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## The Development of an Interactive Video-Based Instructional Package for Teaching Mathematics in Primary Schools in Osun State, Nigeria

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**Abstract:** Low achievement in mathematics and the inadequacy of existing instructional materials continue to pose significant challenges to primary education in Nigeria. This study develops and evaluates an Interactive Video-based Instructional Package (IVIP) for fifth-grade pupils in Osun State, addressing gaps in usability and technological integration. Guided by the ADDIE model, the package was designed, developed, implemented, and assessed using a mixed-method research design. Twenty (20) pupils participated, and reliability testing of the evaluation instruments showed acceptable consistency ( $\alpha = 0.75-0.78$ ). Descriptive and content analyses revealed that the IVIP demonstrated high flexibility ( $\bar{x} = 1.72$ ), suitability ( $\bar{x} = 1.81$ ), acceptability ( $\bar{x} = 1.89$ ), and usefulness ( $\bar{x} = 1.90$ ), all of which



exceeded the threshold of 1.50. Pupils reported enthusiasm and improved mathematics performance, indicating the pedagogical value of the intervention. The novelty of this study lies in the validated integration of interactive video into primary mathematics education in a resource-constrained setting, filling a critical gap in Nigerian EdTech practice. The findings suggest that IVIP is a flexible and effective tool for enhancing mathematics learning, and primary school teachers should adopt it. Future research should extend this innovation to other subjects to further advance technology-supported teaching and learning in Nigerian primary schools.

**Keywords:** interactive video-based instructional package, mathematics education, ADDIE model, digital pedagogy, primary education.

## Introduction

Mathematics plays a crucial role in various fields of knowledge, such as science and engineering, and it helps to develop the cognitive aspect of learning science and technology, as well as other related subjects. The application of mathematical knowledge can be observed in everyday life, including business transactions, data analysis, and problem-solving in diverse real-world situations, among others. Despite the importance of mathematics, previous studies have shown that pupils' achievement in mathematics is not encouraging. This may be traced to the findings, which stated that mathematics is one of the complex and abstract subjects that pupils find difficult to learn. The issue of poor performance in mathematics has been attributed to the difficulty aspect of this topic and the teaching method used. The pupils' scores in an external exam are shown in the table below.

**Table 1**

*Mathematics Achievement of Pupils in Universal Basic Examination in Osun State between 2017 and 2021*

Year	No of Candidate	Candidate Raw Mean Score	Standard Deviation	Percentage
2017	57355	28.9	9.1	31.0
2018	62035	25.5	9.5	38.5
2019	58349	23.4	11.0	47.8
2020	50935	23.3	10.2	43.5
2021	49336	23.2	9.8	43.5

Source: Examination and Record Department, Osun State Universal Education Board, Osogbo, Osun State. Recent observations on pupils' achievement in mathematics in external examinations.



There is a need to utilise technology, such as instructional media, to enhance this abstract subject. Instructional media are essential components of the teaching-learning process, significantly impacting pupils' learning experiences and outcomes. These materials, which include textbooks, tasks and supplementary resources, serve as tools for teachers to demonstrate and explain concepts, procedures, and phenomena. By utilising instructional media, teachers can enhance pupils' understanding, make learning more engaging, and promote active participation. These resources could be human, non-human, or physical facilities that support and improve teaching and learning activities. Oyarinde and Olaide (2019) established that video-based package instruction improves the preservice teacher's mathematics achievements, while Falode (2016) stated that a computer simulation instructional package improves the achievement of geography students in map reading. One of the benefits of using an interactive video-based computer package in schools is that it presents content with images and sound. Studies have shown the positive influence of technology, such as a computer instructional package, on students' learning (Adekunle & Nelson, 2022; Adediran, 2018).

In recent years, there has been a growing emphasis on developing innovative instructional media that can effectively engage pupils and enhance their understanding of complex concepts. This aims to demystify abstract concepts and provide an enabling environment for learners. According to Umuhoza and Uworwabayeho (2021), instructional media are tools or devices that teachers use to make teaching and learning more interesting. Akpan (2022) further describes instructional media as resources that organise and support instruction, making them essential for effective teaching and learning.

Instructional packages create an interactive learning environment through engaging activities. This prompts educational institutions to invest in modern technology and tools, thereby enhancing education through the use of interactive software and program design. Moreover, instructional packages have been found to support differentiated instruction, catering to students' diverse needs and learning (Tomlinson, 2017). Instructional packages can effectively bring the world into the classroom, providing learners with immersive experiences that would be impossible to replicate in a traditional setting (Mayer, 2002). Given the profound impact that instructional packages can have on learners when incorporated into lessons, it is reasonable to declare that their strategic use can significantly enhance teaching and learning outcomes.

