



ANALYSIS OF UNDERGRADUATE MANAGEMENT STUDENTS' ATTITUDE TOWARDS MATHEMATICS

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ABSTRACT :

The study aims to understand how certain different yet interrelated variables such as gender and educational background like stream opted in higher secondary school, place of study (India/foreign) and mathematics opted or not in higher secondary school could lead to an explanation of student attitude towards mathematics in terms of its usefulness, confidence and appreciation and enjoying the subject. In order to understand the differences in the attitude of students towards mathematics, the study was conducted among college students from diverse educational backgrounds; thereby, supporting the generalizability of the findings. The differences in the attitude were analyzed by conducting independent samples t-test which revealed the existence of statistically significant differences in the attitude among the groups with respect to gender, stream chosen in higher secondary school, place of study (India/foreign) and mathematics opted or not in higher secondary school. The study results throw light on what motivates students' choice of program at the Undergraduate level. The differences reflected in the results among the variables would propel educators at the tertiary level, offering management programs to model the curriculum keeping in mind students' attitude and orientation towards mathematics. Also, the result would further reinforce the necessity for developing effective practices, strategies and interventions to make the management students more receptive to the mathematics course which would implicitly strengthen their pursuit of the program.



KEYWORDS : Gender Differences, Higher Secondary School, Mathematical Skills.

INTRODUCTION

Students' interest in a subject is a significant outcome of any educational process and is considered an important element regarding the younger generation's preparedness for living in a knowledge-based society (Krapp & Prenzel, 2011). Students' competence is usually measured in terms of their performance and academic achievement. In higher educational setting this becomes more complex and generally, the intelligence is associated with being adept in mathematical skills. Students' interest in mathematics determines their willingness to opt for STEM (Science Technology Engineering and Mathematics)-related career choices. Students pursuing business studies also require mathematical skills to perform marketing and accounting based study (Stenberg, Varua & Yong, 2010). Statistical skills are important in the field of psychology and economics. Occupations such as actuaries, mathematicians (cryptologist), operations research analysts, statisticians, etc. requires advance mathematical knowledge and problem solving skills (Torpey, 2012). Thus, proficiency in mathematics is considered a precursor to success in the modern society.

Students' interest or attitude in a subject is an important determinant of their success in the subject. Attitude could be either positive or negative. While positive attitude towards mathematics refers to the reflection of a positive emotional disposition regarding the subject, negative attitude towards the subject represents a negative emotional disposition (Zan & Di Martino, 2007). Such attitude towards the subject has an influence on the students' choice of higher education and career. The current study therefore proposes to analyze the attitude of students towards mathematics and the differences in their attitude and attitudes with respect to gender, stream chosen in higher secondary school, place of study (India/foreign) and mathematics opted or not in higher secondary school.

In the past few decades, though there has been an increase in female students registering for higher studies and outperforming male students in different disciplines, women are still under represented in mathematics-intensive fields like Engineering, Mathematics, Science, etc. globally. From the beginning of higher secondary school and college, various socio-cultural factors influence the attitude of mathematical and scientific capabilities among men and women. According to Wang and Degol (2017) sum of biological and socio-cultural factors together lead to interplay between different deciding factors like absolute, relative and field-specific ability, career choice, lifestyle and gender stereotypes and bias which discourages the women to consider a career in math-intensive field. However, some researchers have commented that aptitude in math and science is not gender related (Spelke, 2005). According to Spelke (2005), a male and female child has the same aptitude for mathematics and science, but in later stages choosing mathematics field as a career is largely influenced by socio-cultural factors.

Gender differences in terms of achievement in mathematics and attitude towards mathematics have also been observed by Else-Quest, Hyde and Linn (2010). Their study reported that the gender differences in math achievement can be attributed to the quality of instruction and curriculum. Education system of the school has also been reported to have a significant influence on the math achievement of students. In 2003, International Association for the Evaluation of Educational Achievement (IEA) conducted analysis on self-motivation of eighth graders girls and boys in learning mathematics. They found that though the overall performance of girls in mathematics content such as number, algebra and data were high but the boys exhibited higher self-confidence level. The boys took extra lessons in math and tried to understand the subject by looking up for ideas and information (Ismail & Awang, 2008).

