Effects of Multimedia Courseware on Senior School Students' Performance in Linear Equations involving Word Problems in Gombe, Nigeria

Morenikeji Alex Akanmu[1] & Bala Ayuba[2]

Abstract

This study investigated the effects of multimedia courseware on senior school students' performance in linear equations involving word problems. The study employed a quasi-experimental design to explore whether or not students taught linear-equation-word-problems using the multimedia courseware can perform better than their counterparts taught using the conventional teaching methods. It also investigated gender and score-level effects of on the students' performance. The non-randomized non-equivalent groups pre-test post-test control group design involved exposing a sample of 73 second year mathematics students (39 males and 34 females) from two co-educational senior schools in Gombe, Nigeria, to two treatments (multimedia courseware and conventional teaching) a pre-test and post-test. Two instruments (Multimedia Courseware on Linear Equation Word Problems in Mathematics (MCLEWPs) and Mathematics Performance Test on Linear Equations Word Problems (MPTLEWPs)) were developed, duly validated and approved for data collection. The reliability coefficient of MPTLEWPs was found to be 0.76. The data gathered were analyzed using a t-test and Analysis of covariance at a significance level of .05. Giving to the study's findings, there was a significant difference in the performance of students taught using multimedia courseware and those taught with conventional teaching, with those taught using multimedia courseware outperforming their counterparts $(t(71) = 2.19, p<0.05)$; a significant difference was observed between the performance of male and female students with the males taught using multimedia courseware outperforming their female counterparts $(t(27) = 2.99, p<0.05)$; significant differences were observed among the students in the three scoring levels (high, medium, and low) with the high scorers outperforming the others $(F (2,25) = 21.64, p<0.05)$. The study established that Multimedia courseware enhanced students' performance in linear equation involving word problems, particularly among males and high-scoring students. It is recommended that students should be engaged in learning by using multimedia courseware that is relevant and meaningful to them on a regular basis.

Keywords: mathematics; mathematics performance; multimedia courseware; linear equation word problems

Introduction

Science and technology are the primary vehicles through which humanity progresses, this is so because the development of new technology has been vital for both human survival and human progress. While science is the bedrock that provides the spring board for the growth of technology, Mathematics is the gate and key to the science (Orngudwen, Atindiga & Kper, 2018). The rapid expansion of technology in schools and its integration into teaching and learning have necessitated curriculum reconstruction, change in the thinking and interaction patteren for teachers and students across the globe (Çelik, Pektas & Karamustafaoglu, 2021). As a result, changes have occurred in learning environments. The learning environment which adopts students-

[1]Akanmu, Morenikeji Alex, Department of Science Education, University of Ilorin, Ilorin, Nigeria. Email: alexakanmu@gmail.com;

[2]Ayuba Bala, Department of Science Education, Federal University of Kashere, Gombe State. Email: balaayuba1@gmail.com

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centered, active learning methods is also integrated with computer-assisted teaching methods (Çelik, & Pektaş, 2017). Among these methods, Multimedia Courseware technology is one of the exciting innovations in this information age that could facilitate teaching and learning (Nusir, Alsmadi, Al-kabi & Shardqah, 2012). It is also flexible, easy-to-use, user-friendly and low-cost when supported by mobile learning. Multimedia courseware can be relevant in teaching various school subjects including Mathematics and can be considered the best option for teaching in the 21st century and post-covid era. The foundation of science and technology, which is the basic requirement for development of a nation, is Mathematics. This shows the importance of Mathematics in nation building. Mathematics promotes science and technological development as well as facilitates the training of reasonable, thoughtful and productive citizen (Kratvitz, 2013). Mathematics exposes learners to different ways of solving problems as well as leads them to make discoveries, analyze and interpret their experiences (Salman, Yahaya & Adewara, 2011).

