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Effects Of The Application Of Photomath Software In Enhancing Students' Interest In Algebra In Junior Secondary Schools In Kwali Area Council, Of FCT, Nigeria

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ABSTRACT
This study investigated the effects of the application of Photomath software in enhancing students' interest in Algebra in Junior Secondary Schools in Kwali Area Council, FCT, Nigeria. The quasi-experimental design was adopted for this study. The population of this study was made up of 9,097 Junior Secondary Schools mathematics students in Public Junior Secondary Schools within Kwali Area Council, Abuja. The sample for the study was made up of 76 JSS2 students (33 male, 43 female) in Kwali Area Council. Purposive sampling technique and simple random sampling were used to select the schools from where samples were selected. Questionnaires were used to collect the data. Data collected from the study were analyzed using mean and standard deviation, ANCOVA and Mann Whitney U-test statistics. Research questions were answered using mean, mean ranks and standard deviation. Hypotheses relating to achievement were tested using ANCOVA statistical tool while those related to interest were tested using Mann Whitney U-test statistics. All the hypotheses were tested at 0.05 level of significance.
The findings of this study revealed that the used of the Photomath application software in teaching Algebra promotes the students' interest without gender differences influence. Photomath application software is an effective means of teaching Algebra to Junior Secondary School Students. Based on the findings of this study, the study recommends that Mathematics teachers be trained in the use of effective instructional methods in the classroom, especially in the use of the photomath method in mathematics instruction, so as to improve the students' interest and achievement in this regard and other topics of mathematics that photomath would be effective to teach. Also, students should use more photo math resources for practices to improve their performance in mathematics.
Keywords: Interest, Photomath software

INTRODUCTION
Mathematics, as the science of reasoning and computation, or the study of numbers, quantities, or shapes, has been regarded as a fundamental subject because arithmetic and logical reasoning are the basis of science and technology. For this reason, educational authorities emphasized students' proficiency in computational skills and problem solving (Kitta, 2014). In order to arouse students' interest and

achievement in mathematics, instilling computational and problem-solving skills in junior secondary students is considered of great importance. Algebra as a re-union of broken parts is one of the broad areas of mathematics that deals with the study of mathematical symbols and the rules for manipulating these symbols in formulas. It is a unifying thread in almost all of mathematics. Mathematics algebra is a major component, with its uses extended to almost all other disciplines of mathematics such as arithmetic, geometry, statistics, and calculus. Algebraic thinking is essential to comprehending and interpreting real-world problems mathematically to ultimately find the solution, which is often, abstract (Ling, 2019).

Recently, the results of the programme for International Student Assessment (PISA) and the Trends International Mathematics and Science Study (TIMSS) in 2015 (OECD 2016; Mullis 2016) revealed a challenge for Nigerian schools. Although Nigerian students had a higher average performance in mathematics literacy compared to students in other countries, there were still significant percentages of low-achieving secondary school students in Nigeria. Additionally, most Nigerian students show low levels of interest and confidence in learning mathematics (Lee, 2012; Cheng, Yang, Liao, Chang, Huang, & Chan, 2015).Students' interest in learning Mathematics and its implications for Mathematics instruction have long been a common concern among Mathematics educators. Interest in Mathematics has been considered an important factor influencing participation and success in the subject. Mathematics is made up of a set of concepts, facts, principles, and operations that are fundamental to the existence of every individual (Hafiz, Kadir, and Fatra, 2017). The low-interest problem for some students in Nigeria is usually accompanied by low motivation (Krapp, 2019). Furthermore, students with continuously low achievement in mathematics may eventually lose interest and refuse to learn further (Schraw and Gutierrez, 2012).The existence of a significant percentage of low-achieving students is probably due to teacher-led instruction, which still dominates mathematics classrooms in most African countries (Umameh, 2015). It should be noted that students in every classroom possess different abilities and, hence, demonstrate different achievements. Unfortunately, in teacher-led instruction, all the students are required to learn from the teacher in the same way at the same pace (Hwang and Kandampully, 2012). Low-achieving students, without sufficient time, are forced to receive knowledge passively. According to Barr and Tagg (2015), it was pointed out that it is urgent for low-achieving students to have more opportunities to learn mathematics at their own pace.

