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Research Article

Exploring Investigation of the Impact of Studying Statistics at Enhancing Mathematical Skills during Years of Faculty

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ABSTRACT

Subject of statistics has always known as field related to mathematics and because statistics is commonly taught in schools as part of the mathematics curriculum, it is regarded as a mathematical. In Salahaddin University, entering to the department of statistics is limited to students who graduated from science department at high school. Thus, we anticipate students with good knowledge in mathematical level. Students from all stages of the department were encouraged to participate in the examination and their scores were recorded. The objective of this study are to explore whether there is substantial difference between male and female as well as to discover whether the more higher stages enhance their mathematical level of knowledge. Normality test was done on the dataset and if failed to meet it, non-parametric test such as Mann–Whitney U- and Kruskal–Wallis test at significant level 0.05.

Keywords: Statistics, mathematics, normality test, Mann–Whitney U, Kruskal–Wallis

INTRODUCTION

This is unnecessary to stress the value of statistical literacy for today's person, and we come to an agreement with[1] that lacking of it, having an educated estimation and participating in social and political discussions about the environment, health, education, and other issues is difficult. Many teachers, on the other hand, are uncomfortable with the topic. Teachers who have not had specialized instruction obtain their knowledge straight from school textbooks and may be unable to spot mistakes.[2] As a result, teachers are unable to recognize and react to students' ideas, prejudices, and misunderstandings (Russell, ibid.).

Furthermore, the necessity to teach a topic that is not well-understood causes anxiety. "A sense of uncertainty attributed not so much to a deficiency of training in statistics, but also to an absence of preparation in the teaching of statistics," according to interviews with Italian mathematics students.[3] Furthermore, teachers are unaware of the breadth of the statistical material they could teach. Furthermore, teachers are unaware of the breadth of the statistical material they are required to teach. Descriptive numbers, for example, are thought to be simple and uninteresting. As a result, statistics was relegated to the end of the academic year, if not entirely lost, due to a lack of time.[4]

There is a lot of works on gender and theoretical achievement in mathematics, with a lot of diverse perspectives and observations. Boys outperformed girls in algebra, according to studies undertaken in northern countries.[5,6] Demonstrating that on standardized math exams, boys outperformed children. Female students, on the other hand, seem to do higher than male students, according to a growing body of foreign research.[7,8] A large-scale analysis in the United States of America[8] found that girls have caught up to boys in mathematics results, including in high school, where there was a difference in previous decades. They confirmed that girls outperform boys even in tasks including complicated problem solving.

The International Institute for Educational Planning[9] conducted the Second Southern and Eastern Africa Consortium for Monitoring Education Quality Survey (2000–2002) and found no major gender gaps among students in South Africa. Only in Seychelles did the same research reveal that girls scored slightly higher than boys. Boys, on the other hand, ranked slightly higher than girls in Tanzania, Kenya, Mozambique, Zanzibar, and Malawi. The gaps were not important in other school systems, like those in South Africa.

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Another body of evidence suggests that gender differences in mathematical success are dwindling.[10,11] The divide has been shrinking in the United States of America, according to Perie *et al*.[12] Gender gaps in mathematics achievement are shrinking and changing in Australia, according to research Forgasz *et al*. and Vale.[13,14] Many studies performed in Australasia between 2000 and 2004 reported no substantial variations in mathematics performance between male and female students, while males were more likely to attain higher mean scores, according to Vale.[14]

Researchers have conducted experiments in a variety of ways around the world to look at the aspects that affect gendered math achievement. Many of these findings have concentrated on the causes that contribute to disparities in math achievement between boys and girls.[15-18] Feminist scholars have attempted to interpret male-female gender dynamics to make sense of the interactions of girls and boys in mathematics classes.[19,20] Girls are often overlooked and assigned inferior status in mathematics classes, according to their findings. Teachers' expectations of girls' math success are based on rote learning, hard work, and perseverance rather than innate flexibility, ability, and risk taking, which are the learning styles of boys, according to the results.

