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LEVERAGING THE POTENTIAL OF VIDEO-BASED INSTRUCTIONAL PACKAGES ON PUPILS' ACHIEVEMENT AND RETENTION IN ARITHMETIC IN ONDO METROPOLIS

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Abstract

This study explores the potential of video-based instructional packages on pupils' achievement and retention in arithmetic in the Ondo metropolis. The study adopted a quasi-experimental design with pre-test and post-test control groups. Two primary schools were randomly selected to participate in the study, and one primary school was purposively selected for the experimental group and the other was selected for the control group within the private schools in Ondo metropolis. A total sample of ninety-eight (98) primary II pupils from two private primary schools made up the study's population. Data were collected through the Arithmetic Achievement Test (AAT) and Video-Based Instructional Package (VBIP) developed by the researchers. The data were analysed using ANCOVA. The finding indicated no significant difference in pre-test scores between the two groups, confirming their equivalence at baseline. However, post-test scores revealed that the experimental group significantly outperformed the control group, demonstrating the effectiveness of the video-based instructional packages. Based on the findings of the study, it was recommended among others that primary school teachers should adopt a video-based instructional package as a pupil-driven instructional approach that gives pupils the ability to store, retain, and recall the learning experiences and improve academic achievement in primary schools.

Introduction

The integration of digital technology into education has transformed traditional teaching methods and provided innovative approaches to enhance learning opportunities for all students. The rapid development in the field of technology in the 21st century affects our daily lives and education. Therefore, digital technologies are very useful tool for educators and policymakers in the education

sector because of its capacity to engage, motivate, and enhance learning among different categories of learners, especially at the primary education level.

Primary education is the basic level of education given to children between the ages of 6 and 12 in Nigeria (Federal Ministry of Education, 2014). It is the foundation of all education levels and the bedrock of the entire educational system in Nigeria. Some of the objectives of primary education, as stated in the Nigerian National Policy on Education, are to inculcate permanent literacy, numeracy, and the ability to communicate effectively, and to lay a sound basis for scientific, critical, and reflective thinking, among others (FME, 2014). In pursuance of these objectives, various subject curricula have been designed, one of which is mathematics, which sets out to expose pupils to basic skills in arithmetic.

Arithmetic is a fundamental branch of mathematics that deals with numbers and the basic operations, such as addition, subtraction, multiplication, and division. It is the most elementary and oldest aspect of mathematics and is used in daily life for many purposes like measuring, counting, and computing (Purpura, Baroody, & Lonigan, 2013). Arithmetic is of paramount importance to mathematics for several reasons, serving as the foundation upon which the entire structure of mathematical concepts is built. It provides the basic operations addition, subtraction, multiplication, and division that are essential for all higher-level mathematical concepts. Without a solid understanding of these operations, it would be impossible to progress to more complex areas of mathematics. Learning arithmetic helps develop logical thinking and problem-solving skills. It encourages systematic thinking, precision, and attention to detail, which are essential qualities in all areas of mathematics and beyond. Its simplicity and ubiquity underscore its importance in both ancient and modern contexts. Arithmetic is usually the first mathematical skill that individuals learn, forming the basis for mathematical literacy. This foundational knowledge is critical for understanding and learning more advanced mathematical concepts taught in school and higher education (Uyen, Tong, & Lien, 2022).

Many branches of mathematics, such as algebra, calculus, and number theory, rely heavily on arithmetic principles. Understanding the principles is necessary in order to solve equations, use functions, and look for mathematical patterns and relationships. In computer science, principles are fundamental to the creation of algorithms (Wong, 2017). For complex computations to be

completed in a variety of domains, such as software development, data analysis, and cryptography, efficient algorithms for basic arithmetic operations are essential (Wong, 2017).