Despite the importance of instructional packages, studies have shown that some of these packages are not flexible enough to be adapted by teachers and pupils. In contrast, others are not well-suited for instructional purposes (Olabo et al., 2021). Various instructional packages, including computer-assisted instruction packages, gamification instructional packages, and GeoGebra instructional packages, among others, have been developed by different researchers to aid the teaching and learning process and have been implemented both internationally and locally (Abari et



al., 2019; Okwuoza & Olajumoke, 2023). Most instructional packages are designed for secondary schools, leaving primary schools with few options. Many teachers, especially those at primary schools, face significant barriers to using these packages effectively.

Furthermore, some instructional packages lack clear objectives, specific content, effective instructional practices, adequate feedback, and suitable instructional media, highlighting their inadequacies (Okwuoza & Olajumoke, 2023). The instructional packages used by teachers to teach and draft their subject points are a paramount issue in teaching and learning, as well as the successful transfer of knowledge from teachers to learners. Every teacher needs supplies and resources to have a successful classroom.

In today's digital age, it is widely acknowledged that learners are tech-savvy and would therefore appreciate and embrace instructional packages that are engaging, interactive, and personalised. As 'digital natives,' they are naturally inclined to engage with various digital technologies, such as mobile phones, desktop computers, laptops, and tablets (Agu & Samuel, 2018). Undisputedly, this kind of engagement has become an integral part of their lives in the digital age. Since this set of pupils would like to have a classroom environment equipped with technology, which may help improve their knowledge and skills. In accordance with the foregoing, studies have revealed that the intellectual rate of students using digital technology in their learning was 30% higher than the rate achieved by students using traditional methods (Okopi et al., 2015; Lawlor, Marshall, & Tangney, 2016). Based on the above, it is essential to create an enabling environment that fosters effective learning, such as a learning management system and other environments that can stimulate learners to learn.

An interactive video-based instructional package motivates students to learn and enhance their intellectual abilities (Barman & Jena, 2024). Reiss et al. (2017) posited that interactive video could easily captivate learners and engage them in the learning process, because it stimulates their interest in mathematics. Studies have shown the positive influence of technology, such as computer instructional packages, on students' learning (Adekunle & Nelson, 2022; Adediran, 2018).

From the foregoing, instructional designers are encouraged to develop interactive video-based instructional packages that would be locally relevant and internationally suitable to alleviate or demystify the learning of perceived complex topics in various subjects.

The development of instructional packages for teaching and learning encompasses a comprehensive process, spanning from initial conceptualisation to the final product (Adelana, Ishola & Adeeko, 2021). The development of an effective instructional package necessitates the inclusion of essential features, such as learner tasks, cognitive information processing, and clear instructional objectives. Moreover, the package must cater to the learner's needs and be developed using a systematic



instructional design model. In this study, the instructional package was developed using the ADDIE model, a well-structured framework comprising five phases: Analysis, Design, Development, Implementation, and Evaluation. The development of the interactive video-based instructional package in this study was based on five stages, adopting the ADDIE model. At the Analysis stage, pupils' characteristics are outlined to justify the proposed package.

In contrast, at the Design stage, scripts are written based on the contents, storyboards are designed, media are used, and videos are rendered. At the development stage, an interface was created that clearly reflected the menu, and learning objectives were clearly stated. Engaging content and quizzes were created using various tools, including authoring tools, video editing tools, and graphic design tools. At the implementation stage, the prototype was evaluated by experts in educational technology and Mathematics, and was trial-tested on pupils. Finally, at the evaluation stage, the various components were evaluated before developing the final package.

### **Research Problem**

Mathematics is one of the crucial subjects in schools because it serves as a basis for learning other subjects. Its centrality is essential to the study of other subjects, such as quantitative reasoning and Basic Science, among others. Despite the importance of mathematics, research has shown that it is one of the subjects that pupils find most difficult to understand. Studies have shown that certain factors contribute to pupils' poor performance in mathematics. These factors include teaching methods and instructional strategies. Various strategies have been employed to address this problem, including cooperative learning and gamification. Despite the effectiveness of these strategies, the issue of poor mathematics performance remains unresolved. There is a need to utilise technology, such as instructional packages, since these 21st-century students are often referred to as digital natives. Instructional Packages are referred to as a collection of materials, tools, hardware, and software learning resources designed to deliver specific learning objectives under the guidance of teachers. They can be used at any time with ease. However, despite the importance of Instructional Packages, many existing ones were unsuitable, uninformative, and diverse in their approaches, and did not promote interactive learning. Despite the importance of instructional packages, many existing ones are inadequate, of poor quality, or unsuitable for instructional purposes. Moreover, they often fail to integrate newer technologies. The development of an effective and engaging instructional package is crucial, particularly in mathematics, a subject that has been identified as challenging for many pupils.

There is a need to harness the potential of technology in the classroom to create immersive and interactive learning experiences to meet the needs of learners. This study developed and utilised an



interactive video-based instructional package. Therefore, this study addresses this gap by developing and utilising an interactive video-based instructional package in mathematics in Osun State, Nigeria.

### **Research Focus**

Studies such as Adekunle and Nelson (2022) and Reiss et al. (2017) have posited that interactive video can easily captivate learners and engage them in the learning process, as it stimulates their interest in mathematics. In recent times, teachers have been utilising various derivatives of instructional packages to support learning. One notable example is the interactive video-based instructional package. This type of package typically includes instructional videos, audio components, quizzes, and feedback mechanisms, among other features.