Mathematics curriculum in Nigerian secondary schools is developed and structured around five broad areas namely: number and numeration, algebraic processes, geometry/trigonometry, introduction to calculus and statistics. Algebra is one of these content domains, and is taught to students at the secondary school level of education to university. The knowledge of algebra is so important that its utility is needed as a foundation for further studies in other branches of Mathematics, and students without good knowledge in algebra would be challenged when studying calculus, geometry, statistics and probability (Adu, Mereku, Assuah & Okpoti, 2017). Algebra has been widely recognized as one of the difficult topics

in Mathematics at secondary school and tertiary level of education (Jupri, Drijvers & Van den Heuvel-Panhuizen, 2014). In the area of algebra, there are many concepts that are been taught to students in our Nigerian classroom which, linear equation involving word problems is one of the topic in algebraic process, and is one of the dreaded topic to students.

In the study of Sam-Kayode and Salman (2015) investigated the effect of Ludo game on senior students' performance in probability along-side the influence of scoring levels on students' academic performance. The study employed a quasi-experimental design which involved pre-test and post-test groups design. The sample for the study comprised 100 purposively selected senior secondary school two (SSS II) drawn from two co-educational schools in Ibadan, Oyo State. Analysis of Covariance (ANCOVA) and t-test were used to analyze the collected data. The result of the study revealed that there was a significant difference in the performance of high, medium and low scoring students in the experimental group. It has been observed that students are of different ability level in assimilating facts and principles. As a result, there is need to investigate the influence of scoring level on the academic performance of students in linear equation word problems.

Adu, Mereku, Assuah and Okpoti (2017) carried out study on effect of multimedia courseware with cooperative learning on senior high school students' proficiency in solving linear equation word problems in Agona municipality of Ghana. Adu et al. (2017) used a non-equivalent pre-test post-test control group design for the study. The main independent variable observed was the teaching methods: Multimedia courseware with cooperative learning (MC), cooperative learning (CL) and traditional method. Three

intact classes of 124 senior high school students were purposely sampled and were labelled as cooperative learning only group, multimedia courseware with cooperative learning group, and control group. The Cooperative learning group (treatment 2) consisted of students of mixed-ability group of 4 or 5 who worked together to minimize every student's learning potential. The cooperative learning and the control groups took their lesson in the normal classroom.

The pre-test and post-test consisted of 10 linear equation word problems consisting of age problems, consecutive integer problems, digit problems, geometry word problems and fraction and proportion problems. They also used nineteen (19) closed-ended questions consisting of both positive and negative worded items to assessed students' engagement (participation and involvement) in teaching and learning mathematics. The questionnaire was administered before and after the treatment. The data were organized and analyzed using descriptive and inferential statistics. The reliability for the instrument was 0.783, indicating a high degree of reliability.

The observation in their research was that the teaching methods led to an improvement in the proficiency of the experimental groups in solving linear equation word problems. This improvement is indicative of the fact that teaching with technology comes with several advantages. It enables students to explore and experience real-case algebraic examples with animations. The study revealed that the use of multimedia courseware with cooperative learning can positively influence students' learning of linear equation word problems. The study also showed that students learn to relate to their peers and other learners as they work together in groups. It is also concluded that students have a positive perception about the teaching methods and usefulness of technology with cooperative learning in

teaching and learning of linear equations word problems.

The poor performance of students in Mathematics, particularly linear equations word problems has been a matter of concern to teachers, Mathematics educators and researchers. The causes of this poor performance has been attributed to several factors such as low interest by students, difficulties of examinations, poor instructional strategies, lack of interesting teaching approaches, insufficient qualified Mathematics teachers, ill-equipped Mathematics laboratories, students' perception that Mathematics is difficult and, the use of traditional method of teaching (Ali, Hukamdad, Akhter & Khan, 2010; Akanmu & Fajemidagba, 2013; Salman & Ameen, 2014; Arop, Mbon, Ekanem, Ukpabio, Uko & Okon, 2020). The West African Examinations Council (WAEC) Chief Examiners' Reports highlighted that, majority of candidates who sat for May/June West African Senior School Certificate Examination (WASSCE) in Mathematics have difficulties in answering questions involving word problems in Mathematics most especially, translating word problems into mathematical statements (WAEC, 2012, 2013, 2017 & 2020).

