



**EFFECT OF VIDEO-BASED LEARNING ON SENIOR SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN SOLVING LINEAR EQUATION WORD PROBLEMS IN AKKO LOCAL GOVERNMENT AREA, GOMBE STATE**

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### **Abstract**

This research examined effect of video-based learning on senior school students' academic achievement in solving linear equation word problems in Akko Local Government Area, Gombe State. Two research questions and three hypotheses tested at 0.05 level of significance guided the study. The research adopted a quasi-experimental design, specifically, pre-test and post-test non-randomized control group design. In a population of 5,036 senior secondary class two students, (3,006 males and 2,030 females) in Akko Local Government Area of Gombe State, Nigeria, a sample of 70 students (40 males and 30 females) offering mathematics were selected from two out of the 16 public secondary schools in the LGA. A multistage sampling procedure was used to sample the participants namely: purposive sampling, simple random sampling and lucky dip without replacement techniques. Mathematics Achievement Test on Linear Equation Involving Word Problems (MATLEIWP) was used for data collection. Three experts validated the instruments. The reliability of the MAT was established using Kuder-Richardson 20 Formula, yielding coefficient of 0.82. The experimental and control groups were taught using researchers' developed video model and conventional instructional strategy respectively. Mean and Standard deviation were used to answer the research questions while the hypotheses were tested using ANCOVA at 0.05 level of significance. The findings showed that, video-based learning enhanced students' achievement, gender does not have significant effect on the students' achievement and interaction effect of method and gender was not significant on achievement in solving linear equation involving word problems. The study concludes that video based learning is effective in improving the achievement of SS 2 students in mathematics Based on the findings, it was recommended among others that; teachers should adopt video based learning strategy in teaching mathematics for improved achievement and students should also be engaged in learning using video based learning strategy on a regular basis.

**Keywords: Achievement, Mathematics, SS 2 Students, Video Based Learning**

### **Introduction**

The importance of education to human development has been well documented, highlighting the catalytic roles of education in national and human capital developments. Amatobi & Amatobi (2020) and Bukari (2019) averred that Education is a means of self-development through learning, knowledge, skills, and habits conveyed across generations. The importance of education for the economic, social and moral development of nations cannot be under-estimated. Mathematics is one of such subjects taught at every level of education and has a vital role in everyday life (Nugraha, 2022).



Mathematics is a science of quantity and space, and it also occupies a key position in Nigeria's Education System (Chukwunyelu & Okigbo, 2025). According to Awofala & Lawani (2020), Mathematics is a subject that can train students to develop critical, logical, and creative ways of thinking. Also, Purwati, Happy & Endahwuri (2021) averred that mathematics skills are often the basis for other subjects, and student progress in other issues depends on their ability in basic mathematics. So that through learning mathematics, students can develop their potential in the classroom and everyday life. However, the reality in the field shows that student learning achievement in mathematics is low (Retnawati, 2022). It is unfortunate that the rate of Senior Secondary School Students' poor achievement in word problems involving linear equations in mathematics is quite alarming.

Reports from researchers have shown that Senior Secondary School Students have difficulty in solving simple equations involving word problems (Bukari, 2019; Samuel, Mulenga & Angel, 2016 and Adu, Assuah, & Asiedu-Addo 2015). The Chief Examiners Reports of the West African Examination Council (WAEC) highlighted that majority of candidates who sat for the West African Senior School Certificate Examination (WASSCE) in mathematics in May/June find it difficult to answer questions in word problems in mathematics, in particular translating word problems into mathematical statements (WAEC, 2023).

Several factors have been revealed by researchers to be responsible for poor achievement of students in Mathematics such as students' poor attitude toward the subject, lack of motivation during classroom lessons among others (Makinde, 2019). Similarly, Zalmon & Charles-Ogan, (2021) in their study, found that most of the failures recorded in mathematics are attributed to inadequate exposure of students to classroom activities, lack of teacher preparation, and inability of the students to comprehend questions. Additionally, Okigbo & Chukwunyelu (2025) added that most mathematics teachers' do not employ student-centered methods of teaching which keep the student's passive during the learning process, Hence, it leads to inability of students to understand and retain what they have learnt and apply it in solving further problems.