The mathematical abilities of children have been found to be country-specific by Torbeyns, Schneider, Xin and Siegler (2015). The study observed that the fraction knowledge of students is different among children from different countries. Sapienza and Zingales (2008) reported that the attitude towards math depends on the culture of nation where the women and men are treated equally. In countries like Sweden and Norway, where gender equality is boosted, the stereotypical attitude that women are biologically inferior at mathematics received negative results suggesting that rather than biology, sometimes the cultural bias contributes to the gender gap in math. Similarly, Chiu and Xihua (2008) also observed that students' mathematics achievement, interest and feelings of self-efficacy varied with respect to the resources and culture values across different countries.

Most of the existing studies on mathematical aptitude and attitude towards mathematics have analyzed only the gender differences. However, there is a dearth of systematic research to analyze the cross-national differences and the differences with respect to educational background on the attitudes of students towards mathematics. The current study proposes to address this research gap by empirically analyzing the differences in the attitude of students with respect to gender and educational background (stream chosen in higher secondary school, place of study (India/foreign) and mathematics opted or not in higher secondary school).

OBJECTIVES OF THE STUDY

- To find out the attitude of the undergraduate management students towards mathematics.
- To find out the significant differences in the attitude of undergraduate management students towards the usefulness of mathematics.
- To find out the significant differences in the attitude of undergraduate management students with respect to confidence in mathematics.
- To find out the significant differences in the attitude of undergraduate management students on enjoying mathematics.

HYPOTHESES

1. There is no significant difference in the attitude towards usefulness of mathematics between different groups of students.
2. There is no significant difference in the attitude with respect to confidence in mathematics between different groups of students.
3. There is no significant difference in the attitude on enjoying mathematics between different groups of students.

METHODOLOGY

The study adopted a positivistic research philosophy and relied on statistics to explore the differences in the students' attitude towards mathematics. A quantitative research design was chosen; wherein, a survey questionnaire was used for collecting data. The study participants included 342 students who studied in different schools in Bangalore, India and from other countries and are currently pursuing Undergraduate Management Programme in a college in Bangalore, India. Thus, the study participants were from a wide range of economic and cultural backgrounds. The sample population was selected using purposive sampling technique. In order to measure the students' attitude towards mathematics, the Mathematics Attitude Scale (MAS) developed and standardized by Ali Imam and Tahira Khatoon (2008) was used in the study. The level of attitude towards mathematics was computed using z score as described in the standardized Mathematics Attitude Scale. According to the z-Score norms prepared by the authors, z-Score values above and equal to +2.01 signify extreme favoritism (A) towards mathematics, while values below and equal to -2.01 show extremely poor favoritism towards mathematics (G). The z-Score values ranging from -0.50 to +0.50 showed average/ moderate favoritism towards mathematics (A).

FINDINGS OF THE STUDY

A) Students' Attitude towards Mathematics

The respondents' level of attitude towards mathematics was interpreted with the help of z-Scores as discussed under the Methodology section. It can be seen from the Table 1 that a majority of the participants (n=250) showed extremely poor to moderate levels of favoritism towards mathematics. It was observed that more than half of the study population showed only moderate to below average level of attitude towards mathematics. It is also worthwhile to note that nearly 30% of the participants (n=32) reported extreme to below average levels of attitude towards mathematics. Thus, it can be observed that management student's attitude towards mathematics is unfavourable.

Table 1: Students' Attitude towards Mathematics

	Frequency	Percentage
Extremely favourable	6	1.8
Highly favourable	28	8.2
Above average favourable	58	17
Moderate favourable	140	40.9
Below average favourable	78	22.8
Highly unfavourable	23	6.7
Extremely unfavourable	9	2.6
Total	342	100

B) Attitude towards Usefulness of Mathematics

The differences in the attitude of students towards the usefulness of mathematics were tested using the following hypothesis.

Hypothesis 1: There is no significant difference in the attitude towards usefulness of mathematics between different groups of students.