Researchers suggested one-to-one technology through which every student is equipped with a device to learn in school or at home seamlessly (Chan, Ada, Au, and Keppell, 2016). Furthermore, the students can receive immediate feedback through the use of photomath software, which supports their individualized learning actively and productively. Thus, this may provide more opportunities for helping low-achieving students improve their achievement. The result of real changes in information technological revolution in Mathematics teaching and methods is represented by modern video teaching tapes, some other electronic equipment for the computer, and multimedia and programs. A development was observed in this domain, leading to better achievement in the teaching of mathematics compared to classical methods that rely on the blackboard and other explanatory instruments. However, what is important here is not the comparison between modern and classical methods, but using the most suitable modern methods for the subject, place, and educational environment (Bashiti, 2017).

According to Owano (2014), Photo Math, from the software development company Micro Blink, will make the students' phones spell out homework by just pointing the camera towards the mathematical expression, and Photo Math will display a result. Photo Math solves equations using the camera on an Android, iOS, or Windows phone. More importantly, Photo Math is not just a camera-based calculator. Its value is not just in giving the photo user the answer but in being able to display the solution in the steps taken to solve the problem. One of the most important factors for improving performance is student involvement, which differs by gender. A highly committed male student will have higher achievement in mathematics than a less committed female student, and a highly committed female student will have higher achievement in mathematics than a male student in relation to algebra and photomath software applications. There is now a lot of research to suggest that the more time students invest in the learning process and the more intensely they engage in their own education, the greater will be their growth and

achievement, especially in mathematics, their satisfaction will be their educational experiences and their persistence in school, and the more likely they are to continue their learning (Umameh, 2011).

The ability to solve algebraic equations is elementary for all students who enrol in science, engineering, and the arts. Many researchers are interested in investigating the difficulties faced by most students in learning algebraic equations. The major factor in a student's difficulty in algebra is the inability of the student to differentiate between arithemetic and algebra, or the effort to draw similarities between both disciplines (Egodawatte, 2009); Egodawatte (2019) concludes that difficulties in teaching algebra cannot be solved without any creative solution. New and creative ways to learn and teach mathematics are possible using AR technology; teachers can create more engaging math activities for students using AR with ample time savings (Figueiredo, 2014). Sidhu (in Umameh, 2011) said the elements of novelty, usefulness, and sheer intellectual curiosity is the primary stimuli for the awakening, maintaining the student's interest in mathematics. With genuine attitudinal change, sustained interest, and continual challenge, mathematics would no longer seem to the students as boring, useless to real-life issues, and increasingly incomprehensible, but a subject that would be longed for.Hence, this study investigated the application of Photomath software to enhance students' interest and achievement in algebra in Junior Secondary Schools in Kwail Area Council, Abuja.

Purpose of the Study

This study investigated the effects of the application of Photomath software in enhancing students' interest in Algebra in Junior Secondary Schools in Kwali Area Council. Specifically, this study sought to;

i. ascertain the interest level of students in Algebra when taught with Photomath in Junior Secondary Schools in Kwali Area Council;

ii. investigate if there is a gender difference in students' interest in Algebra when taught with Photomath in Junior Secondary Schools in Kwali Area Council; and

Research Questions

To achieve the objectives of the study, two research questions were raised.

1. What is the difference in the mean interest scores of students taught Algebra with Photomath and those taught with conventional method?

2. What is the difference in the mean interest scores of male and female students taught Algebra using Photomath?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 significance level.

H_{01}: There is no significant difference in mean interest scores of students taught Algebra with Photomath and those taught with the conventional method.

H_{02}: There is no significant difference in the mean interest scores of male and female students taught Algebra with Photomath software.