This study highlights that an Interactive video instructional package can enhance learning and provide numerous benefits, as it captures information in a more precise way and offers an approach that combines video with interactive elements, such as quizzes, animations, knowledge checks, and feedback, among others.

While many studies on Interactive video-based instructional packages have been conducted, a notable discrepancy is that the existing ones are not found to be suitable, flexible, and instructive for students to use technology like a computer instructional package in their learning (Adekunle & Nelson, 2022; Adediran, 2018).

### **Research Aim and Research Questions**

The questions guiding this study are:

- How do the pupils perceive the ease of use of the Interactive video-based instructional package?
- Do the pupils consider the Interactive video-based instructional package suitable?
- What is the pupils' level of acceptance of the instructional package?
- What are the benefits derivable from the use of an Interactive video-based instructional package?
- What are the challenges pupils face in using an Interactive video-based instructional package?

This study aims to develop and validate an Interactive Video-based Instructional Package. It harnessed the potential of technology to create and meet the needs of pupils by developing Interactive Video-based Instructional Packages. It tested its efficacy on pupils' achievement in Mathematics in Osun State, Nigeria.



## Literature Review

Interactive video-based learning is the use of video in education. It is a learning strategy that utilises video; it is a method of acquiring knowledge and instruction through video, which involves incorporating error-free content, graphics, clear audio, and a quiz or assessment. It is a method through which knowledge is presented electronically using computers and other technological tools (Joshi, 2020). Interactive video-based supports this 21st-century global way of learning because it contains features such as audio, graphics, intonation, content, and assessment that learners can interact with, making the lesson more engaging. Interactive video has proven to be an operational technological tool for knowledge delivery (Ilesanmi, 2023). An interactive video-based instructional package contains more than narrative video; it encompasses instructional tools and interactive elements to encourage active engagement and participation. The elements include assessments such as a short quiz, knowledge of results, and other activities. It is a digital video that offers diversification of user interaction through audio, music, touch, and click.

The theoretical foundation for this study can be traced to Jean Piaget, who stressed the cognitive constructivist perspective. According to Jean Piaget, constructivist theory is a learning theory that emphasises the active role of learners in constructing their own understanding, rather than passively receiving information. Constructivists emphasise that people learn when they actively construct their own understanding. In the constructivist theory, the emphasis is placed on the learner, rather than the teacher. Constructivism's central idea is that human learning is constructed; learners build new knowledge on the foundation of their previous learning. Two critical notions orbit around the simple idea of constructed knowledge. The first is that learners construct new understandings by building on what they already know. Learners come to learning situations with knowledge gained from previous experience, and that prior knowledge influences what new or modified knowledge they will construct from new learning experiences. The second notion is that learning is an active process rather than a passive one. Learners confront their understanding in light of what they encounter in the new learning situation. If what learners encounter is inconsistent with their current understanding, their understanding can change to accommodate new experience. Learners remain active throughout this process, applying their current understandings, noting relevant elements in new learning experiences, and judging the consistency of prior and emerging knowledge. Based on this judgment, they can modify their knowledge (Bada & Olusegun, 2015).

Constructivist theory is based on observation and scientific study of how people learn. This theory says that people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences. When an individual encounters something new, they must reconcile it with their previous ideas and experiences, which may lead to a change in their beliefs. It



explains how learners construct knowledge. The theory emphasises that humans construct knowledge and meaning from their experiences. Constructivists believe that learning is influenced by the context in which an idea is presented, as well as by students' prior beliefs and attitudes. Constructivist theory emphasises that knowledge can only exist within the human mind and does not necessarily correspond to any real-world reality. Learners will continually strive to develop their own personal mental model of the real world based on their perceptions of it. As they perceive each new experience, learners will continually update their own mental models to reflect the new information, and will, therefore, construct their own interpretation of reality (Bada & Olusegun, 2015).

Constructivism is one of the most effective alternatives to traditional learning approaches, aiming to improve the teaching and learning process by emphasising collaboration between educators, a learner-centred environment, and encouraging students' reflection through experiential learning. It enhances students' aptitude in relation to advanced technology and the new curriculum. It provides a strong focus on school activities and industrial practices to help students become more familiar with industrial models. Thus, constructivism has a considerable impact on educational theories, affecting both the nature of knowledge and cognitive structures. Enumerates four basic characteristics of constructivist learning environments, which must be considered when implementing constructivist instructional strategies: Knowledge will be shared between teachers and students; teachers and students will share authority; the teacher's role is one of a facilitator or guide; learning groups will consist of small numbers of heterogeneous students.

