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Gender Differences in Mathematics Performance among First-Year University Students at University Eduardo Mondlane in Mozambique

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Abstract

In this paper, it is provided statistical information about students' mathematics performance with the aim to explore possible gender-based differences among first year university students at the University Eduardo Mondlane. The sample consisted of 226 students enrolling the Agronomy, Biology, Engineering and Science courses in 2013 academic year. To gather data for this study achievement tests were used. The results showed a constant males' advantage in all the standardized tests and these differences were found to be statistically significant at 1% in Test-1 and Test-2. However, the classroom tests (called Mini-tests in this study) females outperformed males but the difference was not statistically significant. The gender-related differences were also observed in the performance-criteria with males being better represented at the highest performance-criterion and females at the lowest.

Keywords: *Mathematics, Gender, Differences, Performance, Pearson's Correlation Coefficients, General Linear Model*

1. Introduction

Studies in gender differences in mathematics and related fields have been carried out for about five to six decades, especially in the English speaking world. For instance, a review of the relevant literature in the area reveals that gender-related differences in performance vary considerably both within and between countries. Some studies indicate that males' performance in mathematics is better than females' at some point in high school but that the magnitude of this difference varies a great deal, ([3], [5]). However, [1] found that males generally performed better at the upper percentile levels of the score distribution in mathematics problem solving and science, while females closed the gap and, in some instances, outperformed males at the lower percentile levels. Further there are large differences between the school system and its educational policy, the economic development and the dynamic of the population in Mozambique and the other countries, the results obtained in the studies from other countries cannot readily be transferred to the situation in Mozambique, which is a Portuguese speaking country.

Although the major aims of government policy towards education, since the independence in June 1975, is to create equity of opportunity to enter the formal education system for different social, economic, gender and age groups, there are still a large number of females who have never had the opportunity to enter some levels of the formal education or who have dropped out along the way, particularly in post-primary education, or technical professions, because of their early failure in mathematics.

In 1975, the time of Mozambique's independence, we have only one higher education institution (the University Eduardo Mondlane - UEM), against the total of about fifth in fourth year of independence. At UEM, since 1986, the need to improve the standards in basic sciences (mathematics, physics, chemistry and biology) of first year undergraduate students of Agronomy, Biology; Engineering and Sciences, led to the establishment of a one semester (eighteen weeks) bridging program.

2. Importance and Aim of the Study

The research provided statistical information regarding students' mathematics performance as a starting point for the study of gender inequities in mathematics and science fields in the Mozambican education context. Thus, the study attempted to explore possible gender differences in mathematics performance among first year university students enrolling in mathematics in a bridging course in the 2013 academic year.

3. Material and Methods

3.1 Sample

The sample consisted of 226 first year university students who passed the entrance examination for Agronomy, Biology, Engineering and Science courses at UEM and were registered and enrolled in the Mathematics course

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bridging programme in 2013. There were only 51 females and 175 males in the sample, illustrating the inequity of gender access. The mean age of the sample used was 22 years old, ranging from 17 to 33 for both genders. The mean age for each gender was 21 and 22 years old for females and males respectively.

3.2 Instruments

The instruments used in this study were the longitudinal achievement tests, comprising: i) One diagnostic test (labelled Pre-test, in the study) given at the beginning of the academic year, before students starting their normal courses; ii) Two intermediate test (Test-1 and Test-2) and,
iii) Mini-tests.

The pre-test consisted of 9 multiple-choice items, each with four options, taken from the previously used standardized tests of the secondary school examination certificate, UEM entrance examination, and from the tests and textbooks used for mathematics for the first semester undergraduate students. The intermediate test is a 2-hour test based on either the first eight or the second eight weeks of the semester. The Mini-test is the name given to the short achievement tests comprising two to three questions assessing the content which had been covered during the previous period of approximately sixteen hours of tuition (two weeks). Students must write this type of test during the first 20 minutes of a class in which the mathematics teacher introduces a new topic. The Mini-tests and the two intermediate tests consisted of open-ended questions covering topics of arithmetic, algebra, geometry, trigonometry and pre-calculus.

3.3 Data Analysis

Statistical data analysis using the SPSS (Statistical Package for Social Sciences) was carried out for the calculation of Pearson's Correlation Coefficients and the General Linear Model (GLM). Performance criteria were established to find out possible gender differences in the level of students' achievement in all the tests administered, using the following intervals:

(i) Lower Performance Criterion - scores under 50% (corresponding to the students who are not permitted to write the exam)

(ii) Middle Performance Criterion - scores from 50% and under 70%, (corresponding to those students achieving marks that allow them to write the exam), and the

(iii) Upper Performance Criterion - scores of 70% and over (corresponding to those students who are given credit without writing the exam).