The differences in the attitude of students towards the usefulness of mathematics were tested by conducting independent samples t-tests (Table-2). It has been found that male students had a statistically significant higher attitude about the usefulness of mathematics (3.31 ± 0.83) when compared to that of the female students (2.65 ± 0.83), $t=6.787$, $p<0.05$. The study found that students who opted for commerce stream in higher secondary school had a statistically significant lower attitude towards the usefulness of mathematics (3.01 ± 0.88) compared to those who opted for science in higher secondary school (3.61 ± 0.71), $t=5.304$, $p<0.05$. A statistically significant difference in the attitude towards usefulness of mathematics has been observed among Indian and foreign students. Indian students have been found to have a statistically significant lower attitude towards usefulness of mathematics (3.07 ± 0.87) when compared to foreign students (3.51 ± 0.97), $t=2.268$, $p=0.024$. Further, this study also found that students who studied mathematics in higher secondary school had a statistically significant higher attitude towards usefulness of mathematics (3.74 ± 0.67) when compared to those who did not study mathematics in higher secondary school (2.82 ± 0.82), $t=10.868$, $p<0.05$. Thus, the hypothesis is rejected in the case of gender, stream chosen in higher secondary school, place of study (India/foreign) and mathematics opted or not in higher secondary school.

Table 2: Differences in the Attitude towards Usefulness of Mathematics

Group	N	Mean	SD	t	Sig. (2-tailed)
Gender	Male	233	3.313	6.787	0.000
	Female	109	2.656		
Stream	Commerce	291	3.014	5.304	0.000
	Science	51	3.612		
Place	India	320	3.075	2.268	0.024
	Foreign	22	3.515		
Studied Mathematics	Yes	105	3.740	10.868	0.000
	No	237	2.822		

C) Attitudes with respect to Confidence in Mathematics

The attitude of students with respect to confidence in mathematics was analyzed using the following hypothesis. The hypothesis was tested by conducting independent samples t-test (Table-3).

Hypothesis 2: There is no significant difference in the attitude with respect to confidence in mathematics between different groups of students.

The study observed that male students had a statistically significant higher levels of confidence in mathematics (3.90 ± 0.76) when compared to female students (3.64 ± 0.91), $t=2.635$, $p<0.05$. Similarly, it was observed that students who opted for commerce in higher secondary school had a statistically significant low confidence levels in mathematics (3.75 ± 0.85) when compared to students who opted for science in higher secondary school (4.19 ± 0.49), $t=5.073$, $p<0.05$. However, the study could not observe statistically significant difference in the attitude with respect to confidence in mathematics among the Indian students (3.82 ± 0.82) and foreign students (3.84 ± 0.77), $t=0.111$, $p>0.05$. This study also observed that students who studied mathematics in higher secondary school were significantly more confident about mathematics (4.12 ± 0.68) compared to those who did not study mathematics in higher secondary school (3.69 ± 0.84), $t=4.943$, $p<0.05$. The hypothesis is rejected in the case of gender, stream pursued in higher secondary school and mathematics opted or not in higher secondary school. The hypothesis is accepted in the case of the place from where the student hails.

Table 3: Differences in the Attitude with respect to Confidence in Mathematics

Group		N	Mean	SD	t	Sig. (2-tailed)
Gender	Male	233	3.907	0.762	2.635	0.009
	Female	109	3.642	0.914		
Stream	Commerce	291	3.759	0.851	5.073	0.000
	Science	51	4.191	0.494		
Place	India	320	3.821	0.826	0.111	0.913
	Foreign	22	3.841	0.778		
Studied Mathematics	Yes	105	4.119	0.684	4.943	0.000
	No	237	3.6920	0.845		

D) Attitude on Enjoying Mathematics

In order to examine the differences in the attitude of students on enjoying mathematics, the following hypothesis was stated and tested.

Hypothesis 3: There is no significant difference in the attitude on enjoying mathematics between different groups of students.

