Mathematics Grade		Secondary education		Major	
	$\chi^2$	Sig.	$\chi^2$	Sig.	$\chi^2$	Sig.	$\chi^2$	Sig.	$\chi^2$	Sig.
I have been doing well in mathematics	3.467	0.483	34.843	0.000	75.634	0.000	21.736	0.041	5.012	0.286
I have been interested in mathematics since primary school	0.855	0.931	6.877	0.550	62.167	0.000	10.110	0.606	5.073	0.280
Good mathematics teachers spark my interest in mathematics	8.769	0.067	8.606	0.377	16.008	0.191	12.568	0.401	1.202	0.878
I still remember well my good mathematics teachers	6.336	0.175	3.177	0.923	20.831	0.053	6.121	0.910	3.134	0.536
Teacher gives encouragement to work harder	2.717	0.437	2.822	0.831	8.104	0.524	8.783	0.458	3.100	0.377
My teacher contributed to my interest in mathematics	5.060	0.281	23.375	0.003	27.666	0.006	9.399	0.668	2.732	0.604
Mathematics is a field of manipulating numbers and symbols	4.382	0.357	40.732	0.000	21.273	0.047	10.289	0.591	10.310	0.036
Mathematics is important in real life	6.117	0.191	17.542	0.025	17.250	0.140	13.571	0.329	2.030	0.730
Mathematics is a way of thinking using symbols and equations	2.044	0.728	24.532	0.002	18.501	0.101	6.191	0.906	1.727	0.786
Mathematics is considered as one of the difficult subjects	6.521	0.163	26.880	0.001	17.246	0.141	6.676	0.878	6.438	0.169
Mathematics is a challenging subject	7.359	0.118	9.841	0.276	12.041	0.442	20.196	0.063	4.695	0.320
I believe 'drills and practice' is one of the best ways of learning mathematics	5.095	0.278	31.220	0.000	17.918	0.118	4.255	0.978	14.397	0.006
Mathematics provide foundation for applied sciences	4.649	0.325	21.197	0.007	24.761	0.016	14.339	0.280	4.669	0.323
I like mathematics	0.967	0.915	4.762	0.783	67.225	0.000	13.889	0.308	0.444	0.979
Mathematics enables men to understand the world better	7.510	0.111	36.070	0.000	15.671	0.207	14.841	0.250	1.204	0.877
My lecturer really wants us to enjoy learning	3.575	0.467	14.074	0.080	11.131	0.518	5.312	0.947	11.911	0.018
My lecturer appreciates it when I tried hard	4.682	0.322	9.800	0.279	18.736	0.095	8.802	0.720	2.175	0.704