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THE EFFECTIVENESS OF IPAD USE IN PROMOTING STUDENT ACHIEVEMENT IN A SECONDARY SCHOOL IN SAUDI ARABIA

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Abstract:
The Ministry of Education in Saudi Arabia has used technology to support teaching and learning in Saudi's school system to meet the requirements of the National Transformation Program under Vision 2030. There are different kinds of technology which can enhance the effectiveness of the teaching and learning of mathematics, such as the iPad. This paper presents results of primary research investigating the effect of using iPads in enhancing student achievement in a Saudi secondary school. A quasi-experimental design was used to determine the effect of using an iPad on students' achievement in mathematics across two tenth grade classes (A and B) for two months. In the first month, students of group A used the iPad as a learning tool (treatment group), while students of group B used traditional methods as learning tools (control group). In the second month of the quasi-experimental period, group A became the control group using traditional methods, while group B became the treatment group using the iPad to learn mathematics. At the start of the experiment, a pre-test was completed, and the first post-test occurred one month later, then the treatment was switched. After two months at the end of the quasi-experimental period, both groups had taken the second post-test. Cronbach's alpha coefficient measured the reliability of these tests, with the first test at 0.784 and the second test at 0.792, regarded as very high (close to 1.00). Thus, the tests' reliability and credibility were confirmed. Nine comparisons of the means were used to see if a significant statistical difference between the mean of the two groups or within a group existed, by using the SPSS t-test. After comparing the mean of 'within-group A', 'within group B', and 'group A and group B', it was seen that using the iPad made a statistically significant difference ($p<0.05$) in students' achievements compared to traditional methods. The study summarises the main results and specific recommendations are provided.

Keywords: iPad, tablet, technology, mathematics, achievement, quasi-experimental

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1. Introduction

The Ministry of Education of Saudi Arabia is currently aiming to improve its teaching and learning through technology, in line with Saudi Arabia's National Transformation Program under Vision 2030. It seeks to maintain its path of academic excellence towards aligning with developed countries across the world. Technology enhances teaching and learning opportunities, and it could encourage students to improve their academic performance. There are different kinds of educational technology tools used, such as the iPad, and the integration of the iPad could be utilised to transform traditional teaching and learning methods into highly advanced teaching and learning approaches (Herro et al., 2013). The integration of the iPad in the education sector will provide an excellent opportunity for the teaching and learning of any content to be achieved more efficiently in the classroom. It encourages students to construct new knowledge based on their previous experiences rather than just remembering knowledge (Amin, 2010). The iPad could decrease the achievement gap among students on the topic of mathematics (Zhang et al., 2015). For instance, teachers in the Aldossry and Lally (2019) study suggested that struggling students need more time to complete a task in mathematics, and the iPad was the perfect tool to support them and positively affect their performance with less effort. Furthermore, Alsalkhi conducted a study involving tenth-grade students in Jordan about the effect of the iPad on students' achievements. His research shows that student performance in the treatment group was positively affected and had greater results than the control group (Alsalkhi, 2013). Al-Mashaqbeh (2016) conducted a study investigating the impact of iPad usage in relation to the achievements of first grade students in Jordan, showing that there was a significant difference between the treatment group who used the iPad and the control group who used traditional methods to learn mathematics. Riconscente (2013) conducted a study testing a specific application by using the iPad for 20 minutes, in order to investigate how this app can improve the understanding of fourth grade students at an elementary school in the USA. He found that students' achievements and self-efficacy were increased in the treatment group more than the control group because of the iPad usage.

In Saudi Arabia, Alzannan (2015) conducted a study to investigate the effect of using the iPad in two separate groups from a kindergarten class, in the context of Arabic Language lessons. There was a treatment group and a control group, and it was shown that they had significant differences in their language performance. Similarly, LaBelle et al. (2016) conducted a study of two separate groups from a first-grade elementary class in Saudi Arabia, investigating the impact of iPad usage on the achievements of students in an Arabic Language class. The results show that there was a significant statistical difference between the treatment group who used the iPad as a learning tool and the control group who used pencil and paper as their learning tool .More research is necessary in the Saudi Arabia education context, examining the effect of iPad usage across different levels, particularly secondary school mathematics classrooms. Thus, the main focus of this study is to find out the effectiveness of iPad use in promoting student achievement in a secondary school in Saudi Arabia. The research question of this study is

- What is the impact of iPad usage on student achievement in a mathematics performance assessment for secondary school students in Saudi Arabia?