It is obvious that mathematics concepts are usually being taught by using abstract examples and words when taught using the traditional or conventional instructional methods. This type of teaching requires high intellectual abilities to acquire the subjects taught, which creates high pressure on the students, causing them to lose confidence and reduce their learning capacity (Ameen, Mohammed & Ayuba, 2023). Makinde & Yusuf (2019) suggested that



educators should alternatively explore some student-centered learning models to enhance active engagement of students in mathematics class thereby improving their achievements in mathematics. One of such student-centered learning model is the video - based learning.

Video - based learning can be defined as a learning model that utilizes videos as the primary medium for instruction, skill development, and knowledge acquisition (Sugiharto, 2018). This approach leverages the power of visual and auditory learning to engage learners, improve understanding, and enhance retention (Kumar, Sharma & Kumar, 2020). According to Abdul (2022), Klimova (2019) and Singh & Singh (2019), Video-based learning can be synchronous, where an instructor presents information to a live remote audience, or asynchronous, where learners watch pre-recorded videos at their convenience. Research has shown that video-based learning is more engaging and effective than other types of learning, with learners retaining 55% more information when learning from videos compared to audio or text-based learning (Kirby & Hoadley, 2017)

Another variable of interest in this study is gender. Gender is a socially ascribed attribute which differentiate feminine from masculine. Gender issue has been a subject of discourse and concern to science educators (Ogoke & Okigbo, 2021). According to Igbo, Onu and Obiyo (2015) gender refers to the biological and physiological reality of being male or female. Several research works had led to a series of divergent views on the influence of gender on students' achievement and interest in Mathematics. Ajayi (2020) and Usman (2018) submitted that males continue to outperform females on measures of Mathematical achievements especially on more difficult concepts. Gunderson, Ramirez, Levine & Beilock (2012) were of the opinion that females have more negative attitude toward Mathematics than male thus, affects their achievement in Mathematical concept. Ossai (2023) and Amatobi & Amatobi (2020) in their different studies discovered that there is no significant difference on the academic achievement of male and female students, while some others established significant difference particularly during early education (Tarfa & Dike, 2022). Although most researchers have found boys performing better than girls especially on higher order knowledge (Yar'adua, 2021). This calls for serious attention and if unchecked it would be a great challenge to gender equality in Mathematics.

However, the above inconclusive opinions of the researchers on effect of gender on students' achievement in mathematics have necessitated the present study which tries to attend to such a gap that has been introduced in literature. Hence, this study determined effect of



video-based learning on male and female students' academic achievement in solving linear equations word problems in Akko Local Government Area in Gombe State, Nigeria.

### **Purpose of the Study**

The aim of this research was to examine the effect of video-based learning on senior school students' academic achievement in solving linear equations word problems in Akko Local Government Area in Gombe State. Specifically, this study determined:

1. Difference in mean achievement scores of students taught word problems involving linear equations in mathematics using video-based learning strategy and that of those taught using the conventional instructional strategy.
2. Difference in mean achievement scores of male and female students taught word problems involving linear equations in mathematics using video - based learning strategy.
3. Interaction effect of instructional method and gender on students' academic achievement in solving word problems involving linear equations in mathematics.

### **Research Questions**

The study was guided by the following research questions:

1. What are the differences in mean achievement scores of students taught word problems involving linear equations in mathematics using video-based learning strategy and that of those taught using the conventional instructional strategy?
2. What are the differences in the mean achievement scores of male and female students taught word problems involving linear equations in mathematics using video - based learning strategy?

### **Hypotheses**

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the mean achievement scores of students taught word problems involving linear equations in mathematics using Video-Based learning strategy and that of those taught using conventional instructional strategy.
2. There is no significant difference between the mean achievement scores of male and female students taught word problems involving linear equations in mathematics using Video-Based learning strategy
3. There is no significant interaction effect of instructional method and gender on students' academic achievement in solving word problems involving linear equations in mathematics.