Though the concept of linear equations word problems spans across the junior secondary school up to the senior secondary school levels, research findings have also shown that students found it difficult to solve simple linear equations involving word problems (Adu, Assuah, & Asiedu-Addo, 2015; Samuel, Mulenga & Angel, 2016; Wati, & Fitriana, 2018; Bukari, 2019). Fajemidagba, Salman and Ayinla (2012) investigated the effect of teachers' instructional strategy pattern on senior secondary school students' performance in mathematics word problems in Ondo, Nigeria. The findings from their study revealed that the experimental group exposed to instructional strategy pattern

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performed significantly better in Mathematics word problems-solving involving simultaneous equations than their counterparts in the control group who were not exposed to instructional strategy pattern. As found in the literature reviewed, several researchers have proffered solutions toward students' difficulties in linear equations word problems (Fajemidagba, Salman & Ayinla, 2012; Adu, Mereku, Assuah & Okpoti, 2017). There is however dearth of literature on the effects of multimedia courseware on secondary school students' performance in linear equations word problems. Thus, the work of Adu, Mereku, Assuah and Okpoti (2017) on the effect of multimedia courseware with cooperative learning on senior high school students' proficiency in solving linear equation word problems, though in Ghana, becomes relevant as the outcome showed that technology use and cooperative learning in Mathematics classroom improved students' performance in solving linear equation word problems.

As at the time of this study, the researchers are not aware of any study in the literature that explores the use of multimedia courseware on secondary school students' performance in linear equations involving word problems. As found in the literature reviewed, none of these studies also considered students' gender and score level as a moderating variable as it is being done in this present study. Thus, the present study investigated the effects of multimedia courseware on senior school students' performance in linear equations involving word problems in Gombe, Nigeria.

Research Questions and Hypotheses

The study raised and answered the following research questions:

1. Is there any difference in the academic performance of students taught linear equations involving word problems using multimedia courseware and those not exposed to multimedia courseware?

2. Is there any difference in the mean gain scores of male and female students taught linear equations involving word problems with multimedia courseware?

3. Is there any difference in the mean gain scores of high, medium and low scoring students taught linear equations involving word problems?

4. Are there any interaction effects among multimedia courseware, students' gender and score levels on students' performance in linear equations involving word problems?

The following hypotheses were tested in this research at 0.05 alpha level of significance.

$H0_1$ There is no significant difference between the senior school students' performance in linear equations involving word problems when taught using multimedia courseware and those not exposed to multimedia courseware.

$H0_2$ There is no significant difference in the performance of male and female senior school students in linear equations involving word problems when taught using multimedia courseware.

$H0_3$ There is no significant difference in the performance of low, medium and high scoring students when taught linear equations involving word problems using multimedia courseware.

$H0_4$ There is no interaction effect among multimedia courseware, gender and scoring levels on students' performance in linear equations involving word problems.

Method

Design

The study was a quasi-experimental study. It was a pre-test, post-test, non-randomized, non-equivalent control group involving a $2 \times 2 \times 3$ factorial design. The study involves two groups: an experimental group which was

teach linear equations in mathematics and offer assessment to monitor the students' progress. The web package is designed using HTML, CSS and JavaScript technology. HTML and CSS was used to create the user interface (UI) which is the part the students interact with while using the application. The

Table 1 *The layout representation of the research design*

Group	Pre-test	Treatment	Post-test
Experimental Group	0_1	X_1	0_2
Control Group	0_1		0_2

Where,
0_1 means pre-test for both experimental and control group
0_2 means post-test for both experimental and control group
$\times_1$ means treatment for the experimental group

exposed to multimedia courseware mode as the treatment and, control group which was not exposed to multimedia courseware mode of teaching. The design used is shown in Table 1.

Participants

Two intact classes of 73 senior secondary school students were purposively sampled from two schools in Gombe, Gombe State. The two classes were labelled: Experimental Group and Control Group.

Procedure`

Permission letter was sent to the principals of the senior secondary schools to seek for their approval and consent to allow Mathematics teachers of the various classes, the ICT department and students to participate in the study.