### ***Relevance of the theory to the study***

Constructivism is a theory that emphasises that learning is individual to the learner. This theory hypothesises that individuals will try to make sense of all information that they perceive, and that each individual will, therefore, "construct" their own meaning from that information (Bada & Olusegun, 2015). The relevance of this theory to the study lies in the fact that the learner will be actively involved in the learning process. Students will be fully involved in the learning process because individual has access to the computer, and learners will be able to solve problems. Also, the new information that the students acquired can be applied to another situation since constructivism is associated with the idea of "learning by doing", which implies that the learner is active and engaged.

### ***Effects of an Interactive video-based instructional package***

Interactive video-based learning is the use of video in education. It is a learning strategy that utilises video; it is a method of acquiring knowledge and instruction through video, which involves incorporating error-free content, graphics, clear audio, and a quiz or assessment. It is a method through which knowledge is presented electronically using computers and other technological tools (Joshi,



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An interactive video-based instructional package can also be used for individualised learning. It is one of the powerful tools that present information in a motivating and precise way. It has been observed that this is one of the popular modes that the majority utilise in disseminating information to diverse kinds of learners, including auditory learners, visual learners, and others (Zhang, 2021). Interactive video-based instruction allows students or users to have independence over their learning, as they can re-watch or review content until mastery is achieved. Additionally, they can pause the video if they want to take a break, which makes interactive video-based learning an engaging option.

Interactive video can be categorised as non-linear or interactive digital video technology, which allows students to pay full attention to the learning material and review any part of the video as many times as they want. In his opinion, he proposed three approaches to video, which entail linear still video, linear dynamic video and interactive video. Interactive video is considered one of the best media because it combines audio, text, and visual elements to provide a multisensory experience for learners. It provides a unique chance to present, teach, and internalise information, and also an outstanding means for focusing the students' attention on specific details based on the prepared and highlighted material itself.

### ***Comparative studies of traditional and digital methods***

Mathematics is an indispensable tool for human development. It has been considered a necessary tool for effective functioning in society. It has developed the scientific and professional values. It helps individuals operate in society with a basic knowledge of arithmetic, at least to count, add, subtract, and measure, which are essential applications of Mathematics.

Therefore, mathematics should be taken seriously in school, especially at the primary level, which serves as the foundation for higher levels. The method used by teachers in disseminating knowledge is highly relevant because it plays a crucial role in understanding instructional content for meaningful learning and the development of necessary skills. The traditional method used by teachers, which is teacher-centred, has been dominated by teachers without any interaction between teachers and



students. The traditional approach places an instructional emphasis on chalk and talk-based instruction, which has been widely criticised because it fails to prepare students to attain high achievement. It makes students passive with limited interaction; it lacks a visual and real-world context, and does not effectively cater to different learning styles. Teachers often use this method to teach mathematics, which has not encouraged students' collaboration and engagement in the classroom. This method needs to be enhanced with technology-based instructions that can actively engage students in the instructional process and help them gain a deeper understanding of the content.

It is a well-known fact that students of this digital age are referred to as digital natives, who prefer a classroom environment dominated by digital technology, such as mobile phones, laptops, online games, and iPads, among others. Undisputedly, this kind of engagement has become an integral part of their lives in this digital age. The students expect a classroom experience that helps them develop knowledge and skills, rather than passively receiving one-dimensional information. The use of technology in the classroom can make mathematics more engaging, enhance students' problem-solving skills, and improve students' content mastery. The use of digital technologies in mathematics education has the capacity to open up diverse pathways for students to construct and engage with mathematical content. It can facilitate an emphasis on the practical applications of mathematics through modelling, visualisation, manipulation, and more complex scenarios, thereby improving student motivation and engagement, and personalising learning and providing feedback (Bray and Tangney, 2014). Studies have shown that technology helps engage students in learning mathematics and is also found to help demystify some abstract mathematical concepts (Ersozlu, 2024).

### ***Specificity of primary mathematics education***

Primary mathematics serves as the basis for learning the fundamental aspects of Mathematics. It requires teaching and learning of basic mathematical concepts and skills. This foundation is crucial, as it forms the basis for all future mathematics learning. Therefore, it is necessary to equip the teaching and learning of mathematics with technological tools. Different technological tools, such as video-based instruction and computer-aided learning, have been used to facilitate the teaching and learning of mathematics at the secondary School level of education, with positive outcomes in terms of students' academic performance. Studies, such as those by Olumuyiwa (2021), utilised an interactive e-note and developed a video-type instructional mode to teach mathematics at the senior secondary school level. There is a need to use more technology in primary schools.

### ***Models for developing learning materials***

The model guiding the research work is the ADDIE model, which is in five stages.



## **Analysis**

The content development process commences with analysis, a crucial step that involves gathering insightful information about the target audience. In this initial phase, the following tasks are performed: problem and need analysis, learners' characteristics, learning objectives and constraints.

Research has shown that many existing instructional packages have been criticised for being inadequate, difficult to operate and ineffective, leading to a lack of engagement and motivation among pupils.

Also, research has consistently shown that mathematics is one of the most challenging subjects for pupils to grasp. In contrast, the 21st century has ushered in a new era of digital natives, where pupils are naturally inclined to interact with technological devices, such as computers. This presents an opportunity to leverage technology to enhance the learning experience and improve outcomes in mathematics.