2. Material and Methods

In order to investigate the effect of using the iPad on students' achievement, a quasi-experimental design was adopted for two months in two different classes in a secondary school in Saudi Arabia. The secondary school was the Al-Rowad Secondary School in Jubil city. The sample size was made up of 50 students from the school's population of 600. Also, the two involved classes (A and B) had 25 students each (See Table 1), and a random distribution was used to account for individual differences between students. Both classes A and B were taught by the same teacher to ensure the teaching quality. This research collected data in a way that allowed both classes to be evaluated fairly. In the first month, class A learned with the iPad as a learning tool in the treatment group, and class B learned by using traditional methods. In the second month, the control and treatment groups were switched, so B became the treatment group and A the control group.

Table 1: Sample Size

	Student
Class A	25
Class B	25
Total	50

In the first day of the quasi-experimental period, students of both classes were given a pre-test and, after one month, students were given the first post-test. At this point, the treatment and control groups were switched and after two months, both classes were given the second post-test. Stability (test-retest) reliability was used in this study to assess the test (pre-test, post-test 1, and post-test 2) reliability. This approach could be used to measure reliability by showing that the test results of the two pilot groups had a high correlation, similar means and similar standard deviations (Cohen et al., 2007). In this research, there were two mathematics tests taken from the Assessment Guide - Teacher Edition from the Ministry of Education's books. The first mathematics test covered the lessons in the first month, which used for the pre-test and first post-test, and the second test covered the mathematics lessons in the second month, used for the second post-test. Thus, test-retests were given to two pilot groups before the quasi-experimental design started, and each group had 25 students. The researcher used Cronbach's alpha coefficient to measure the reliability of these tests, showing that the value of the first test was 0.784 and the second test was 0.792, regarded as very high (close to 1.00). This means that the reliability and credibility of the tests is confirmed, and the researcher could depend on them during their study.

Table 2: Cronbach's alpha coefficient tests

The test	Cronbach's alpha coefficient
First test	0.784
Second test	0.792

3. Results and Discussion

This research aims to investigate the impact of iPads on student achievement in a mathematics performance assessment, for a secondary school in Saudi Arabia. To address the research question, multi-statistical methods were used by using SPSS (t-test) to compare the means of the dependent variable for all students in their mathematics achievements. Before comparing the means of the two groups, the researcher needed to test the normal distribution of the sample.

3.1 Test of Normal Distribution

A t-test was used to compare the means of the dependent variable between the two groups. A t-test is a test to find out whether there is a statistically significant difference between two samples, for a continuous variable (Muij, 2010). Thus, if the researcher wants to use the t-test, the normal assumption must be met. To test if the sample is a normal distribution, the Shapiro–Wilk test is appropriate (Shapiro and Wilk, 1965). Also, the Kolmogorov-Smirnov test is the most powerful normality test for the sample (Ghasemi, and Zahediasl, 2012; Razali and Wah, 2011). The P-value was 0.125 and 0.200 for samples A and B, and they are more significant than $\alpha = 0.05$, which means that sample A and sample B are normally distributed. Furthermore, the researcher then used the Shapiro-Wilk Test. The P-value was 0.108 and 0.596 for samples A and B respectively, and as the results are greater than $\alpha = 0.05$, then sample A and sample B have normal distribution. Further details are seen in Table 3.

Table 3: Test of Normality

The sample	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig. P. value	Statistic	df	Sig. P. value
A	.155	25	.125	.934	25	.108
B	.137	25	.200	.968	25	.596

To compare the means of samples A and B, nine comparisons of the means are divided into three categories (within group A, within group B, and group A and group B).

3.2 Comparing the Means Within Group A

To find out if there was a statistical difference in the means from group A when students used the iPad as a learning tool or traditional methods, the researcher compared the mean of 'group A pre-test and group A first post-test', 'group A pre-test and A second post-test', and 'group A first post-test and A second post-test'.

3.3 Group A pre-test and group A first post-test

A Paired-Samples T-Test was used to compare the mean of two variables for a single group, and it this is an appropriate method for estimating a period-scale variable, under normal distribution (McCrum-Gardner, 2008). This test was used to find out if there were statistically different results for the students' performance before and after using the iPad at the significance level α= 0.05.