Multimedia courseware (MC) on linear equation word problems in Mathematics was the treatment instrument for the experimental group. The MC on linear equation package is designed to be used in a website and an android application. It is an offline application/software. It is designed to teach students with the assistance of a teacher to

Logic part of it which is includes assessment and score calculation is done using JavaScript programming language. The mobile application is created and packaged using a Vue.js and Capacitor respectively. Vue.js is employed to design and create the user interface while it is converted into an installable application in the students' phones using a library called Capacitor.js. The developed courseware can be assessing with computer through the given link.

The study lasted for four weeks. In the first week, the students were informed about the objectives of the study and the test instrument (MPTLEWPs) was administered to the experimental group and control group before applying the treatment. Students' pre-test scores were used to categorize the students' performance into high, medium and low score level. Students that score 70% and above were rated as high scoring students, students that score within an interval of 50% to 69% were rated as medium or average scoring students while, students that score within interval of 0% and 49% were rated as low scoring students.

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The second and third week was used to administer the treatment instrument to the experimental group using (MCLEWP). The

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Table 2 Descriptive statistics of performance of students in the experimental and control groups in the pretest and post-test

Groups	N	Pretest		Posttest		Mean Gain Score
		Mean	Std. Dev.	Mean	SD	
Experimental	29	49.62	19.53	66.10	16.59	16.48
Control	44	44.50	10.88	58.48	13.04	13.98

MPTLEWPs was re-arranged containing the same test item as in the pre-test as post-test. The post-test was administered to both the experimental group and control group at the fourth week.

Test re-test method was used to determine the reliability of the instruments within the interval of three weeks. A reliability coefficient of 0.76 was determined using Pearson Product Moment Correlation Statistics at 0.05 alpha level of significance.

Results

The data were analyzed using the software Statistical Package for Social Sciences (SPSS) version 25.0 to perform descriptive and inferential statistical analysis. Each of the four (4) research questions had four (4) research hypotheses that were tested using the t-test and Analysis of Covariance (ANCOVA) in this study. Research hypotheses I and II were tested using an independent sampling t-test at the 0.05 alpha level of significance, whereas research hypotheses III and IV were tested using ANCOVA.

multimedia courseware and those not exposed to multimedia courseware?
(Research Question 1)

Table 2 presents the descriptive statistics of the pretest performance of the experimental and control groups of the mathematics students who participated in the study,

The pretest mean scores for the experimental and control groups were 49.62 and 44.50, respectively, but the post-test mean scores for the experimental and control groups were 66.10 and 58.48, respectively. In addition, the mean gain scores for the experimental and control groups were 16.48 and 13.98, respectively. The mean gain scores of the experimental and control groups differed by 2.50, with the experimental group having a higher mean gain score.

The data was further analyses to test the null hypothesis that there is no significant difference between the senior school students' performance in linear equations involving word problems when taught using multimedia courseware and those not exposed to multimedia courseware. The results of the analysis for the research hypothesis, which was tested using a *t*-test, are shown in Table 3.

Table 3 The t-test results for differences in the performance between the students in the experimental and control groups in the post-test

Groups	N	Mean	Std. Dev.	df	T	Sig. (2-tailed)
Experimental	29	66.10	16.59	71	2.19	0.032
Control	44	58.48	13.04			

$p < 0.05$

According to the results of the analysis in, the t-value ($t_{(71)} = 2.19$, $p<0.05$) was significant at the 0.05 alpha level. This implies that there was a significant difference in performance between the experimental and control groups, with the experimental group outperforming the control group. As a result, the first hypothesis was rejected, meaning that using multimedia courseware enhanced students' performance in linear equation involving word problems.

Is there any difference in the performance of male and female students taught linear equations involving word problems with multimedia courseware? (Research Question 2)

Table 4 presents the results of the descriptive statistics of male and female students who participated in the experiment. The male and female students had significantly different mean scores of 72.94 and 56.42, respectively. This indicates that the male students benefited more from the use of multimedia courseware to teach linear equations involving word problems, as they had a higher mean score than the female students, with a mean score difference of 16.52 in their favor.