METHOD

The quasi-experimental design was adopted for this study. The population of this study was made up of 9,097 Junior Secondary School mathematics students in Public Junior Secondary Schools within Kwali Area Council, Abuja (Department of Quality Assurance, Education Resource Centre, Abuja, 2024). The sample for the study was made up of 76 JSS2 students (33 male, 43 female) in Kwali Area Council. Purposive sampling technique and simple random sampling were used to select the schools from where samples were selected. The instruments for data collection were Mathematics Achievement Test (MAT) as well as Mathematics Interest Scale (MIS). The instrument were designed based on the 4-point Likert scale responses: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The respondents (students) were asked to tick only one option as best appealing to them.

The instruments developed were subjected to face and content validation both by the supervisor and two other experts from the Department of Science and Environmental Education, University of Abuja. The teaching of the experimental and control groups was done by the research assistants for a period of six weeks. Data collected from the study were analyzed using mean and standard deviation, ANCOVA and

Mann Witney U-test statistics. Research questions were answered using mean, mean ranks and standard deviation. Hypotheses relating to achievement were tested using ANCOVA statistical tool while those related to interest were tested using Mann Witney U-test statistics. All the hypotheses were tested at 0.05 level of significance.

Data Analysis

Research Question 1: *What is the difference in mean interest scores of students taught Algebra with photomath and those taught with conventional method?*

Table 1: Mean Rank and Sum of Ranks of Interest Rating Scores of Students Taught Algebra with Photomath and Those Taught with Conventional Method

Group	Mean Rank		Sum of Ranks
	Pre-test	Post-test	
Experimental	27.00	57	2223.00
Control	21.00	19	703
Mean Rank Difference	6.00	38.00	

Table 1shows the mean rank and sum of ranks of interest rating scores of students taught algebra with photomath and those taught with conventional method. From the results obtained, students taught Algebra with photomath had a mean rank interest rating score of 57.00 with a sum of ranksof 2223.00while the students taught Algebra using conventional method had a mean rank interest rating score of 19.00with a sum of ranks of 703.00. Therefore, the mean rank difference in interest rating scores between students taught Algebra with photomath and those taught with conventional method is 38.00in favour of students in photomath group.

Research Question 2: *What is the difference in the mean interest scores of male and female students taught Algebra using photomath?*

Table 2: Mean Rank and Sum of Ranks of Interest Rating of Male and Female Students Taught Algebra with Photomath software

Group	Mean Rank		Sum of Ranks
	Pre-test	Post-test	
Male	14.00	21.22	339.50
Female	12.00	19.15	440.50
Mean Rank Difference	2.00	2.07	

Table 2 shows the mean rank and sum of ranks of male and female students of Photomath group with respect to their interest rating in Algebra. From the results obtained, male students had a mean rank interest rating score of 21.22with a sum of ranks of 339.50while the female students had a mean rank interest rating of 19.15with a sum of ranks of 440.50. Therefore, the mean rank difference in interest rating between male and female students in Photomath group was 2.07 in favour of male students.

Testing of Hypotheses

In this section, the null hypotheses formulated to guide this study were tested at 0.05 level of significance.

Ho_1: There is no significant difference in mean interest scores of students taught Algebra with Photomath and those taught with the conventional method.

Table 3: Summary of Mann Whitney Results of Interest Rating of Students Taught Algebra with Photomath and Those Taught with Conventional Method

Group	N	Mean Rank	Sum of Ranks	Mann Whitney U	Z	Sig@0.05	Remark
Photomath	39	57.00	2223.00	0.000	7.542	0.000	Significant
Convention	37	19.00	703.00				

From Table 3 results of the Mann Whitney nonparametric test shows that the computed mean interest rank scores are 57.00 and 19.00 by Photomath and conventional method groups respectively. The computed sum of ranks scores are 2223.00 and 703.00 by Photomath and conventional method groups respectively. The computed Mann Whitney U value of 0.000 is less than the 7.542 Z scores. The calculated p-value of 0.000 is less than the 0.05 level of significant. This implies that the mean interest development of photomath and conventional method groups is significantly different when both groups are taught Algebra. Consequently, hypothesis one which states that there is no significant difference in mean interest scores of students taught Algebra with Photomath and those taught with conventional method, is hereby not accepted.