In this article, we will attempt to demonstrate how statistics will help students understand mathematics by encasing certain mathematical terms in a genuine and inspiring way. In reality, plentiful of mathematics is established to explain and model life phenomena, from day-to-day depending to medicine and economics, and statistics is often used to do so. Another objective of this study is to show how score of math score varies between male and female, as well as the students between stages of studying at department of statistics.

Importance of Simple Data Analysis

Mathematics was created to solve issues that people faced on a daily basis. Comparisons, charts, and other numerical communications all use numbers in daily life. As a result, "it is vital to create children's mental representations of numbers at the same time as they learn to count and calculate."[20] Most of this mathematics is encapsulated in statistics that attempt to explain the universe around us. Statistics comprises the majority of the mathematics taught in primary school and a portion of the high school curriculum, according to an examination of some school textbooks and accounts of experiments. When it comes to small surveys, descriptive statistics are normally the first step. Moreover, preschoolers may benefit from these basic tasks.

The development of graphical representations is also ripe for the picking. Allowing the children to build their own images is a vital first step and then bringing them to see the elements that are central and those that are absent, such as names, references, and so on.

Collecting, organizing, categorizing, storing, and symbolizing data are a basic data handling operation. Number principles such as cardinal and ordinal, numbering, and basic arithmetical operations are enabled in this activity. It's just the start.

Numbers will gradually take the place of dots, and words will replace the sketches that represent each data type. Simple pictograms can pave the way for well-organized tables, with numerical details and periods replacing categories. The definition of a number as a metric, such as height or weight, would emerge.

Importance of Proportionality

Several experiments[21-23] suggest that relational logic and, in particular, fractions and percentage are not well understood. It was discovered that gymnasium students, as well as teachers, had trouble with this sort of figures.[24,25] The principle of proportion is a fundamental concept in mathematics that encompasses the scope of percentage but is also essential to comprehend the linear function. The principle of proportionality is a fundamental mathematical concept that encompasses the concept of percentage while also being essential to comprehending the linear function. It's often connected to fractions and decimals, as well as graphical representation.[23] There is a "training to obey such laws" rather than a "gain of experience."[26]

Statistics, once again, provides beneficial ways to focus on both of these concepts. Many everyday circumstances, such as things and their prices, time, and speed, may be the focus of a mathematical survey, which will deal with the multiplicative systems, which are the basis of the proportionality principle.

Importance of Variability and Functions

Variability and functions are examples of mathematical principles that are often found in statistics. Line diagrams depicting the association among two variables, for example, can be used to analyze patterns and make forecasts, as well as another technique to view statistics and, finally, modeling. It also serves as a primer on the analysis of heterogeneity and functions. This holds true with linear relationships and regression as well. Scatter plots can be seen right away.[27]

Students should then search for the straight line (or, finally, the shape) that can best translate the relationship between the two variables. They would use the principle of distance between a point and a line or between two lines, as well as absolute values and absolute value functions, to do so. Then, you'll have to do with numbers of distances or squares of distances.

METHODOLOGY

Data

To find out the effect of statistics at enhancing mathematical level, a 20 math questions were developed and designed for a sample of 262 students at Salahaddin University – College of Economics and Administration, Department of Statistics. The sample includes students from all four stages and both male and female gender.

The results were generated using SPSS v 25 to explore and implement descriptive statistics as well as inferential statistics

like non-parametric comparison tests such as Mann–Whitney test, Kruskal–Wallis test. An 0.05 significance level was used as threshold value to report the tests results.

RESULTS

Descriptive Statistics

It is always important, as a first step to do any statistical analysis, to have a tour on some statistical measurements to see how the data are distributed, and for that some tables and graphs have been generated. As shown from Table 1, the distribution is based on gender and female participants are way higher than males with 181 and 82, respectively, in terms of their distribution, as first thought we can see that there is no huge difference between male and female with respect to mean and SD values. Figure 1 confirms that the score variable is sort of equally distributed with a little bit difference and yet cannot be sure until further investigation is made. We can also hint that the score variable is relatively far to be distributed normally for both male and female [Table 2].

