



Gender Differences in Mathematics Performance among Undergraduate Engineering Students: The Case of Bahir Dar University

Baynesagn Mekonnen¹ and Yimer Lebesse²

¹⁻²Ethiopian Institute of Textile and Fashion Technology

Bahir Dar University

Ethiopia

ABSTRACT

In all developing countries like Ethiopia, mathematics education plays an important role for the future. For an all-round contribution, there is a need to involve both men and women in mathematical knowledge. This study focused on the gender differences in Performance in mathematics among undergraduate engineering students. The study emphasized on the influence of gender on students' mathematics performance. This study examined gender differences in the performance of undergraduate engineering students in mathematics in Bahir Dar University. A sample of 236 students of which 158 males and 78 females were conveniently selected from first-year undergraduate engineering students in which the researchers were assigned to teach. The design for the study was a descriptive survey. In the study, students' performance in mathematics for engineering students' scores were collected directly from the office of the registrar, Bahir Dar University and were analyzed using the t-test using SPSS tools. Based on the findings of the study, there was no statistically significant difference in their performance.

Keywords: Undergraduate Students, Gender, Students Performance, Performance in Mathematics.

1. INTRODUCTION

1.1. Brief Historical Background

The purpose of this study was to find out gender differences in performance in mathematics among first year undergraduate engineering students in Bahir Dar University. This study was designed to find out if statistically significance difference exists between the performance of male and female undergraduate engineering students in mathematics at Bahir Dar University.

It is of optimum importance that sufficient knowledge in mathematics equips one to fit well into various scientific and technological fields in this modern world. All branches of engineering depend on mathematics for their description and there has been a steady flow of ideas and problems from engineering that has stimulated and sometimes initiated branches of mathematics. Together with physics, mathematics has helped engineering develop (Affandi, Khalid, & Kanafiah, 2015).

The history of formal education in Ethiopia reveals a long-standing attempt at giving equal educational opportunities to boys and girls. The Ethiopian society now appears sufficiently convinced of the importance of girls' education and attention now seems to be shifting towards addressing gender stereotyping in the choice of school subjects and careers, hence the popular saying, "when you educate a man you educate an individual; but when you educate a woman you educate a nation". The Wisconsin Education Association Council (as cited in Tetteh et al, 2018) set their definition of performance as the one requiring students to demonstrate skills and competencies by performing or producing something.

The magnitude of the gender difference in mathematics performance has declined over the years; for studies published in 1973 or earlier it was 0.31, whereas it was 0.14 for studies published in 1974 or later (Hyde, Fennema, & Lamon, 1990). Various meta-analyses (Hedges, 1995; Hyde et al, 1990) in the 1970s and 1980s demonstrated a slight male advantage in mathematics in secondary students at least in complex problem-solving tasks.

Though there are massive research evidences for male's superiority in mathematics achievement, some research findings do not support the difference between the two genders in mathematics achievement. For example, a study showed no gender differences on the mathematically reasoning ability at elementary level (Springler, 2003).

Findings from meta-analyzed data from 242 studies published between 1990 and 2007, representing the testing of 1,286,350 people support the view that males and females perform similarly in mathematics (Lindberg, Hyde, & Petersen, 2010).

In Bahir Dar University, there are several undergraduate engineering programs in the current curriculum namely: Textile Engineering, Civil Engineering, Leather Engineering, Mechanical Engineering, and Electrical Engineering to name a few. During the study time students join different engineering programs by their own choice after completing a one semester common courses. When the researchers taught different courses of mathematics for several semesters in different academic years, they observed that the percentage of first year female undergraduate engineering students who scored low grades in mathematics is slightly greater than the number of male students, but there are some female students who scored the highest grades in mathematics. This initiated the researchers to investigate if there is a statistically significant performance difference in mathematics between male and female engineering students.

This study examines evidence from 236 first year undergraduate engineering students, 158 males and 78 females, in one mathematics course called Applied Mathematics I with contents mainly Linear Algebra I and Calculus I which is given for all first year undergraduate engineering students by the time these researchers taught the course for four different semesters each in the first academic years in four consecutive academic years from 2015 to 2018 at Bahir Dar University in two different technology institutes namely the Ethiopian Institute of Textile and Fashion Technology (EiTEX) and Bahir Dar Institute of Technology (BiT).