Despite the importance of arithmetic to all other aspects of mathematics, research findings have shown that the performance of pupils in mathematics has been on the decline in primary schools (Prather, 2012; Sari & Olkun, 2019). It cannot be denied that mathematics plays an important role in life, but the reality is that the majority of students find it very difficult to acquire the different mathematical skills and basic operations that are useful in their everyday lives. The reason for this may vary, but it could sometimes be related to the teaching method used by teachers (Chianson, Kurumeh, & Obida, 2010). In Nigerian primary education, teachers use the conventional method to teach mathematics. Mathematics at this level is full of teacher-centred procedures that have to be mastered.

To find an immediate solution to the problems of mathematics at this level, primary school teachers need to improve their teaching methods to ensure that pupils are adequately engaged during the instructional process and to improve pupils' learning outcomes. The conventional way of teaching arithmetic has fallen short of providing an immediate learning environment, faster evaluations, and more engagement, which makes pupils passive with less interaction (Wong, 2017). In contrast, digital learning tools such as video-based instruction have the potential to go a long way in filling the gap in learning by allowing the pupils to use technological devices that would inevitably be part of their future professional practice.

Video-based instruction is one of the most diversified and distinct virtual learning mediums that capture and presents information more precisely (Oyarinde & Komolafe, 2019). It enables learners, especially primary pupils, to understand the contents more and retain information better. Video is one of the best methods to attract students to enjoy and understand the materials delivered at the mastery level (Reiss, Diestmann, Inkermann, Albers, & Vietor, 2017).

Similarly, Furo (2015) opined that video-based instruction involves the use of an electronic approach that combines texts, audio, visuals, and images to offer learning experiences. According to Ogochukwu (2010), it is also defined as the fusion of various digital media, including texts, sounds, and images, presented to an audience in an integrated, multiple-sensory manner to facilitate learning. Several features of video-based learning promote meaningful learning

opportunities that allow the pupils to activate, acquire, and apply knowledge in a meaningful way (Kumar, 2010). Studies have shown the influence of video-based instructions as a promising transformative technology-supported approach on students' engagement and learning outcomes (Olatoye, 2017; Monday & Joel, 2017; Mendoza, Caranto & David, 2015; and Oyarinde, 2021).

Andor, Aneshie-Otakpa, Akobi, Agah, Okeke, Ube, & Iroanusi (2020) also conducted a study on the effect of video-aided instruction on primary school pupils' interest and memory development in arithmetic in Ogoja local government and revealed that video-aided instruction improves primary school pupils' interest and memory development in arithmetic. Gambari et al. (2016) also carried out a study on the effects of video-type instructional packages on the achievement of students in mathematics among senior secondary schools in Minna, Nigeria. The results revealed that there is a significant difference in the mean achievement score of students taught mathematics using Text Only (TO), Text Animation (TA), Text Narration (TN), and Text Animation Narration (TAN) video-type instructional packages.

Moreover, Olatayo, Omiola, & Adedapo (2017) conducted a study on the effect of using video-mediated instruction as an advanced organiser on the cognitive achievement of students in mathematics and discovered that students exposed to video-mediated instruction as an advanced organiser performed better in their achievement than their counterparts. The authors found that the use of video-based instruction increased students' achievement in indices and logarithms aspects of mathematics. Other studies have also shown that video-based instructions led to great improvements in students' attendance to lessons, interest, motivation, and positive achievement in mathematics (Ogochukwu, 2010; Chaudari, 2013; Abragan & Hambre, 2017; and Oyarinde, 2021). Based on previous studies, video-based instructions were effective in classroom activities. The effective ways of using video-based instruction to complement conventional teaching approaches would engage, increase the attention rate of pupils, and improve their academic achievement positively.

Apparently, achievement and retention in any academic pursuit are vital learning outcomes that show the degree to which learning has occurred. Retention is the ability to store what has been learned by an individual and be able to retain and recall the learning experiences. Any experience not retained cannot be recalled when the need arises. Therefore, retention is fundamental to

academic achievement in arithmetic and mathematics generally. According to Amin and Malik (2014), factors affecting retention include rehearsal, exercise, testing, and reward. The scholars report that rehearsal entails repeated reception of the same content, events, and information through verbal or visual means. The use of text with images, coupled with frequent practice, could facilitate the retention rates of the pupils. Parrot (2019) identifies practice as one of the factors that could improve the ability of a child to recall what he or she has learned. The above postulation shows that the use of video-based instruction has potential in instructional delivery because it allows the pupils to view the contents over and over, and frequent practice on assigned tasks could improve retention, resulting in positive academic achievement.