The data was further analyses to test the null hypothesis that there is no significant difference in the performance of male and female senior school students in linear equations involving word problems when taught using multimedia courseware. The results of the data analysis for research hypothesis II, which was examined using the *t*-test, are shown in Table 5.

Table 5 The t-test results for differences in the performance between the Male and Female Students' in the post-test

Groups	N	Mean	Std. Dev.	df	T	Sig. (2-tailed)
Male	17	72.94	9.84	27	2.99	0.006
Control	12	56.42	19.62			

$p < 0.05$

The t-value ($t_{(27)} = 2.99$, $p<0.05$) was statistically significant at the 0.05 alpha level, as indicated in Table 5. This finding demonstrates that male and female students who were taught linear equations involving word problems using multimedia courseware performed significantly differently, with male students outperforming female students, and it answers research question 2. As a result, the second hypothesis was rejected, implying that multimedia courseware assist male students' more than female students.

Table 4 Descriptive statistics of performance of male and female students' performance in the in the post-test

Gender	N	Posttest Mean	Posttest Std. Dev.	Mean Gain Score
Male	17	72.94	9.84	16.52
Female	12	56.42	19.62	

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Is there any difference in the mean gain scores of high, medium and low scoring students taught linear equations involving word problems? (Research Question 3) Table 6 shows the results of the descriptive

Table 7 *Summary of the Analysis of Covariance of Significant Differences in Students' Performance in the Experimental Group for High, Medium and Low Scorers*

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	6481.005[a]	3	2160.335	44.064	.000
Intercept	5652.815	1	5652.815	115.299	.000
Pretest	367.148	1	367.148	7.489	.011
Score Levels	2122.240	2	1061.120	21.643	.000
Error	1225.685	25	49.027		
Total	134427.000	29			
Corrected Total	7706.690	28			

a. R Squared = .841 (Adjusted R Squared = .822)

statistics of the performance of the participants in the three scoring levels (high, medium, and low) in the experimental group. High, medium, and low scorers' students obtained mean scores of 76.93, 62.90, and 33.50, respectively with the high scorers obtaining the highest score suggesting they benefited the most from the teaching of linear equation involving word problems utilizing multimedia courseware.

Table 6 *Descriptive statistics of performance of students' in the three scoring levels (high, medium, and low) in the in the post-test*

Score Levels	N	Mean	Std. Dev.
High	15	76.93	6.87
Medium	10	62.90	7.12
Low	4	33.50	12.58
Total	29	66.10	16.59

The data was further analyses to test the null hypothesis that there is no significant difference in the performance of low, medium and high scoring students when taught linear equations involving word problems using multimedia courseware. The data was analyzed using ANCOVA. The F-value ($F_{(2,25)}$ = 21.64, $p<0.05$) was observed to be significant since the p-value of 0.00 was less than the 0.05 alpha level, as shown in Table 7.

The results in Table 7 indicates that there was a significant difference between the low, middle, and high scorers' students when they were taught linear equations involving word problems utilizing multimedia courseware, with the high scorers' students benefiting the most, and it provides the answer to research question 3. As a result, hypothesis III was disproved, implying that using multimedia courseware significantly enhanced high-scoring students' performance in linear equations involving word problems.

Are there any interaction effects among multimedia courseware, students' gender and score levels on students' performance in linear equations involving word problems? (Research Question 4)

The descriptive statistics of the performance of the participants by gender and the three

linear equations involving word problems and the results are presented in Table 9.

Table 9 shows that no interaction effects were observed in the ANCOVA results. According to the results of the analysis, the F-value ($F_{(1,23)}$ = 0.918, $p>0.05$) was not significant because the p-value of 0.35 was more than the

Table 8 Description of the interaction effects of multimedia courseware by gender and score levels of students' when taught linear equations word problems

Gender	Score Levels	N	Mean	Std. Dev.
Male	High	11	77.91	7.134
	Medium	6	63.83	7.387
	Total	17	72.94	9.845
Female	High	4	74.25	6.131
	Medium	4	61.50	7.550
	Low	4	33.50	12.583
	Total	12	56.42	19.621
Total	High	15	76.93	6.871
	Medium	10	62.90	7.125
	Low	4	33.50	12.583
	Total	29	66.10	16.590

scoring levels (high, medium, and low) in the post-test are presented in Table 8.