4. Results

In Table-1 are displayed the correlation coefficient between the tests by gender. As can be seen, the measures of mathematical performance were all positively related, and, when the data were analyzed by gender, the results were, in general significant. It should be noted that the correlation for males is generally stronger than that of the females, but these differences are not significant.

Table-1: Pearson's product-moment Correlation Coefficient between the tests by gender.

	Males		***Females***		***Males & Females***	
	N	***r***	***N***	***r***	***N***	***r***
Pre-test/Test-1	172	.141	51	.215	223	.197**
Pre-test/Test-2	170	.281**	51	.323*	221	.314**
Pre-test/Mini-test	171	.163*	51	.438**	222	.207**
Test-1/Test-2	170	.403**	51	.450**	221	.448**
Test-1/Mini-test	171	.176*	51	.290*	222	.174**
Test-2/Mini-test	170	.357**	51	.481**	221	.361**

* Correlation is significant at the 5% level (two-tailed).
** Correlation is significant at the 1-% level (two-tailed).

4.1 Gender Differences on the Performance Criteria

Means and Standard deviations achieved by the students considering gender, in the tests, are presented in Table-2. The mean difference between males and females in Test-1 and Test-2 were in favor of males and it was found to be statistically significant, at the 1-% level. Despite the non-significant gender difference in favor of the female students in the Mini-tests, it is evident that females tended to outperform males in the tests that reflect a classroom content, which means that females performed slightly higher in the systematic assessment. This result supports that of [4], showing that females are in disadvantageous position when standardized tests are given but not when doing tests that reflect classroom content. However, it does not support [6], who concluded that males outperformed females on mathematics tasks using a test that reflected classroom content.

Table-2: Means and Standard Deviations by gender

		Pre-test	***Test-1***	***Test-2***	***Mini-test***
[illegible]	***N***	175	172	170	171

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	Mean	50.6	63.3	49.1	63.8
	SD	18.3	17.2	16.0	13.7
Females	***N***	51	51	51	51
	Mean	43.8	49.7	41.1	66.0
	SD	16.6	20.9	15.0	13.8
	t	2.39	4.73	3.20	-1.00
	p	0.018	<0.001	0.002	0.317

4.2 Gender Differences on Means Performance

A comparison between males and females achievement at performance criteria was also done and Figures-1, 2, 3 and 4 give a graphical illustration of the distribution of the students by performance-criteria. In the Pre-test, the percentage of males in the middle performance-criterion is higher compared to that of the lower and upper performance criteria, contrasting the distribution with their counterpart females who are more and over represented than males at the lower performance criterion. However, the differences in performing at specific performance criterion were statistically non-significant at 1% level, when Chi-squared test was computed ($x^2=7.747$, $p=0.021$). This implies that achieving scores at specific performance criterion in the Pre-test was also not related to gender. In Test-1 the achievement of performance criteria is statistically significant related to gender, ($x^2=17.371$, $p<0.001$).

A higher percentage of males (42.4%) than that of females (19.6%) achieved at the upper performance criterion. The opposite situation occurs in the lower performance criterion where the percentage of females (51%) is higher compared to that of males (22%). In the middle performance criterion the distribution was similar between the two genders. In Test-2 a small percentage of students, mainly males, achieved the upper performance criteria. The percentage of females exceeds that of males only at lower level of performance. Again the performance of the students is statistically significantly related to gender ($x^2=10.154$, $p=0.006$). In the Mini-tests 39% of females achieved the highest scores against 33% of males. At lower performance criterion, the percentage of males (15%) was a double of the percentage of females (8%). For both gender groups, the highest percentage was found at the middle performance criterion. However, gender is unrelated to performance in the Mini-tests ($x^2=1.779$, $p=0.411$).