Table 4: Paired Samples T-Test Results in A pre-test and Group A first post-test

The Paired Sample	N	Mean	Std. Dev.	(T) value	df	Sig. P. value	Mean Difference	Std. Error Difference
A pre-test	25	13.12	2.991	8.168	24	0.000	- 5.440	0.666
A first post-test	25	18.56	1.502					

From Table 4, the results from the t-test show that the P-value of 0.000 is less than α= 0.05 and the calculated (T) value = 8.168, meaning it is more than the tabulated (T) value = 2.064 at df = 24. Thus, it can be seen that there is a statistically significant difference between group A pre-test and group A first post-test. In turn, it is seen that the mathematics performance of students increased after iPad usage. Furthermore, it is clearly seen that the mean of group A students in the post-test (18.56), is more than the mean of the same students in the first pre-test (13.12). This means that the students' level of mathematics performance was improved and positively affected by their use of iPads as a learning tool.

Moreover, it is useful to consider the effect size to indicate the level of prominence of statistical significance. Thalheimer and Cook (2002) show that measurements of the effect-size are supportive by giving information about the relative size of the experimental treatment and effect-size. The effect size of the iPad usage must be calculated on the level of mathematics performance by using Cohen's d. The values of d are 0.2, 0.5, and 0.8 for small, medium and large effects respectively, which is the most common interpretation in social sciences from Cohen (Rice and Harris, 2005).

From the equation:

$$d = \frac{t}{\sqrt{N}}$$

$$d = \frac{8.168}{\sqrt{25}} = 1.63$$

As $d = 1.63 > 0.8$, it stands as a large effect, where the impact of using iPads for the students of group A is large and improves their level of mathematics performance.

3.4 Group A pre-test and Group A second post-test

A Paired-Samples T-Test was used to investigate if the means of students from group A in their mathematics performance were statistically significantly different after taking the iPad away in the second month. The used iPads in the first month of the quasi-experimental design and returned to the traditional method to learn mathematics in the second month with the significance level: $\alpha = 0.05$.

Table 5: Paired Samples T- Test results of Group A pre-test and Group A second post-test

The Paired Sample	N	Mean	Std. Dev.	(T) value	df	Sig. P. value	Mean Difference	Std. Error Difference
A pre-test	25	13.12	2.991	2.219	24	0.036	- 2.200	0.992
A second post-test	25	15.32	3.625					

From Table 5, the P-value = 0.036, less than $\alpha = 0.05$ and also (T) value = 2.219, more than the tabulated (T) value = 2.064 at df = 24. This denotes a statistically significant difference for group A second post-test against group A pre-test. Thus, there is a difference in the students' level of mathematics performance between their second post-test and their pre-test. Furthermore, the mean of group A students for the second post-test degrees = 15.32, which is more than the mean of the pre-test degrees = 13.12. Therefore, the students' level of mathematics performance of the second post-test increased, potentially because of the iPad usage during the first month, even though they did not use it during the second month.

The effect size of the iPad usage related to level of mathematics performance is calculated by using (Cohen's d):

From the equation:

$$d = \frac{t}{\sqrt{N}}$$

$$d = \frac{2.219}{\sqrt{25}} = 0.44$$

As d = 0.44 > 0.2 &< 0.5, this is a nearly medium effect. Students who used the iPad in the first month showed a medium impact to their level of mathematics performance.

3.5 Group A First Post-Test and Group A Second Post-Test

A Paired-Samples T-Test was employed to investigate if the means of group A mathematical performance were statistically different after not using the iPad in the second month of the quasi-experimental period, at the significance level: $\alpha = 0.05$.

Table 6: Paired Samples T- Test results of Group A first post-test and Group A second post-test

The paired sample	N	Mean	Std. Dev.	(T) value	df	Sig. P. value	Mean Difference	Std. Error Difference
A first post-test	25	18.56	1.502	4.079	24	0.000	3.240	0.794
A second post-test	25	15.32	3.625					

The results from Table 6 show that P-value = 0.000 is less than $\alpha = 0.05$, and calculated (T) value = 4.079 is more than tabulated (T) value = 2.064 at df = 24. It is clearly seen that there is a statistically significant difference between the results of students in the first post-test and their results in the second post-test. Clearly, student performances were worse in the second post-test, potentially because their iPad was taken away after their first month, and traditional learning methods resumed. Furthermore, the students' mean of first post-test degrees = 18.56 is more than their mean of the post-test degrees = 15.32, meaning that student performances in mathematics were enhanced in the first month by using the iPad. Secondly, when they no longer used the iPad.