## Methods

The researchers adopted pretest-posttest non-randomized control group quasi-experimental design. The study was conducted in Akko Local Government Area of Gombe State, Nigeria. The population consisted of 5,036 senior secondary class two (SS 2) students (3,006 males and 2,030 females) offering mathematics in all the public secondary schools in the Akko Local Government Area. The study's sample consisted of 70 (40 male and 30 female) SS 2 students offering mathematics, selected from two out of the 16 public secondary schools in the LGA. A multistage sampling procedure was used to sample the participants namely: purposive sampling, simple random sampling and lucky dip without replacement techniques. The two sampled schools were co-educational because gender is a variable of consideration and also had functioning computer laboratory for the Video-Based learning model. Thus, intact classes were used in each school.

The primary data collection tool was the Mathematics Achievement Test on Linear Equation Involving Word Problems (MATLEIWP). The instrument is divided into sections A and B. Section A is to obtain the bio-data of the respondents which include: Gender, class and test number while Section B of the instrument consisted of five (5) essay questions on linear equation word problems in Mathematics adapted from three testing organizations: the West African Examination Council (WAEC), the National Examination Council (NECO), and the National Business and Technical Examinations Board (NABTEB) for the years 2018 – 2023. Scoring was based on a step-by-step solution to each question, leading to the correct answers. Each question was awarded a maximum of 20 marks for correct steps and the final answer, totaling 100 marks across all 5 questions. Three experts validated the instruments; one lecturer each from Departments of Science Education and Educational foundations (Measurement and Evaluation Unit) respectively from Federal University of Kashere, Gombe State and one experienced Mathematics teacher (of at least ten years of teaching experience) in Akko Local Government Area of Gombe State, Nigeria. The reliability of the MAT was established using Kuder-Richardson 20 Formula yielding a reliability coefficient of 0.82.

The experimental procedure was divided into three stages: pre-treatment, treatment and post-treatment.

### Stage 1; Pre-treatment

This phase involved introductions, training of the regular mathematics teachers in the two sampled schools to serve as research assistants (which lasted for one week over three contacts) and the administration of pre-test.



### Stage 2: Treatment

Trained research assistants taught their students in each school using researchers' developed lesson plan, also, using regular school time table, of two contacts per week. The experimental group was taught by the research assistant using Video based Instructional strategy making use of researchers' developed video model (recorded video of the math's lesson on linear equations involving word problems, see the appendix). The videos were played for the students in the computer laboratory during the regular mathematics period while the students watched, made notes and attempted the evaluation questions that proceeded the video. The control group, on the other hand, was taught using the usual conventional instructional strategy, with lesson notes developed by the researchers to reflect the same learning objectives as the Video based instructional strategy.

### Stage 3: Post-treatment

After three weeks of instruction and a revision period, the same test instrument: MATLEIWP was re-administered as a post-test to both groups in their respective schools during the third week. The completed scripts were collected and handed over to the researcher for scoring and analysis. The actual treatment lasted for three weeks in each of the schools. The 1<sup>st</sup> week was for administering the pre-test (MATLEIWP) while the 2<sup>nd</sup> and 3<sup>rd</sup> week were for the treatment and administering of the reshuffled MATLEIWP as post-test.

The researcher analyzed the data using students' raw scores from the pre-test and post-test to calculate the mean and standard deviation which were used to answer the research questions. The hypotheses were tested using ANCOVA statistical procedure at 0.05 level of significance, with the decision rule being to reject the null hypotheses if the p-value was less than or equal to 0.05 alpha level; otherwise, the null hypotheses was retained.

### Results

**Research question 1:** What are the differences in mean achievement scores of students taught word problems involving linear equations in mathematics using video-based learning strategy and that of those taught using the conventional instructional strategy?

**Table 1: Mean achievement Scores and Standard Deviations of Students' Taught Word Problems involving Linear Equations in mathematics Using Video-Based Learning Strategy and Those Taught using Conventional Instructional Strategy**

Groups	N	Pretest		Post-test		Mean Gain
		Mean	Std.Dev.	Mean	Std. Dev	
Experimental	40	13.90	4.67	59.75	11.75	45.85
Control	30	10.73	5.27	38.53	10.93	27.80



The Academic achievement of experimental and control groups of Mathematics Students were compared in table 1 above. The Pretest Mean scores for the experimental and control groups were 13.90 and 10.73 with standard deviations of 4.67 and 5.27 respectively, while the post-test Mean scores for the experimental and control groups were 59.75 and 38.53 with standard deviations of 11.75 and 10.93 indicating that the experimental group has less homogenous scores in there posttest than the control group. However, the experimental group has a higher Mean gain scores of 45.85 as against the control group (27.80). This indicates that the Students taught word problems involving linear equations in Mathematics using video-based learning strategy achieved better than those taught using the conventional teaching method.