Figure-1: % of students by performance criterion and gender in Pre-test

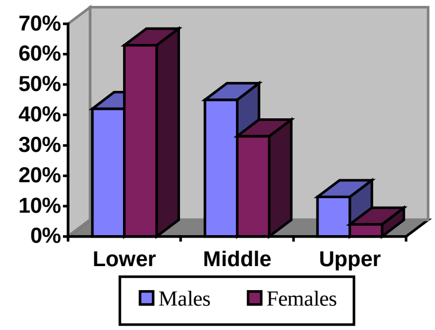


Figure-2: % of students by performance criterion and gender in Test-1

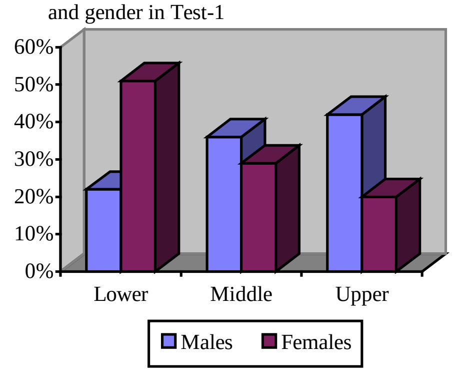


Figure-3: % of students by performance criterion and gender in Test-2

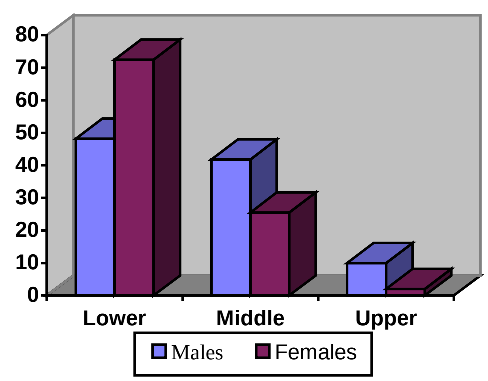
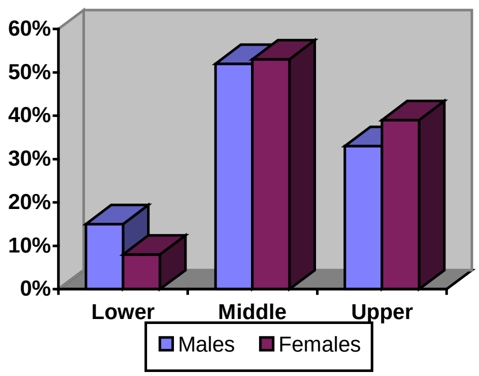


Figure-4: % of students by performance criterion and gender in Mini-test



4. Conclusions

The previous comparison of the mean scores showed a constant males advantage, in all standardized tests and these differences were found to be statistically significant in Test-1 and Test-2. However in the classroom tests (Mini-test), females' advantage was seen, which means that females performed slightly higher in the systematic assessment. Gender differences in mathematics performance were also observed when performance-criteria were considered. Therefore, the gender-based differences on achieving at specific performance criterion were statistically significant at the 1% level, for Test-1 and Test-2 where males were better represented at the highest performance criterion, and females were better represented at the lowest performance criterion. There can be many explanations for the variation of the present results from the findings of the other researchers. Firstly, the nature of the sample of this study is different from that of the majority of the investigations. In the other studies the participants have invariably been primary and secondary school children. In this investigation the majority of subjects are adults' students with an average age of 22 years. Some aspects of the mathematics taught in the bridging mathematics syllabus are comparable to the mathematics contents taught at secondary level in certain developed countries, at which stage gender-related differences in mathematics performance was very small or not even existent.

Other explanation for the inconsistent gender-related differences in mathematics performance of the genders in the present study was sought by considering their background factor. Some researchers, such as [2], stated that if the background of both male and female students is controlled, the gender differences in mathematics performance may decrease or disappear. This is possibly the case at tertiary level in Mozambique because; these students are adults, whilst in other studies the subjects are children or adolescents. Further, the centralized control of the education system should yield an equality of educational background. All the students in this program have very restricted curricula and interests, and the sample may be homogeneous. As the study was limited to a small university group, the researchers would recommend that similar studies must be conducted with students in secondary school to find out more specific differences in performance as well as differences in students attitudes toward mathematics and the environment taking place in mathematics classrooms.

References

[1] BECKER, D. F. and Forsyth, R. A, "Gender Differences in Mathematics Problem Solving and Science: A Longitudinal Analysis", International Journal of Educational Research, Vol. 21, No. 4, 1994, pp. 407-416.

[2] FENNEMA, E, "Explaining Sex-Related Differences in Mathematics - Theoretical Model", Educational Studies in Mathematics Vol. 16, 1985, pp. 303-320.

[3] FENNEMA, E. and Sherman, J. A, "Sex-Related Differences in Mathematics Achievement, Spatial Visualisation and Affective Factors", American Education Research Journal, Vol. 14, No. 1, 1977, pp. 51-71.

[4] KIMBAL, M, "A New Perspective on Women's Math Achievement", Psychological Bulletin, Vol. 105, 1989, pp. 198-214.

[5] MACCOBY, E. & Jacklin, C, The Psychology of Sex Differences, Stanford, CA: Stanford University Press, 1974.

[6] SEEGERS, G. & Boekaerts, M, "Gender-Related Differences in Self-Referenced Cognitions in Relation to Mathematics", Journal for Research in Mathematics Education, Vol. 27 No. 2, 1996, pp. 215-240.