Next, the effect size of the iPad usage is calculated, relative to the level of mathematics performance, by using (Cohen's d):

From the equation:

$$d = \frac{t}{\sqrt{N}}$$

$$d = \frac{4.079}{\sqrt{25}} = 0.816$$

As $d = 0.816 > 0.8$, the iPad effect is large, for students that used it in the first month, when it comes to improving their level of mathematics performance compared to their performance in the second month.

3.5.1 Comparing the Means Within Group B

To investigate whether there was a statistical difference in the means of group B when students used traditional methods or the iPad as a learning tool, it is better to compare the means of the group B pre-test and the group B first post-test results, then compare group B pre-test and B second post-test, and lastly compare group B first post-test and B second post-test.

3.6 Group B pre-test and group B first post-test

A Paired-Samples T-Test was employed to investigate if their results were statistically different for student performances of group B before and after using the traditional methods of the first month. Then, this was recalculated after they used the iPad in the second month, at the significance level: α = 0.05.

Table 7: Paired Samples T- Test results of Group B pre-test and Group B first post-test

The Paired Sample	N	Mean	Std. Dev.	(T) value	df	Sig. P. value	Mean Difference	Std. Error Difference
Group B pre-test	25	13.88	3.193	1.254	24	0.222	- 1.480	1.181
Group B first post-test	25	15.36	4.508					

The results in Table 7 show that P-value = 0.222 which is more than α = 0.05, and the calculated (T) value = 1.254 , which is less than tabulated (T) value = 2.064 at df = 24. Therefore, no statistically significant difference was seen in student results in the pre-test and first post-test. Also, the mean of group B students in the pre-test degrees = 13.88, which is similar the mean in the first post-test degrees = 15.36. Therefore, the difference is only 1.480, which is a very small value. In turn, it is concluded that the level of mathematics performance for group B students in the pre-test was almost the same as with the first post-test, as they did not use the iPad so far.

3.7 Group B pre-test and Group B second post-test

A Paired-Samples T-Test was used to find out if there were statistical differences between group B students for their mathematics performance after they used the iPad compared to in the second post-test, at the significance level: $\alpha = 0.05$.

Table 8: Paired Samples T- Test results of Group B pre-test and Group B second post-test

The paired sample	N	Mean	Std. Dev.	(T) value	df	Sig. P. value	Mean Difference	Std. Error Difference
Group B pre-test	25	13.88	3.193	6.553	24	0.000	- 4.760	0.726
Group B second post-test	25	18.64	1.868					

From Table 8, the results show that the mean of group B students in the second post-test degrees = 18.64 , which is more than the mean of group B students in the pre-test = 13.88. Furthermore, the results show that the P-value = 0.000 is less than $\alpha = 0.05$, and the calculated (T) value = 6.553 which is more than tabulated (T) value = 2.064 at df = 24. It is seen that a statistically significant difference exists between group B students mathematics performance in the second post-test and the level of their mathematics performance in the pre-test. Students who used iPads in their learning of mathematics in the second month had a positive impact on their achievements thereafter.

The effect size of iPad usage on the level of mathematics performance is calculated by using (Cohen's d):

From the equation:

$$d = \frac{t}{\sqrt{N}}$$

$$d = \frac{6.553}{\sqrt{25}} = 1.31$$

The result shows $d = 1.31 > 0.8$, which denotes a large effect. Thus, the iPad helped students of group B to improve their mathematics performance in the second month of the quasi-experimental period.

3.8 Group B First Post-Test and Group B Second Post-Test

To compare the mean of group B, the statistical method of Paired-Samples T-Test was used at the significance level: $\alpha = 0.05$. This would allow the effect of iPad usage on students' mathematics performance to be calculated.