Referencing to stage variable, it is clear that the number of participants for Stages 1 and 2 is quite close to each other with 64 and 55 students, respectively, and only 38 students at Stage 4 joined the examination. However, a huge number of students were seen in the test with 106. It is worth mentioning that Stages 1 (13.203) and 3 (11.783) were much better than students at Stages 2 (9.763) and 4 (9.500) concerning to their mean values as they are above the cut value (>10). There might be rational reason for that as at Stages 1 and 3, there are some topics which are purely mathematics.

Figure 2 shows a very useful information in relation to variable distribution. It does tells us that the students in mathematics examination at all four stages had done differently and as seen students at Stage 1 were the best one, followed by Stages 3, 4, and 2. No normality of the data can be stated.

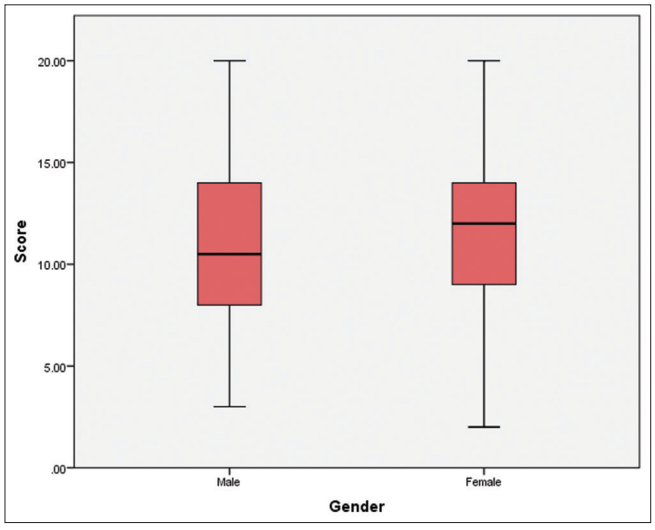

Figure 1: Boxplot for both male and female and score achievement

Table 1: Mean and SD exploration for gender

Gender	Score		
	n	Mean	SD
Male	82	11.024	4.128
Female	181	11.508	3.769

Conducting any statistical test to do some comparison requires some assumption to be met. The most common requirement is whether the data are normally distributed. Before implementing the normality test, it is better to see the nature of the data. Thus, we created the histogram plots for the data and none of the dimensions refer our thoughts to normal distribution. Thus, none of the groups strongly suggested to have a perfect normal distribution.

However, to be sure about the normality distribution or homogeneity, first let's see what the Shapiro–Wilk test leads us. Table 3 provides enough evidence to go ahead with non-parametric test to know whether the categorical variables are significantly difference between the levels in response to score achievements.

Test Comparison

The time has come to go further into the investigation to discover whether gender has any effect on students to be knowledge with mathematical subjects in statistical department regardless to their stages. Since we ended up with not normally distributed and hence, we implemented Mann–Whitney U-test to compare two groups (in our case gender) and Kruskal–Wallis test for more than 2 groups (in our case stages). Table 4 demonstrates that there is no statistical difference between male and female regarding to their level of knowledge in mathematics since the p-value (0.270) is much larger than the significance level (0.05).

Referencing to stages as we expected that somehow there might be some discrepancies in their performances at the examination. We thought the more studying in statistics, the more involvement with mathematics is happened. The Kruskal

Table 2: Mean and SD exploration for stages

Stages	Score		
	n	Mean	SD
One	64	13.203	3.941
Two	55	9.673	3.283
Three	106	11.783	3.602
Four	38	9.500	3.689

Table 3: Normality test for both independent variables in response to score achievement

	Shapiro–Wilk		
	Statistic	df	Sig.
Gender			
Male	0.968	82	0.036
Female	0.983	181	0.027
Score			
1	0.976	64	0.250
2	0.933	55	0.004
3	0.977	106	0.057
4	0.960	38	0.190