Ho_2: There is no significant difference in the mean interest scores of male and female students taught Algebra with Photomath.

Table 4: Summary of Mann Whitney Results of Interest Rating of Male and Female Students Taught Algebra with Photomath

Gender	N	Mean Rank	Sum of Ranks	Mann Whitney U	Z	Sig@0.05	Remark
Male	16	21.22	339.50	164.500	0.569	0.570	Not Significant
Female	23	19.15	440.50				

From Table 4 results of the Mann Whitney nonparametric test shows that the computed mean interest rank scores are 21.22 and 19.15 by male and female respectively. The computed sum of ranks scores are 339.50 and 440.50 by male and female respectively. The computed Mann Whitney U value is 164.500 and the Z score is 0.569. The calculated p-value of 0.570 is greater than the 0.05 level of significant. This implies that the mean interest development by male and female students in photomath group is not significantly different when both genders are taught Algebra using photomath. Consequently, hypothesis two which states that there is no significant difference in students' interest taught Algebra with Photomath based on gender is hereby accepted.

Summary of Findings

1. There is significant difference in mean interest scores of students taught Algebra with Photomath and those taught with conventional method in favor of students taught with Photomath.

2. There is no significant difference in the mean interest scores of male and female students taught Algebra with Photomath. So, there is a moderate interest in both genders including male and female taught Algebra with Photomath.

DISCUSSION OF FINDINGS

The first finding from this study revealed that there was significant difference between the interest of students taught using PhotoMaths and those taught using conventional method. it was confirmed that a child who has a positive attitude, such as interest in what he or she learns, will be highly motivated to engage in activities that promote learning by developing a positive attraction to the use of educational technology tools for learning. This finding is in accordance with the finding of Onah (2014) who found that INDICAB-Games increases the interest of students more than the conventional method

Findings from the study also revealed that teaching mathematics using Photomaths enhanced students' achievement in content better than using lectures or conventional methods. The present study shows that there is a significant difference in the mean achievement scores of students taught Algebra with Photomath and those taught with conventional methods, the findings correlate with Igcasama, Ramirez and Salanap, (2020)'s study which showed that there was a significant difference between the pre-test and post-test results of the section with "Photo Math" as intervention. Moreover, there was also a significant difference between the pre-test and post-test results of the section without the said application as

intervention. However, it showed that there was no significant difference between the two sections when Photomath was used. Hence, the study implied that Photo math as a teaching tool had an effect on teaching elementary Algebra.

The findings from the study further revealed that there is no significant difference in the mean interest scores of male and female students taught Algebra using Photomath, this is supported by the study Hertono (2020) who examined the interest levels of male and female students taught Algebra using photomath and mathematics skills and the results indicated that there was no significant difference in interest levels between male and female students taught with Photomath, suggesting a moderate level of interest in both genders. This suggests that the impact of photomath in learning Algebra in mathematics in Junior Secondary School is uniform for both genders.

CONCLUSION

Drawing from the findings of this study, it can be concluded that the use of the Photomath application software in teaching Algebra promotes the students' interest without gender differences influence. Photomath application software isan effective means of teaching Algebra to Junior Secondary School Students.

RECOMMENDATIONS

Based on the findings of this study, the study recommended the following:

1. Since this study revealed that the photomath method significantly affected students' achievement positively compared to any of the other methods used in this study, it is therefore recommended that Mathematics teachers be trained in the use of effective instructional methods in the classroom, especially in the use of the photomath method in mathematics instruction, so as to improve the students' interest and achievement in this regard and other topics of mathematics that photomath would be effective to teach.
2. Students: Consider using photomath as a supplementary tool for learning Algebra. The research suggests that students taught with photomath showed higher interest and achievement scores compared to those taught with conventional methods. By utilizing photomath, students can potentially enhance their understanding and performance in Algebra.

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