Table 9: Paired Samples T- Test results of Group B first post-test and Group B second post-test

The paired sample	**N**	**Mean**	**Std. Dev.**	**(T) value**	**df**	**Sig. P. value**	**Mean Difference**	**Std. Error Difference**
Group B first post-test	25	15.36	4.508	3.065	24	0.005	- 3.280	1.070
Group B second post-test	25	18.64	1.868					

The results of Table 9 show that the mean of students' results in the second post-test degrees is 18.64, which is more than the mean of the first post-test degrees, which is 15.36. Furthermore, the p-value = 0.005 is less than α= 0.05, with the calculated (T) value = 3.065, higher than the tabulated (T) value = 2.064 at df = 24. Thus, it is concluded that the performance of students in mathematics was positively impacted by iPad usage in the second month of the quasi-experimental period, compared to their performance in the first month learning mathematics by traditional methods.

Next, the effect size of the iPad usage on the level of mathematics performance is calculated by using (Cohen's d):
From the equation:

$$d = \frac{t}{\sqrt{N}}$$

$$d = \frac{3.065}{\sqrt{25}} = 0.61$$

As d = 0.61 > 0.5, this denotes a medium effect seen from the iPad usage on students' mathematics performance.

3.8.1 Comparing the Mean of Group A and Group B

An independent samples T-Test was used to compare the mean of the two different groups, with a normally distributed sample (McCrum-Gardner, 2008). Thus, an Independent Samples T-Test was used to investigate if there were statistically significant differences between the two groups with regards to their mathematics performance by using the iPad or traditional methods when learning, at the significance level: α = 0.05. Group A used the iPad as a learning tool in the first month and group B used traditional methods, and this was reversed in the second month, as mentioned.

3.9 Group A Pre-Test and Group B Pre-Test

Levene's test of homogeneity of variance is the most common statistical test to be used for one or two categorically independent variables which have the same interval dependent (Gastwirth et al., 2009). The significance level of Levene's test is at 0.05 or higher and when the two groups have equal variances, the researcher could reject the null hypothesis (Garson, 2012).

Table 10: Descriptive Results

The Sample	N	Mean	Std. Deviation
Group A pre-test	25	13.12	2.991
Group B pre-test	25	13.88	3.193

Table 11: Independent Samples T- Test results

The Sample	Levene's Test for Equality of Variances		T-Test Results				
	F	sig. (P. value)	(T) value	df	sig. (P. value)	Mean Difference	Std. Error Difference
Pre-test	.065	.800	0.869	48	.389	- 0.76	.875

The results of Levene's Test show that the P-value = 0.800 is more than α= 0.05, which means that the two samples are homogeneous. Also, the result from the T-test shows that P-value = 0.389 is more than α = 0.05, with calculated (T) value = 0.869 less than tabulated (T) value = 2.011 at df = 48, shown in Table 11. In turn, it is concluded that there is no statistically significant difference between group A pre-rest and group B pre-test. Also, the mean of group A in the pre-test degrees is 13.12, which is nearly equal to the mean of group B in the pre-test degrees of 13.88 (see Table 10). It is clearly seen that there is no difference between the two groups in their mathematics performance because both groups did not use the iPad yet.

3.10 Group A First Post-Test and Group B First Post-Test

An Independent Samples T-Test was used as the statistical method to find out if there is a significant difference between the two groups after the iPad, was given to group A and traditional methods were used in group B after a one month period at the significance level: α = 0.05.

Table 12: The descriptive results

The Sample	N	Mean	Std. Deviation
Group A first post-test	25	18.56	1.502
Group B first post-test	25	15.36	4.508

Table 13: Independent Samples T- Test results of
Group A first post-test and Group B first post-test

The Sample	Levene's Test for Equality of Variances		T-Test Results				
	F	sig. (P. value)	(T) value	df	sig. (P. value)	Mean Difference	Std. Error Difference
post1	.749	.391	3.367	48	.002	3.200	.950

From the t-test, the mean of group A students (the first post-test) degrees is 18.56, which is greater than the mean shown by group B students for the first post-test, for 15.36 (shown in Table 12). Also, the results of Levene's test shows that P-value is 0.391, which is more than α = 0.05. As a result, it is concluded that there is homogeneity amongst the two groups .Furthermore, from the t-test, P-value = 0.002, which is less than α= 0.05. Also, the calculated (T) value of 3.367 is more than the tabulated (T) value of 2.011 at df = 48, as per Table 13. These findings show that the level of mathematics performance for students in group A had improved through iPad usage, compared to their peers in group B who used only traditional methods during that time.