Independent samples t-test was conducted to analyze the differences in the attitude of students on enjoying mathematics. The study observed that male students perceived to enjoy mathematics more (3.80 ± 0.90) when compared to female students' (3.39 ± 1.11), $t=3.34$, $p<0.05$. Similarly, a statistically significant difference ($t=4.158$, $p<0.05$) were also observed among the students who opted for commerce (3.59 ± 0.99) and science (4.12 ± 0.81) in higher secondary school. The study also showed that there existed no statistically significant difference among the Indian students (3.66 ± 0.99) and foreign students (3.77 ± 0.99) in their attitude on enjoying mathematics ($t=0.488$, $p>0.05$). The study also observed that students who studied mathematics in higher secondary school had a statistically significant higher attitude on enjoying mathematics (3.90 ± 0.84) compared to students who did not study mathematics in higher secondary school (3.57 ± 1.03), $t=3.14$, $p<0.05$ (as indicated in Table 4). The hypothesis is rejected in the case of gender, stream pursued in higher secondary school and mathematics opted or not in higher secondary school. The hypothesis is accepted in the case of the place from where the student hails.

Table 4: Differences in the Attitude on Enjoying Mathematics

Group		N	Mean	SD	t	Sig. (2-tailed)
Gender	Male	233	3.803	0.900	3.343	0.001
	Female	109	3.394	1.116		
Stream	Commerce	291	3.593	0.998	4.158	0.000
	Science	51	4.127	0.818		
Place	India	320	3.665	0.992	0.488	0.630
	Foreign	22	3.773	0.997		
Studied Mathematics	Yes	105	3.905	0.847	3.148	0.002
	No	237	3.570	1.033		

DISCUSSION

The present study observed that management students have extremely unfavourable to moderately favourable level of attitude towards mathematics. This supports the stance put forward by researchers like Aromolaran, Karim, Ikegwu, Okoroafor, et al. (2014) and Singh, Misra and Srivastava (2017) who also observed and reported low inclination of management students toward mathematics. Gender difference in educational choices is well-documented by various researchers in the past. The gender differences observed in the current study regarding the educational choices of higher secondary school students is in concurrence with the previous findings made by Buser, Niederle and Oosterbeek (2014) in their study on "gender, competitiveness and career choices." Similar findings were also reported by Reuben, Wiswall and Zafar, (2017), and Ayalon (2003) who observed gender differences in the choice of field in higher education. Though, research interest in exploring the gender-gap in students' attitude towards mathematics courses in higher secondary school has narrowed in recent decades, very few studies exists that explore the gender differences in the confidence levels of students in mathematics and their attitude towards enjoying mathematics. Our findings have been found to be similar to the previous findings made by Watt, Shapka, Morris, Durik, et al. (2012) who also identified gender differences in the intrinsic values students held for mathematics. Gender differences in the attitude towards mathematics has also been observed and reported previously by Else-Quest, Hyde and Linn (2010), who stated that boys exhibited more positive attitude towards mathematics.

The study provides an international perspective on mathematics by examining the differences in the attitude towards mathematics among Indian students and students from other countries. In contrast to the previous research findings that reported cross-national variability in students' attitude towards mathematics, the current study identified no significant differences among Indian students and the students from other countries in their attitude towards mathematics. While there are a number of studies that discuss gender differences in the attitude towards mathematics and students' achievement in mathematics, studies dealing with difference in the attitude towards mathematics with respect to the streams chosen in higher secondary school are highly limited. Further, there is also a limitation of studies looking into the differences in the values held by the students in terms of its usefulness and confidence, with respect to whether or not they had a strong mathematical foundation laid in higher secondary school. The current study, therefore, is a novel attempt in this regard as it analyzes the differences in the students' attitude towards mathematics based on their educational background in higher secondary school.

CONCLUSION

The results of the study showed that management students showcased extremely unfavourable to moderately favourable level of attitude towards mathematics. The study also identified statistically significant differences in the attitude of students towards mathematics in terms of usefulness, enjoying and having confidence in mathematics. Significant differences were observed between groups who opted for

commerce and science streams in higher secondary school and between those who had and did not have any exposure to mathematics in higher secondary school. However, the study results showed that Indian students and foreign students' attitude regarding their confidence in mathematics and enjoying the subject were similar. The study findings signal the need for future work to examine the interaction of gender and mathematics achievement and the interaction of educational background in higher secondary school and attitude towards mathematics. Further probe into the factors that define the relationships between mathematics achievement and these differences in the attitude must be carried out in future. Most importantly, the unfavourable level of attitude exhibited by the management students towards mathematics calls for the development of new and effective strategies and practices to make mathematics interesting for them.

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