However, with the growing trend of technology-assisted learning, it is observed that little effort has been made to improve the teaching and learning of arithmetic in Nigerian primary schools using technology, particularly video-based instructional packages. It seems the approach has not been extensively utilised in the teaching and learning of arithmetic. As a result, there is a need for learner-centred instructional methods that actively engage pupils in the use of technology for classroom activities. A video-based instructional package has the potential to fill this gap in instructional delivery, as it will directly expose the pupils to the use of technology to engage them in classroom activities. Therefore, this paper examined the potential of video-based instructional packages on pupils' academic achievement and retention in arithmetic.

Purpose of the study

The purpose of this study is to investigate the potential of video-based instructional packages on pupils' achievement and retention in arithmetic. The study:

1. examined the potential of video-based instructional packages on the academic achievement of primary school pupils in arithmetic.
2. determined the potential of video-based instructional packages on the retention ability of primary school pupils in arithmetic.

Research Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

Ho_1: There is no significant difference in the academic achievement scores of pupils taught arithmetic using video-based instruction packages and their counterparts taught with conventional methods.

Ho_2: There is no significant difference in the retention ability of males and females pupils taught arithmetic using video-based instruction packages.

Methodology

The study adopted a pre-test, post-test, and control group quasi-experimental research design. The study population comprised all the primary II pupils in private schools in the Ondo metropolis of Ondo State for the 2023/2024 academic session. Primary II pupils were chosen because they were at the age where the foundation of arithmetic knowledge and skills is being laid. Two primary schools were randomly selected to participate in the study, and one primary school was purposively selected for the experimental group because they are boarding schools with well-equipped computer laboratories that are accessible to pupils, and the other was selected for the control group. Intact classes of ninety-eight (98) primary II pupils made up the study's population. Forty-eight (48) primary II pupils were assigned to experimental and fifty (50) to control groups. Two research instruments were used to obtain information from the participants: the Arithmetic Achievement Test (AAT) and the Video-Based Instructional Package (VBIP) developed by the researchers. The reliability coefficient of the instruments was obtained using a Cronbach's alpha for AAT; a value of 0.78 and a value of 0.84 were obtained. This was considered to be relatively high enough for the instrument to be used for the study. The researcher adopted these procedures to collect the information from the participants, first administering the instruments (Arithmetic Achievement Test (AAT) Questionnaire) as a pretest to the pupils, and their scores were recorded. The researcher then exposed the experimental group to the topics in arithmetic using a video-based instructional package for 5 weeks. The control group was also subject to the conventional method teaching for the same number of weeks. The completed copies of the questionnaire were collected and analysed using ANCOVA.

Results

$H0_1$: There is no significant difference in the mean achievement scores of pupils taught arithmetic using video-based instruction packages and their counterparts taught with conventional methods. ANCOVA was used to test null hypotheses 1 and 2 (**Ho_1 and Ho_2**) and the results presented in the table below.

Table 1: Analysis of Covariance (ANCOVA) of Post-Achievement by Treatment and Retention.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4273.552[a]	4	2136.776	122.737	.000	.923
Intercept	888.775	1	888.775	392.575	.000	.729
Pre-Achievement	4517.686	1	4517.686	1995.478	.000	.932
Treatment	1433.065	1	1433.065	622.990	.000*	.814
Retention	.615	1	0.615	.272	.603	.002
Treatment x Retention	1.074	1	1.074	.474	.492	.003
Error	330.538	97	2.264			
Total	41004.000	98				
Corrected Total	4927.470	97				

R Squared = .923 (Adjusted R Squared = .931), *p<.05

Table 1 showed that there was a significant main effect of treatment on pupils' academic achievement in arithmetic. ($F_{(1,170)} = 622.99$; $p<0.05$, partial $\eta 2 = 0.81$). The effect is 81.0%. This indicated that there was a significant difference in the pupils' post- academic achievement in arithmetic. Thus, hypothesis 1 was rejected. To determine the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups was carried out and the result is presented in table 2.