Next, the effect size iPad usage had on the level of mathematics performance is calculated using (Eta squared). The effect size is indicated by an eta-squared result across three different sizes: small size (0.01 to 0.06), medium size (0.06 to 0.14), and large size (0.14 and over).

From the equation:

$$n^2 = \frac{t^2}{t^2+df}$$

$$n^2 = \frac{(3.367)^2}{(3.367)^2+48} = 0.191$$

As n^2 = 0.19 > 0.14, a large effect was shown to occur, meaning that the iPad had a large effect on the mathematics performances of students in group A.

3.11 Group A Second Post-Test and Group B Second Post-Test

An Independent Samples T-Test was used as the statistical method to compare the mean of group A's second post-test and group B's second post-test at the significance level: α = 0.05.

Table 14: The descriptive results of the second post-test

The Sample	N	Mean	Std. Deviation
A Second post-test	25	15.32	3.625
B Second post-test	25	18.64	1.868

Table 15: Independent Samples T- Test results of the second post-test

The Sample	Levene's Test for Equality of Variances		T-Test Results				
	F	sig. (P. value)	(T) value	df	sig. (P. value)	Mean Difference	Std. Error Difference
Second Post test	1.361	.249	4.070	48	.000	- 3.32	.816

The results from Table 14 show that the mean of group B's second post-test degrees is 18.64, which is more than the mean of group A's second post-test. Also, the Levene's test result shows that the P-value is 0.249, which is more than α = 0.05. This means there is a level of homogeneity amongst the two groups. Furthermore, t-test shows that P-value = 0.000, which is less than α = 0.05, and (T) value = 4.070, which is more than the tabulated (T) value = 2.011 at df = 48, shown in Table 15. It can be concluded that there were statistically significant differences amongst group B and A in the second month, as group B's students had used the iPad as a learning too, while group A used only traditional

methods. Therefore, iPad usage clearly made a difference in group B's level of mathematics performance compared to group A, at the time of the second post-test.
Next, effect size was calculated for the iPad's usage in relation to mathematics performance level, using (Eta squared):

From the equation:

$$n^2 = \frac{t^2}{t^2 + df}$$

$$n^2 = \frac{(4.070)^2}{(4.070)^2 + 48} = 0.257$$

As the result of 0.257 is greater than 0.14, this means there is a large effect seen by using the iPad when it comes to improving mathematics performance in the students of group B (second post-test).

4. Conclusion

This research aimed to investigate whether there is an effect seen by using an iPad on students' achievement in mathematics, in two tenth grade classes from a secondary school in Saudi Arabia. There were three comparisons of means conducted, which were within group A, within group B, and between the two groups. The results helped to answer the research questions set, and the findings were then evaluated by using the SPSS t-test. The purpose of using these methods is to find whether there was a statistically significant difference between the students' tests before and after the treatment (iPad) compared with traditional methods, either within a group or between the two groups. The results after comparing the means within group A show that the level of students' mathematics performance was increased when they used the iPad in the first month as a learning tool, and their level of mathematics performance was lower when the iPad was taken away from them in the second month of the quasi-experimental design. Also, the results produced after comparing the mean within group B shows there was no difference in their mathematics performance in the first month, as they had not used the iPad, and instead used traditional methods to learn mathematics. However, their level of mathematics performance was increased after they used the iPad in the second month.