## **Design**

During the design phase, the instructional strategies, content, and media were planned and organised. (a) At this stage of the package's development, the selected topics were divided into six lessons. Each lesson was further divided into units.

Text materials were sourced using the recommended textbook for primary school mathematics.

(b) Scripts were written for the different components of the package. The package was divided into units. There is a user's guide, and there is a section that allows users to navigate the package. Objectives of each unit, which state what the pupils are expected to be able to do after watching each lesson, are also included. There is an assessment question for pupils at the end of the lesson.

### (b) Content Design

(i) Content breakdown - The package was divided into sections, which include the user's guide, home page, lesson page and quiz.

(ii) Voice Over - Camtasia was used to record and do the screen recording, the voice-over into segments as represented in the lessons.

(iv) Media Development - The graphics were developed using Microsoft PowerPoint and Canva (for development of the slides).



## ***Development***

In this phase, the interactive video-based instructional package was developed. The video content was produced, and the interactive elements were programmed using authoring and video tools. Scripts were written and storyboards were created.

Video editing tools, such as Camtasia software, were used to edit the media elements (video, voiceover, music, text). Adobe Captivate and Articulate Storyline were used to design the Interactive video-based instructional package.

## ***Implementation***

The package prototype was presented to educational technologists at the University of Ibadan's Department of Science and Technology.

Education, as well as mathematics experts. Based on their feedback and suggestions, necessary corrections and improvements were made to the prototype to ensure its effectiveness and accuracy. The refined instructional package was then implemented in a pilot study, where it was tested with a sample of primary school pupils. The package was installed on computers, and the pupils used it to learn mathematics.

## ***Evaluation***

At this stage, drafts of the component of the prototype were evaluated by experts for necessary feedback for a series of revisions and refinements that should be carried out to improve the quality of the package.

- A rubric was used to evaluate the Interactive video-based instructional package.
- The package was given to the assessors to grade the quality of the contents.
- The prototype was implemented with a small group of pupils.
- Comments and observations made were considered for the second prototype.
- The second prototype was implemented.

## ***Validation of educational technologies***

Experts in educational technology and Mathematics validated the interactive video-based instructional package. Seven experts from educational technology, including two professors, three senior lecturers of educational technology, two Postgraduate students and three experts from Mathematics, which are one professor and two Associate professors of Mathematics. The rubric was used to test the efficacy of the instructional package.



A rubric was used to evaluate the Interactive video-based instructional package.

**Table 2**

*Criteria for evaluating the effectiveness of an Interactive video-based instructional package*

<b>Category</b>	<b>Very Good</b>	<b>Good</b>	<b>Satisfactory</b>	<b>Needs Improvement</b>
<b>Content</b>	The content is very accurate and level appropriate	The content is accurate and level appropriate	The content is partially accurate and level appropriate	The content is not accurate and level appropriate
<b>Presentation details</b>	The presentation is made with exactly the right amount of detail throughout	The presentation is typically good	The presentation seems to need more editing	The presentation needs extensive editing.
<b>Objective</b>	Establishes the objective early and maintains a clear focus throughout.	Establishes the objective early and maintains focus for most of the presentation.	There are a few lapses in focus, but the objective is fairly clear	It is difficult to figure out the objective of the presentation.
<b>Voice Consistency</b>	Voice quality is clear and consistently audible throughout the presentation.	Voice quality is clear and consistently audible throughout the majority presentation.	Voice quality is clear and consistently audible through some of the presentation	Voice quality needs more attention.
<b>Quality of Images</b>	Images create a distinct atmosphere or tone that matches different parts of the topic.	Images create an atmosphere or tone that matches some parts of the topic.	An attempt was made to use images to create an atmosphere/tone but it needed more work.	Little or no attempt to use images to create an appropriate atmosphere/tone.
<b>Grammar and Language Usage</b>	Grammar and language usage are correct	Grammar and language usage correct (for the class level) and errors did not detract from the presentation.	Grammar and language usage are correct (for the class level) but errors detracted from the presentation.	Repeated errors in grammar and language usage distracted greatly from the presentation.



After evaluating the instructional package, the researcher made corrections, which were then checked again by the assessors. The instructional package was validated and was taken to the field.

## Materials and Methods

This study adopted the mixed-methods research design. The descriptive statistics of frequency count and percentage were used to analyse the quantitative data, while the qualitative data were analysed using content analysis. The population comprised primary five pupils in Osun State. One school was selected for the study using the purposive sampling technique.