The data was subjected to further analyses using ANCOVA to test the null hypothesis that there is no are no interaction effects among multimedia courseware, gender and scoring levels of students' performance in

0.05 alpha level. This finding demonstrates that there was no significant interaction effect of treatment on gender or scoring levels when students were taught linear equation involving word problems, and thus answers research question 4. As a consequence, the hypothesis was retained, meaning that gender and level of scoring (moderating variables) had no effect

Table 9 ANCOVA of interaction effects of treatment on gender and score levels of students by performance when taught using multimedia courseware

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6540.944a	5	1308.189	25.810	.000
Intercept	4998.959	1	4998.959	98.629	.000
Pretest	374.747	1	374.747	7.394	.012
Gender	6.622	1	6.622	.131	.721
Score Levels	1656.399	2	828.200	16.340	.000
Gender * Score Levels	46.532	1	46.532	.918	.348
Error	1165.746	23	50.685		
Total	134427.000	29			
Corrected Total	7706.690	28			

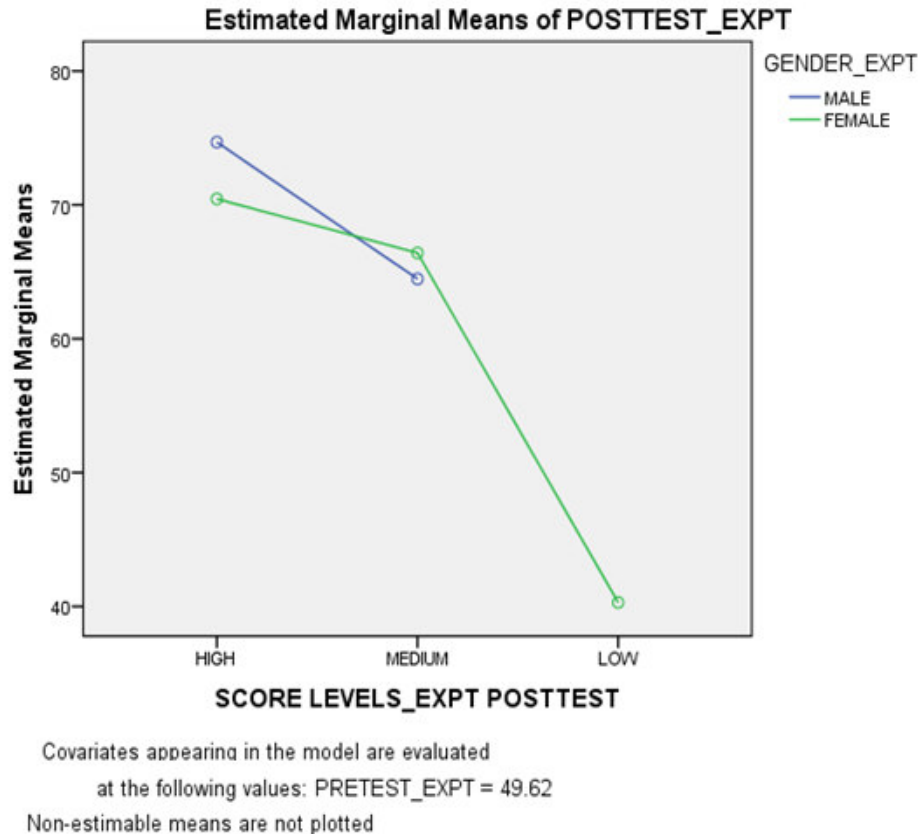a. R Squared = .849 (Adjusted R Squared = .816)

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on multimedia courseware (the treatment). As a result, the adoption of multimedia courseware as a major treatment had a considerable impact on students' performance.