Finally, when comparing the mean of group A and group B, the results showed that there was no significant difference between the mean of the two groups in the pre-test, which means their level of mathematics performance was almost equal because both groups had not used the iPad yet. After one month, the result of the first post-test showed that there was a statistically significant difference between group A who used the iPad and group B who used traditional methods in mathematics. However, the result of the second post-test shows that there was a significant difference between the means of group B who used the iPad and group A who did not use the iPad, during the second month of the quasi-experimental period. Students' mathematics performance increased when they used the iPad to a greater extent than when traditional methods were used (Riconscente, 2013; Al-Mashaqbeh's, 2016). The iPad usage supported struggling students in mathematics activities and affected their performance in a positive way (Aldossry and Lally, 2019).This study is supported by the findings of LaBelle et al. (2016), who found a statistically significant difference between the group who used an iPad and the group who used paper and pencil methods. It is summarised that the iPad encourages students to study the Arabic Language and improve their achievements in this area, in Saudi Arabia. Similarly, the result of this study was supported by Alzannan (2015), who found that there was a statistical difference in the achievements of kindergarten students in Saudi Arabia who used the iPad, compared to those who did not. The students' performances were positively affected in the treatment group, but the specific study was related to students' achievements in the Arabic language. The current paper measured tenth-grade students' performance in mathematics in Saudi Arabia, in order to provide findings with more statistical confidence. It was found that the iPad made a difference in students' mathematics performance, which was increased when students used the iPad as a learning tool and their performance decreased when they study using traditional methods only (paper and pencil). By looking at the results of this research, learning mathematics concepts using an iPad and its applications provides an excellent opportunity for students to study the subject, and solve mathematics problems, as their performances were positively impacted, and they felt more motivated. Overall, the findings provide evidence in support of promoting students' mathematics learning in the tenth grade across Saudi Arabia to be through iPads instead of traditional methods. Thus, students become more interactive when they use the iPad and its applications, which encourages them and assists them to perform better.

About the Author

Badi is a PhD student at School of Education, University of Glasgow, UK and the director of Saudi Society at the university since 2019. His study is focused on E-Learning on mathematics education, and he has experience teaching mathematics since 2007.

References

Al-Mashaqbeh, I. F. (2016). iPad in Elementary School Math Learning Setting. International Journal of Emerging Technologies in Learning, 11(2).

Aldossry, B., Lally, V. (2019). Assessing the Impact of Using iPad In Teaching and Learning Mathematics Within Saudi Arabian Secondary Schools, INTED2019 Proceedings, pp. 1423-1428.

Alsalkhi, M. (2013). The Effect of Using iPad on the Achievement of the Ninth Grade Students in the Islamic Education in Jordan. Journal of Education and practice, 4(17), pp.94-107.

Alzannan, B. M. (2015). The Effect of Using iPad on the Achievement of Children in Layla Kindergarten in Saudi Arabia.

Amin, J. (2010). Twenty first century classrooms: Changing scenario. Learning Community: An International Journal of Education & Social Development, 1(1), pp.23-28.

Cohen, L., Manion, L. and Morrison, K. (2007). Research methods in education.

Garson, G. D. (2012). Testing statistical assumptions. Asheboro, NC: Statistical Associates Publishing.

Gastwirth, J. L., Gel, Y. R. and Miao, W. (2009). The impact of Levene's test of equality of variances on statistical theory and practice. Statistical Science, 24(3), pp.343-360.

Ghasemi, A. and Zahediasl, S. (2012). Normality tests for statistical analysis: a guide for non-statisticians. International journal of endocrinology and metabolism, 10(2), p.486.

Herro, D., Kiger, D. and Owens, C. (2013). Mobile technology: Case-based suggestions for classroom integration and teacher educators. Journal of Digital Learning in Teacher Education, 30(1), pp.30-40.

LaBelle, D., Alsulami, J. and Leone, J. (2016). September. Effects of using iPads on First Grade Students' Achievements in Arabic Language Classes in Saudi Arabia. In Proceedings of the 5th Annual Conference on Research in Information Technology (pp. 25-28).

McCrum-Gardner, E. (2008) Which is the correct statistical test to use?. British Journal of Oral and Maxillofacial Surgery, 46(1), pp.38-41.

Muijs, D. (2010) Doing quantitative research in education with SPSS. Sage.

Razali, N. M. and Wah, Y.B. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. Journal of statistical modeling and analytics, 2(1), pp.21-33.

Rice, M. E. and Harris, G. T. (2005). Comparing effect sizes in follow-up studies: ROC Area, Cohen's d, and r. Law and human behavior, 29(5), pp.615-620.

Riconscente, M. M., (2013). Results from a controlled study of the iPad fractions game Motion Math. Games and Culture, 8(4), pp.186-214.

Shapiro, S. S. and Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). Biometrika, 52(3/4), pp.591-611.

Thalheimer, W. and Cook, S. (2002). How to calculate effect sizes from published research: A simplified methodology. Work-Learning Research, 1.

Zhang, M., Trussell, R. P., Gallegos, B. and Asam, R. R. (2015). Using math Apps for improving student learning: An exploratory study in an inclusive fourth grade classroom. TechTrends, 59(2), pp.32-39.

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