This was done so that the school would have computer gadgets and a power supply for the implementation of the instructional package. The study participants were 20 primary school pupils. The instruments used were Ease of Use of IVIP ( $r = 0.77$ ), Suitability of IVIP ( $r = 0.75$ ), Acceptability of IVIP ( $r = 0.78$ ), Benefits of IVIP ( $r = 0.76$ ), and Challenges of IVIP ( $r = 0.75$ ). The qualitative data were content analysed. Flexibility (1.72), suitability ( $\bar{x} = 1.89$ ), beneficial (1.90), and usability (1.08) were all good against the threshold of 1.50. The study took six months the development. This was followed by four weeks of trial testing on primary school pupils. Data gathered in the study were descriptively and content analysed using the survey research design as shown in Table 1, which presents the mean values of participants regarding perceived ease of use of the instructional package. The weighted mean of 1.72 was derived, indicating that the value exceeded the criterion of 1.50, which suggests that the participants perceived the package as easy to use.

The results reveal that pupils find the package flexible and easy to use, and the overall findings highlight the need for continued use of the instructional package.

**Table 3**

*Do pupils perceive the ease of use?*

S/N	Items	NO	YES	$\bar{x}$	SD
1	The instructional package is easy to start	4 20%	16 80%	1.80	0.41
2	The package is easy to navigate through different lessons	8 40%	12 60%	1.60	0.50
3	Are the instructions for using the package clear?	7 35%	13 65%	1.65	0.49
4	Are the fonts, colors, and visuals clear and readable?	9 45%	11 55%	1.55	0.51



5	Do you experience any difficulties in using the buttons, menus, or features?	9 45%	11 55%	1.55	0.51
6	Did the instructional package respond quickly when you clicked on options or buttons?	6 30%	14 70%	1.70	0.47
7	Is the instructional package engaging?	4 20%	16 80%	1.80	0.41
8	Do you find the package enjoyable to use?	5 25%	15 75%	1.75	0.44
9	Would you like to use this package again for learning?	2 10%	18 90%	1.90	0.31
10	Is the instructional package flexible for learning?	3 15%	17 85%	1.85	0.37
	Weighted mean= 1.72				
	Criterion mean = 1.50				

Table 3 presents the mean values of participants regarding the perceived ease of use of the instructional package. The weighted mean of 1.72 is greater than the criterion of 1.50, indicating that the participants perceived that the package is easy to use.

## Results

The results reveal that pupils find the package flexible and easy to use, and the overall findings highlight the need for continued use of the instructional package.

**Research question 1:** How do the pupils perceive the ease of use of the Interactive video-based instructional package?

Participants' views on the perceived ease of use of the instructional package

**Table 5**

*Do pupils perceive the ease of use?*

S/N	Items	NO	YES	$\bar{x}$	SD
1	The instructional package is easy to start	4 20%	16 80%	1.80	0.41
2	The package is easy to navigate through different lessons	8 40%	12 60%	1.60	0.50
3	Are the instructions for using the package clear?	7	13	1.65	0.49



		35%	65%		
4	Are the fonts, colors, and visuals clear and readable?	9 45%	11 55%	1.55	0.51
5	Do you experience any difficulties in using the buttons, menus, or features?	9 45%	11 55%	1.55	0.51
6	Did the instructional package respond quickly when you clicked on options or buttons?	6 30%	14 70%	1.70	0.47
7	Is the instructional package engaging?	4 20%	16 80%	1.80	0.41
8	Do you find the package enjoyable to use?	5 25%	15 75%	1.75	0.44
9	Would you like to use this package again for learning?	2 10%	18 90%	1.90	0.31
10	Is the instructional package flexible for learning?	3 15%	17 85%	1.85	0.37
	Weighted mean= 1.72				
	Criterion mean = 1.50				

Table 5 presents the mean values of participants regarding the perceived ease of use of the instructional package. The weighted mean of 1.72 is greater than the criterion of 1.50, indicating that the participants perceived that the package is easy to use.

The results reveal that pupils find the package flexible and easy to use, and the overall findings highlight the need for continued use of the instructional package.

**Research question 2:** Do pupils consider the Interactive video-based instructional package suitable?

**Table 6**

*Participants' responses on the suitability of the instructional package*

S/N	ITEMS	NO	YES	$\bar{x}$	SD
1	Do you think the instructional package is appropriate for you?	3 15%	17 85%	1.85	0.37
2	Does the package match the topics you are learning in school?	2 10%	18 90%	1.90	0.31
3	Are the examples and exercises in the package relate to what you are taught in class?	6 30%	14 70%	1.70	0.47



4	Is the language used in the package easy to understand?	3 15%	17 85%	1.85	0.37
5	Do you understand the images, videos and audio used in the package?	2 10%	18 90%	1.90	0.31
6	Does the instructional package allow you to learn at your own pace?	1 5%	19 95%	1.95	0.22
7	Does the package support your learning?	6 30%	14 70%	1.70	0.47
8	Can the package be used both in the classroom and at home?	5 25%	15 75%	1.75	0.44
9	Do you think the content of the package is engaging and interactive?	6 30%	14 70%	1.70	0.47
10	Are you comfortable in using this instructional package?	4 20%	16 80%	1.81	0.41
Weighted mean= 1.81					
Criterion mean = 1.50					

Table 6 presents the mean response to the suitability of the instructional package. The weighted mean of 1.81 exceeds the weighted mean of 1.50, signifying that the weighted mean of 1.81 out of the obtainable score of 2.0 is higher than the criterion mean of 1.50. This means that the majority of participants perceived the package as suitable for use.