Table 2. Estimated marginal means for post- academic achievement by treatment and control group

Treatment	Mean	Std. Error
Video-Based Package	18.60	.22
Conventional Method	11.13	.17

Table 2 indicated that in Video-Based Package (VBP) treatment group had the higher adjusted post-achievement mean score in arithmetic (=18.60), while the Conventional Method (CM) control group had the least adjusted post-achievement mean score (= 11.13). This order can be represented as VBP > CM.

Ho_2: There is no significant difference in the retention ability of males and females pupils taught arithmetic using video-based instruction packages.

Table 2 shows that there was no significant difference between the retention ability of male and female pupils in arithmetic after the intervention ($F_{(1,170)} = 0.27$ $p>.05$). Therefore, hypothesis 2 was not rejected. This implies that the video-based instructional package will be of immense benefit to all pupils, regardless of their gender disparity.

Discussion of Findings

The results obtained from Hypothesis 1 reveal that there is a significant difference in the achievement scores of the pupils taught with the video-based instructional package and their counterparts taught with the conventional method of teaching. This implied that the video-based instructional package had a significant influence on pupils' achievement in arithmetic. In other words, this approach allows pupils to study at their own pace, promotes active learning, and makes the learning contents more accessible to them. Also, it allows pupils to spend more time on assigned tasks, and they are able to prepare and study the learning contents several times. The power of video to actively engage learners and stimulate their interest could have been responsible for this improvement in pupils' achievement after the experiment. The result is in support of findings by Gambari et al. (2016), Monday & Joel (2017), Olatayo, Omiola, & Adedapo (2017), Hambre (2017), and Oyarinde & Komolafe (2019). The findings of the study show that there is significant progress made by pupils in the process of learning the arithmetic aspect of mathematics using video-based instruction. This is in tandem with the finding of Andor et al. (2020), where the scholars observed that pupils progressed through video-based instruction faster and understood the concept in greater depth, and this stimulated their interest through the interactivity in the video package.

The results of the analyses obtained from Hypothesis 2 showed that there was no significant difference between the retention ability of male and female pupils in the experimental group after the intervention. This implies that both male and female participants have the ability to store, retain, and recall the learning experiences equally. In other words, the male and female participants benefited equally from the learning package. This is to show that the instructional package will be of immense benefit to all pupils, regardless of gender disparity. This finding aligns with the observation of Gumel & Galadima (2014), who revealed that gender has no significant effect on

students' retention in geometry. The study discovered that the problem-solving approach is not sensitive to gender differences. The result was in line with the finding of Falode & Mohammed (2023), who reported no significant difference in the retention ability of male and female students in geography. Observation from this study revealed that incorporating class activities into the video package could have encouraged pupils to pay attention to the content during the instruction and improve their retention ability on arithmetic. This implies that a video-based instructional package is an effective learning delivery because it has contributed positively to the academic achievement of the pupils in primary schools.

Conclusion

Based on the findings of this study, it was proven that a video-based instructional package is more effective in enhancing pupils' levels of achievement in arithmetic than the conventional method. Also, the video-based instructional package significantly improved pupils' retention ability on arithmetic learning because the media component of the video-based strategy engaged in instructional contents, which in turn led to improved academic achievement. The results revealed there is no significant gender implication in their retention ability; the interventions benefit both male and female pupils equally.

Recommendations

The recommendations made based on the findings from this study are:

i. Primary school teachers should be adequately sensitised through workshops, seminars, and conferences on the use of video-based instruction for instructional delivery at the primary school level.
ii. Primary school teachers should leverage the potential of video-based instruction to improve pupils' achievement in arithmetic at the primary school level.
iii. Curriculum planners and developers in Nigerian primary education should emphasise the need to continuously use innovative strategies such as video-based instruction to improve instructional delivery.

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