The interaction impact of gender and scoring levels is depicted in Figure 1. The graph

i.   There was a significant difference in the performance of students taught linear equations involving word problems using multimedia courseware and those taught without multimedia courseware in favor of

Covariates appearing in the model are evaluated
at the following values: PRETEST_EXPT = 49.62
Non-estimable means are not plotted

Figure 1: Gender and score levels interaction effects graph

demonstrates that the lines intersect at a location where various forms of interaction can be seen. The interaction is weak and there is no interaction effect because the p-value of 0.35 is higher than the 0.05 alpha values. This means that neither gender nor scoring level has an impact on the use of multimedia courseware.

Summary of Findings

The following are the findings of the study:

those taught using multimedia courseware;

ii.   There was a significant difference in the performance of male and female students taught linear equations involving word problems using multimedia courseware in favor of the male students;

iii.   There was a significant difference in the performance between high, medium, and low scorers' students

when they were taught linear equations involving word problems using multimedia courseware, with the high scorers' students outperforming the others; and

iv. There was no significant interaction effect on gender and score levels of students' when taught linear equations involving word problems using multimedia courseware.

Discussion

The experimental group fared better than the control group, according to the findings of this study. This difference could be explained by the usage of multimedia courseware, which may have gotten the experimental group more involved in learning and so allowing them to do better without distress. This finding is consistent with that of Adu, Mereku, Assuah and Okpoti (2017), who found that the interactive multimedia courseware group outperformed the traditional group in solving linear equation word problems. Also, in line with Han, Abd Halim, Sharriffuddin, and Abdullah (2013) who found that computer-based courseware has a considerable impact on students' mathematics learning.

It was also discovered in this study that male students in the therapy group outperformed their female counterparts. Multimedia courseware had a positive impact on male performance as a result. Perhaps the multimedia courseware's features appealed more to male students, making them more adaptable and driven, which could have aided them in completing the work quickly and effectively. This study is in line with the findings of Alordiah, Akpadaka, and Oviogboda (2015), who discovered that male students outperformed female students in Mathematics achievement. The study, however, contradicts Omenka and Kurumeh's (2013) findings, which found no significant effect of gender on pupils' achievement in

number and numeration when taught using an ethnic Mathematics method.

Another finding of this study is that multimedia courseware had a better influence on students' performance in the experimental group among the three score levels (low, medium, and high scorers' students), with the high scorer's students benefiting the most. As a result, high-scoring students did well, whereas low-scoring students improved on average. This finding is in line with that of Sam-Kayode and Salman (2015), who found a significant difference in the performance of high, medium, and low scoring students in the experimental group who were taught probability using the Ludo game.

There were no interaction effects of multimedia courseware on gender or student score levels when students were taught linear equation involving word problems, according to the findings of this study. This implies that the treatment (multimedia courseware) was unaffected by the interaction between gender and score levels, making it easier to conclude that the experimental groups' higher performance was due to the use of multimedia courseware.

Conclusion and Recommendations

Multimedia courseware increased students' performance in linear equations word problems, particularly among males and high-scoring students, according to this study. It means that multimedia courseware-based instructions will have an impact on students' learning and teaching outcomes, particularly in Mathematics. Furthermore, the multimodal character of multimedia courseware, which featured the use of words and moving images, reduced the abstract nature of the subject, making it easier for students to understand and interact with the content materials. As a result, multimedia courseware in Mathematics is a successful learning tool and a substantial

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improvement over traditional Mathematics instruction.

Recommendations

The study therefore recommends that the use of multimedia courseware in learning appears to have inspired students to understand linear equations involving word problems, according to this study. As a result, students should be engaged in learning by using multimedia courseware that is relevant and meaningful to them on a regular basis. Again, both male and female students should be encouraged to use multimedia courseware to improve their performance in other perceived tough topics in Mathematics. More-over, students with a medium or low score should try to use multimedia courseware-based activities to bridge the gap between the three categories of scorers. It is therefore suggested that the study should be repeated with other difficult or demanding Mathematics topics, in different places, and in higher educational institutions such as colleges of education and universities. More study can be done in the future to determine the impact of additional variables such as student retention of learning content, attitude toward the nature of the subject, and perceptions of multimedia courseware.

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Morenikeji Alex Akanmu & Bala Ayuba