The results show that the participants believed the package was suitable for use both in the classroom and at home.

**Research question 3:** What is the pupils' level of acceptance of the instructional package?

**Table 7**

*Pupils' level of acceptability of the package?*

S/N	ITEMS	NO	YES	$\bar{x}$	SD
1	Do you think this instructional package is suitable for you?	4 20%	16 80%	1.80	0.41
2	Will you accept the package to be used for learning?	0 0%	20 100%	2.00	0.00
3	Are you satisfied with the overall experience of using the package?	3 15%	17 85%	1.85	0.37



4	Is the package interesting?	0 0%	20 100%	2.00	0.00
5	Does the instructional package fit well with the way you like to learn?	3 15%	17 85%	1.85	0.37
6	Will you like to continue using this package for learning?	2 10%	18 90%	1.90	0.31
7	Does the instructional package make learning more enjoyable?	5 25%	15 75%	1.75	0.44
8	Does the instructional package relate with the topics in the school curriculum?	2 10%	18 90%	1.90	0.31
9	Do you think this instructional package should be used in all schools?	0 0%	20 100%	2.00	0.00
		Weighted mean= 1.89			
		Criterion mean = 1.50			

Table 7 presents the mean response to the acceptability of the package. It has a weighted mean of 1.89 out of the obtainable score of 2.0, which is higher than the criterion mean of 1.50. This means that the participants accepted the use of the package.

The results indicate that the participants considered the package acceptable.

**Research question 4:** What benefits do pupils derive from the use derivable from the use of the instructional package?

### Table 8

*Participants' responses to the benefits of the instructional package*

S/N	ITEMS	NO	YES	$\bar{x}$	SD
1	The instructional package is beneficial to learning.	3 15%	17 85%	1.85	0.36
2	The instructional package helped to improve my learning.	0 0%	20 100%	2.00	0.00
3	The instructional package motivates me to learn more.	4 20%	16 80%	1.80	0.41
4	The package better than the traditional learning materials (e.g., textbooks, worksheets).	0 0%	20 100%	2.00	0.00



5	The package makes it easier to remember what I have learnt.	3 15%	17 85%	1.85	0.36
Weighted mean= 1.90					
Criterion mean = 1.50					

Table 8 presents the mean response to the benefits of the instructional package. It has a weighted mean of 1.90 out of the obtainable score of 2.0, which is higher than the criterion mean of 1.50. It means that the participants perceived that the instructional package is beneficial.

The item-by-item analysis is presented as follows: The instructional package helped me to improve my learning, and the package is better than traditional learning material, was ranked highest among the mean score. This is followed by the instructional package is beneficial to learning and the package make it easier to remember what I learnt ( $\bar{x} = 1.85 > 1.50$ ). Lastly, the instruction motivates me to learn  $\bar{x} = 1.80 > 1.50$ . This implies that the participants agreed that the instructional material improved their learning, better than traditional learning materials, was beneficial to learning, made it easier to remember, and motivated them to learn. The findings show that the instructional package was interesting and beneficial to them.

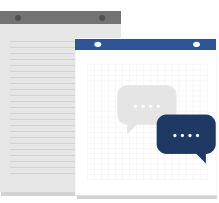
**Research question 5:** What are the challenges pupils face when using the instructional package?

**Table 9**

*Responses to the challenges pupils face when using the instructional package*

S/N	ITEMS	NO	YES	$\bar{x}$	SD
1	It is time consuming	20 100%	0 0%	1.00	0
2	My teacher needs to assist me because it is difficult to operate	18 90%	2 10%	1.10	0.30779
3	It is not user friendly	18 90%	2 10%	1.10	0.30779
4	I face technical problems while using the package?	18 90%	2 10%	1.10	0.30779
Weighted mean= 1.08					
Criterion mean = 1.50					

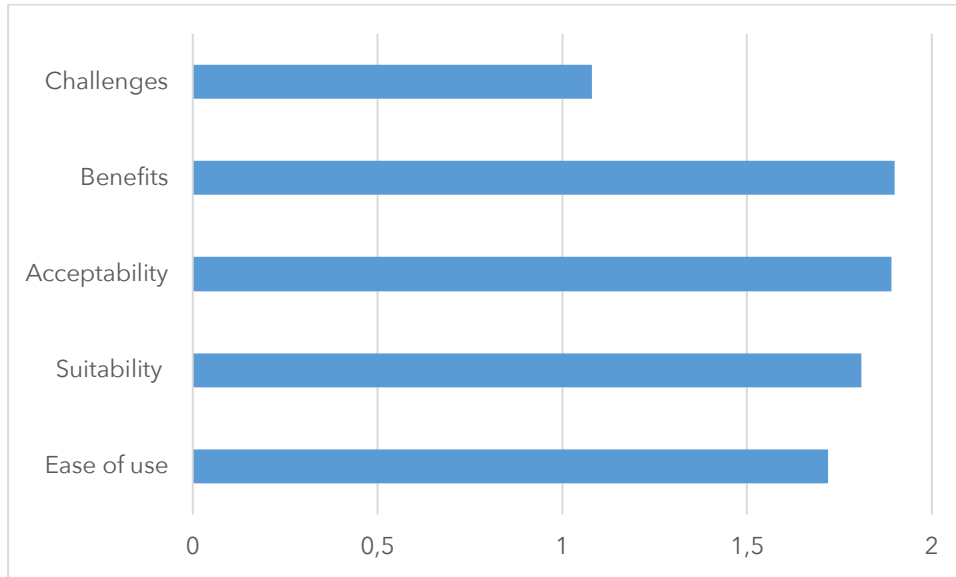
Table 9 presents the mean response to the challenges of the instructional package. It has a weighted mean of 1.08 out of the obtainable score of 2.0, which is less than the criterion mean of 1.50.