1.2. Statement of the Problem

Engineering students are expected to perform better in mathematics because mathematics is widely used in every engineering field. There is a widely understood need for professional engineers and student 'becoming engineers' to think mathematically and to use mathematics to describe and analyze different aspects of the real world they seek to engineer (Harris,2015).

Several researches showed that male students perform better than female students in mathematics. The performance in mathematics showed reliable and clear cut sex differences in favour of males (Asante, 2010). There was a downward trend in performance on the mathematical tasks as grade level increased (Hall & Hoff, 1988). The number of women who choose to study careers related to Science, Technology, Engineering and Mathematics (STEM) has diminished from time to time. In the Universities across the United States found that Calculus I was a reason for women to lose confidence in their ability to continue progressing towards a STEM degree (Ellis, Fosdick, & Rasmussen, 2016). The nature and extent of gender differences in mathematical performance remains a controversial topic, because there are many confounding variables and because a variety of testing procedures are used as measures of performance.

Unfortunately, none of these studies were conducted at Bahir Dar University. Therefore, this study was designed to fill this apparent vacuum and to find out whether there is gender difference in performance in mathematics among first year undergraduate engineering students in Bahir Dar University.

1.3. Significance of the study

This study is intended to show whether there is a significant difference in mathematics among male and female first year undergraduate engineering students in Bahir Dar University and to help confirm or deny the impression that mathematics is for only men and to fill performance gaps by using different mechanisms or open it for further study.

2. RESEARCH DESIGN

The design of this study used quantitative approach which is descriptive based on the students' scores of the mathematics course Applied Mathematics I which is taken by all first year undergraduate engineering students in Bahir Dar university.

2.1. Sampling Procedure and Sample Size

The population of this study includes all first year undergraduate engineering students in Bahir Dar University who took the mathematics course Applied Mathematics I. By Convenience Sampling method the researchers selected only first year

undergraduate engineering students of four consecutive academic years from which they were assigned to teach the course. The number of students selected for this study were 158 male and 78 female first year undergraduate engineering students.

2.2. Data Collection and Processing Data

The data for this research which is the score of male and female first year undergraduate engineering students in Applied Mathematics I based on the assessment rule of Bahir Dar University was collected from the office of registrar of Bahir Dar University by retrieving reports of mathematics scores from the students information management system database which were taught by the researchers in the past academic years from 2015 to 2018 of each first semester and coded for analysis, i.e. transformed into numbers so that it can be analyzed.

2.3. Data Analysis

All the data collected from the registrar office of Bahir Dar University were then put into a frequency table form which is a grouped frequency distribution for easy interpretation. Also the researchers used the independent samples t-test technique which compares the means of two independent groups in order to determine whether there is a statistically significant performance difference between male and female first year undergraduate engineering students in Bahir Dar University.

2.4. Research Hypothesis

Null Hypothesis: There is no significant difference between the means of the scores of male and female first year undergraduate engineering students in mathematics.

Alternative Hypothesis: There is a significant difference between the means of the scores of male and female first year undergraduate engineering students in mathematics.

3. RESULTS AND DISCUSSION

Table 1: Frequency table for the scores of male and female undergraduate engineering students

		Engineering Students' Gender		Total
		Male	Female	
Grouped Frequency Distribution of Scores	30-40	5	3	8
	40-50	19	8	27
	50-60	25	17	42
	60-70	29	21	50
	70-80	32	12	44
	80-90	29	10	39
	90-100	19	7	26
Total		158	78	236

Table 1 shows the class interval of the scores of undergraduate students in Mathematics in terms of gender.

Table 2: Group Statistics of scores of engineering student

Engineering Students' Gender	N	Mean	Std. Deviation
Male	158	69.3797	16.63857
Female	78	65.5449	15.62158

Table 2 shows the number of undergraduate engineering students' scores means and standard deviations. Accordingly, male undergraduate engineering students had Mean higher than their female counterparts. It also shows male undergraduate students Standard deviation is slightly higher.

Table 3: Results of the Independent Samples t-test on scores obtained in mathematics

Independent Samples Test

		Levene's Test for Equality of Variances							t-test for Equality of Means	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		
Engineering Student's Score	Equal variances assumed	.742	.390	1.699	234	.091	3.83488	2.25714		
	Equal variances not assumed			1.736	162.414	.084	3.83488	2.20925		

As seen from Table 3, the significant value is 0.390 and the alpha level is 0.05 which means that the significant value is greater than the alpha level and this indicates that the column labeled equal variances assumed t-value is chosen. Moreover, the significant (2-tailed) value is 0.091 which implies that it is greater than the alpha level. Based on the result obtained, the null hypothesis is not rejected. Therefore, there is no statistically significant difference in performance in mathematics for male and female undergraduate engineering students.