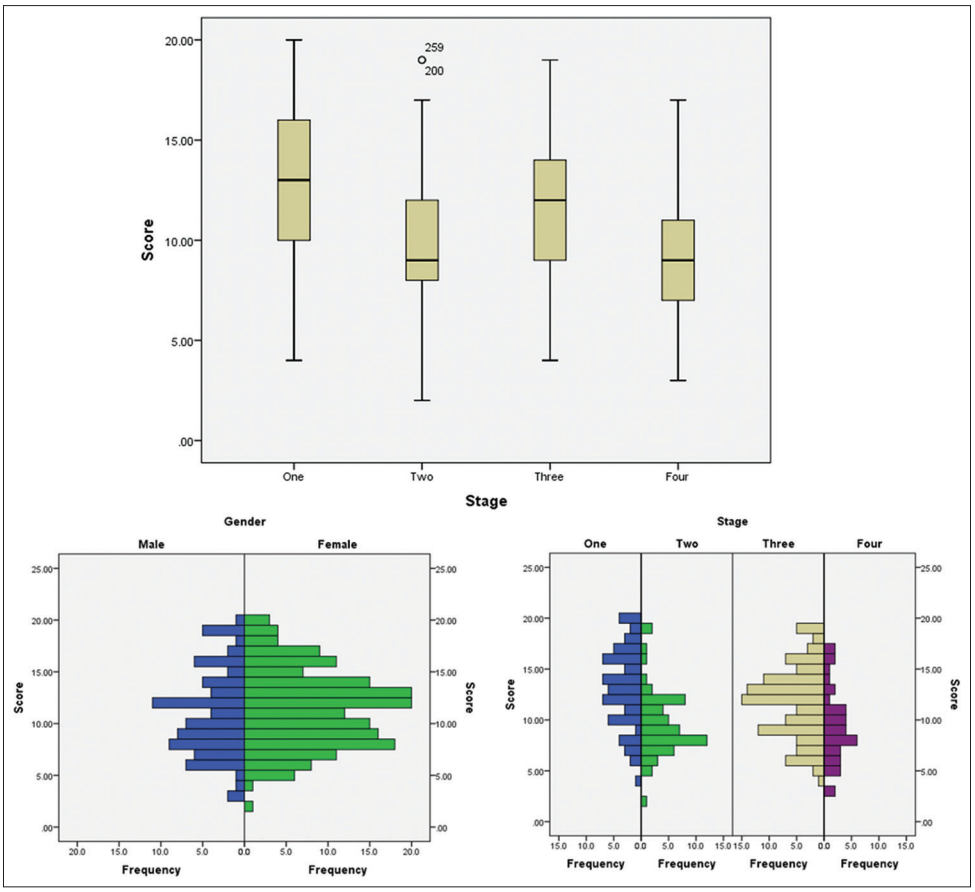

Figure 2: Boxplot and histograms for detecting how the variables are distributed

Table 4: Mann–Whitney U and Kruskal–Wallis test result for the case study

	Mean rank	Chi-square	P-value	Pairwise comparison
Gender		Mann–Whitney		-
Male	124.341	1.216	0.270	
Female	135.470			
Stage		Kruskal–Wallis		Mann–Whitney
1	167.125	35.779	0.000	No difference only occurred between Stages 2 and 4
2	96.900			
3	141.840			
4	96.197			

test confirmed that there were statistical differences in achieving scores in the examination mathematics since the p-value (0.000) is less than 0.05. Nevertheless, we cannot know exactly between which stages the difference was occurred, and we needed to compute the multiple comparison tests among each pair. For this purpose, Mann–Whitney U-test was applied and ended up that there was no difference between Stages 2 and 4 only.

CONCLUSION

As we reach to conclusion, the study reported that there were no differences among males and females in achieving higher or lower mark in mathematical examination at the department of statistics. This result matches with other previous studies. Although, female participants were much higher than male participants with about nearly 100 students and still the descriptive result showed no statistical significance result. On the other hand, stages as expected unlike gender had shown that students might increase their level of mathematics while studying statistics and in our study interesting result came up. Students in Stages 1 and 3 performed better than student at Stages 2 and 4 in the examination with reference to descriptive statistics. Similar to gender, again non-parametric test was used and consequently showed significant outcome. Kruskal–Wallis test which works just like ANOVA was calculated and indicated significant conclusion. Furthermore, to dive into the detail, Mann–Whitney U-test was applied again between each pair of stages and reached to report that there was only difference in student's performance at Stages 2 and 4.

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