**Research question 2:** What are the differences in the mean achievement scores of male and female students taught word problems involving linear equations in mathematics using video - based learning strategy?

**Table 2: Mean achievement Scores and Standard Deviations of Male and Female Students' Taught Word Problems involving Linear Equations in mathematics Using Video-Based Learning Strategy**

Gender	N	Mean	Standard Deviation	Mean Difference
Male	22	58.55	12.18	2.67
Female	18	61.22	11.38	

Table 2 above shows the results of male and female students in the experimental group who were taught linear equations involving word problems. Male and female students had different mean scores of 58.55 and 61.22 and standard deviation of 12.18 and 11.38 respectively. This indicates that the female students gained more than their male counterparts when taught linear equations involving word problems in mathematics using video-based learning strategy, as they had a higher mean score than the male students, with a mean score difference of 2.67 in their favour. Also, with a lesser standard deviation of 11.38, the female students had a more homogenous scores than the male students (12.18).

**Hypothesis 1:** There is no significant difference between the mean achievement scores of students taught word problems involving linear equations in mathematics using Video-Based learning strategy and that of those taught using conventional instructional strategy..

**Table 3: ANCOVA Analysis of the Significant Differences in the Academic Achievement of students in Experimental and Control Groups.**



Type III Sum of						
Source	Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	669.844 <sup>a</sup>	4	167.461	2.421	.055	
Intercept	60.422	1	60.422	.874	.353	
PREACHIEV	200.058	1	200.058	2.892	.093	
Method	621.325	1	621.325	8.982	.004	Sig.
Gender	67.798	1	67.798	.980	.325	
Method * Gender	.205	1	.205	.003	.957	Not. Sig.
Error	5464.478	65	69.171			
Total	62141.000	70				
Corrected Total	6134.321	69				

Table 3 shows the results of the data analysis for research Hypotheses I, which was examined using the ANCOVA. The F-value (1, 65) = 8.982, P = 0.004 < 0.05 was significant at 0.05 alpha level. Therefore, the null hypothesis is rejected meaning there is significant difference between the mean achievement scores of students taught word problems involving linear equations in mathematics using Video-Based learning strategy and that of those taught using conventional instructional strategy. The difference was in favour of video-based learning strategy. This implied that using video-based learning strategy enhanced students' achievement in linear equation involving word problems in mathematics.

**Hypothesis 2:** There is no significant difference between the mean achievement scores of male and female students taught word problems involving linear equations in mathematics using Video-Based learning strategy.

**Table 4: ANCOVA Analysis of the Significant Differences in the Academic Achievement of Male and Female students in the Experimental Group.**

Dependent Variable: Pretest

Type III Sum of						
Source	Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	94.988 <sup>a</sup>	2	47.494	.900	.416	
Intercept	38.045	1	38.045	.721	.402	
PREACHIEV	37.268	1	37.268	.706	.407	
Gender	40.424	1	40.424	.766	.388	Not. Sig.
Error	1741.901	37	52.785			
Total	21624.000	40				
Corrected Total	1836.889	39				

Table 4 shows the results of the data analysis for research Hypotheses II, which was examined using the ANCOVA. The F-value (1, 37) = 0.766, P = 0.388 > 0.05) was statistically insignificant at the 0.05 alpha level, as indicated in table 4. These findings demonstrated that male and female students who were taught linear equations involving word problems using



video-based learning strategy achieved significantly indifferently. Though the female students performed higher than the male counterparts but the difference in their mean achievement scores was insignificant. As a result, hypothesis II was not rejected, implying that video-based learning strategy assisted both male and female students indifferently.

**Hypothesis 3:** There is no significant interaction effect of instructional method and gender on students' academic achievement in solving word problems involving linear equations in mathematics.

Analysis of hypothesis 3 is presented in table 3.