The t-test conducted showed males (M = 69.3797, SD = 16.63857) do not have higher level of performance in mathematics than females (M = 65.5449, SD = 15.62158); $t(234) = 1.699$, $P = 0.091$ (two-tailed), $\alpha = 0.05$ in Bahir Dar University. This result showed both male and female undergraduate engineering students have no difference in mathematics performance and agreed with the study conducted by Hyde et al (1990) and Lindberg et al (2010). However, it contradicts the result obtained by (Asante, 2010), which reveals that the performance in mathematics showed reliable and clear cut sex differences in favour of males. The results in this study indicated that there was no statistically significant difference in performance in mathematics in terms of gender for undergraduate engineering students in the case of Bahir Dar University.

4. CONCLUSION AND RECOMMENDATIONS

It is evident from this study that both male and female undergraduate engineering students perform similarly in mathematics. From the study, we can deduce that mathematics performance is not dependent on gender. According to the t-test result, we can conclude that male engineering students do not have higher level of performance in mathematics as compared with their female counterparts. Further research would need to be conducted to investigate situational factors that may be influencing gender differences like classroom cultures, parental and teacher attitudes and others in greater depth.

REFERENCES

- Affandi, M., Khalid, S., & Kanafiah, S. N. (2015, June 15). *Applications of mathematics in various engineering fields*. Retrieved from <https://www.researchgate.net/publication/281629940>
- Ajai, J., & Imoko, I. (2015). Gender Differences in Mathematics Achievement and Retention Scores: A Case of Problem-Based Learning Method. *International Journal of Research in Education and Science (IJRES)*, 1(1), 45- 50.
- Asante, K. O. (2010). Sex Differences in Mathematics Performance among Senior High Students in Ghana. *Gender and Behaviour*. doi:10.4314/gab.v8i2.61947
- Bossart, J., & Bharti, N. (2017). Women In Engineering: Insight Into Why Some Engineering Departments Have More Success In. *American Journal of Engineering Education*, 127-140.

5. Brown, L. I., & Kanyongo, G. Y. (2010). Gender differences in mathematics performance in Trinidad and Tobago: Examining affective factors. *International Electronic Journal of Mathematics Education*.
6. Ellis, J., Fosdick, B. K., & Rasmussen, C. (2016). Women 1.5 Times More Likely to Leave STEM Pipeline after Calculus Compared to Men: Lack of Mathematical Confidence a Potential Culprit. *PLOS ONE*. doi:https://doi.org/10.1371/journal.pone.0157447
7. Goni, U., B. Y. w., Ali, H. K., & Bularafa, M. W. (2015). Gender Difference in Students' Academic Performance in Colleges of Education in Borno State, Nigeria: Implications for Counselling. *Journal of Education and Practice*, ISSN 2222-1735 (Paper).
8. Hall, C., & Hoff, C. (1988). Gender differences in mathematical performance. *Educ Stud Math*, 19, 395–401. doi:https://doi.org/10.1007/BF00312455
9. Harris, D., Hernandez-Martinez, P., Black, L., & Pepin, B. (2015). Mathematics and its value for engineering students: what are the implications for teaching? *International Journal of Mathematical Education*.
10. Hedges, L. V., & Nowell, A. (1995). Sex differences in mental test scores, variability, and numbers of high-scoring individuals. *Science*, 269(5220), 41–45. doi: https://doi.org/10.1126/science.7604277
11. Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: a meta-analysis. *Psychol Bull*.
12. Lindberg, S. M., Hyde, J. S., & Petersen, J. L. (2010). New Trends in Gender and Mathematics Performance: A Meta-. *Psychol Bull*, 1123–1135.
13. Springler, D. M., & Alsup, J. K. (2003). Mathematical reasoning: Analogies, metaphors and images. Teaching children mathematics. doi:http://www.highbeam.com
14. Tetteh, H. N., Wilmot, E. M., & Ashong, D. (2018). GENDER DIFFERENCES IN PERFORMANCE IN MATHEMATICS AMONG PRESERVICE TEACHERS IN THE BRONG-AHAFO REGION OF GHANA. *International Journal of Education, Learning and Development*, 38-45.