Table 3 also reveals that there is no significant interaction effect of instructional strategies and gender on students' achievement in solving word problems involving linear equations in mathematics,  $F(1, 65) = 0.003, P = 0.957 > 0.05$ . Therefore, the null hypothesis was not rejected meaning there is no significant interaction effect of instructional strategies and gender on students' achievement in mathematics. This implies that academic achievement of students in solving word problems involving linear equations in mathematics in relation to the teaching methods employed is not influenced by their gender.

### Discussion

The findings from the results revealed that the students taught word problems involving linear equations in Mathematics using video-based learning strategy (Experimental group) performed better than students taught using the Conventional instructional method (Control group). This difference in achievement is confirmed by the test of hypothesis which showed that there was significant difference in the mean achievement scores of students taught mathematics using video-based learning strategy and those taught using Conventional instructional method in favour of video-based learning strategy. This highlights the effectiveness of modern teaching technologies in improving students' learning outcomes. It implies that video-based learning strategy was found to be effective in improving students' achievement in mathematics. This may be attributed to the fact that video-based learning strategy offers audio and visual channels of processing information as was suggested by Cognitive Theory of Multimedia Learning (CTML). This theory states that students' process verbal and visual information simultaneously, allowing them to better understand and assimilate complex ideas. Additionally, video-based strategy encourages students' active involvement and participation in the learning process. The finding is consistent with the findings of Ogunboye & Odutuyi (2024), Ameen *et. al* (2023) and Kumar *et. al* (2020) that



those students exposed to video-based learning strategy achieved significantly higher than those exposed to Conventional instructional learning method.

Furthermore, gender was not significant in the achievement of students based on the instructional strategy. Though the female students had higher mean scores than the male students, but the ANCOVA analysis showed that there was no significant difference in the academic achievement of male and female senior school students in word problems involving linear equations in Mathematics when taught using video-based learning instructional strategy. This indicates that video-based learning strategy impacted both the male and female students indifferently. Hence video-based learning strategy is not gender biased, it enhances students' achievement in solving word problem involving linear equation irrespective of their gender. This finding is consistent with the result of Egara (2023); Ossai (2023); Amataobi & Amataobi (2020) and Musa & Samuel (2019) who concluded that there exists no significant difference in achievement of male and female students in mathematics. On the other hand, the result was in disagreement with the findings of Ameen *et. al* (2023); Tarfa & Dike (2022); Wordu & Iwok (2018) and Yar'adua (2021), who found out that significant difference exists by gender on mathematics achievement of students.

Also, the interaction effect of instructional strategy and gender was examined on students' achievement in solving linear equations in word problems in mathematics. The findings revealed that instructional strategy and gender have no significant interaction effect on students' achievement in mathematics. In other words, the instructional strategies used in the study did not impart the male and female students differently based on their academic achievement in mathematics. This is inconsistent with the findings of Ogoke & Okigbo (2021), who averred that gender and treatment have significant interaction effect on students' achievement in mathematics. However, the finding agrees with the findings of Ogunboye & Odotuyi (2024) and Eze (2023) who concluded that there is no significant interaction effect of methods and gender on achievement in mathematics. The above discussion implies that male and female students did not react differently to the instructional strategies in terms of their academic achievement in mathematics.

### **Conclusion**

The findings of this study suggest that video-based learning strategy significantly improves students' mathematics achievement compared to the Conventional instructional method. Also, it is not gender biased as it relates to achievement in mathematics because it improves both male and female students' achievement equally. It can be concluded that



integrating video-based learning strategy into mathematics education is an effective strategy for enhancing students' achievement thereby emphasizing the importance of adopting modern interactive teaching tools in the classroom.

### Recommendations

Based on the findings, the following recommendations are made that:

1. Mathematics teachers in secondary schools should incorporate video-based learning strategy in their teaching practices.
2. Educational institutions should invest in video resources and technology to support teaching and learning.
3. Curriculum planners should adopt video-based learning strategy as an innovative teaching strategy when reviewing mathematics curriculum.
4. The Science Teachers Association of Nigeria in collaboration with the ministry of education should organize seminars and workshops to train teachers on how to use video-based learning strategy in teaching and learning of mathematics and other science subjects.

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