This means that the participants perceived that the instructional package is not difficult to use. The results indicated that the instructional package is not difficult. In other words, it shows that the instruction is easy to use.

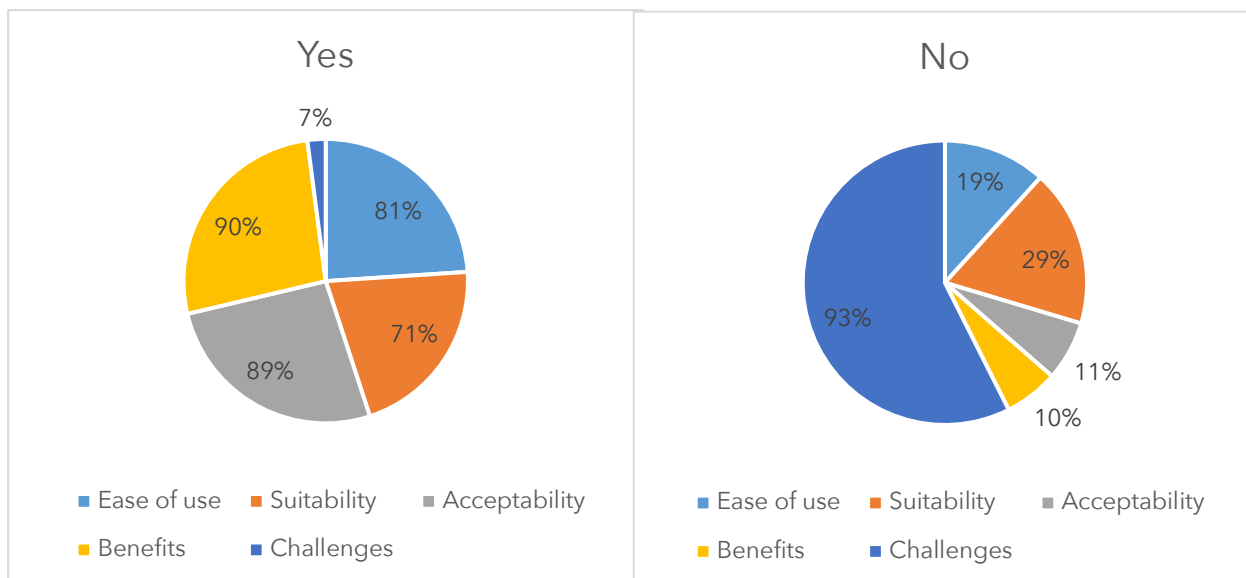
**Figure 1**

*Comparative Analysis of Mean Values*



**Figure 2**

*Pie charts showing the percentage of positive versus negative responses for Ease of Use, Suitability, Acceptability, Benefits, and Challenges of the Package*





To highlight the findings, the chart shows that:

- 81% have a positive response to the ease of use of the package, while 19% have a negative response.
- 71% positive response to the suitability of the package, while 29% negative response to the suitability of the package.
- 89% positive response to the acceptability of the package, while 11% negative response to the acceptability of the package.
- 90% positive response to the benefit of the package, while 11% negative response to the benefit of the package.
- 93% had no challenges with the package, while 7% experienced challenges with it.

**Table 10**

*Correlation Heatmap*

Indicators	Ease of use	Suitability	Acceptability	Benefits	Challenges
Ease of use	1				
Suitability	0.63*	1			
Acceptability	0.57*	0.893*	1		
Benefits	0.07	0.425	0.550*	1	
challenges	-0.13	-0.600*	-0.686**	-.678*	1
Mean	0.38	0.7125	1	0.4973333333	0.433
Standard Deviation	0.362635262	0.406586399	0.673138024	0.470687086	0.80185909

\* denotes significance at  $p < 0.05$

Table 10 indicates that there was a positive, moderately significant relationship between ease of use and suitability ( $r = 0.63$ ), and acceptability ( $r = 0.57$ ), but not with benefits and challenges. This result implies that suitability, acceptability and ease of use are positively related. There was a significant relationship between suitability and acceptability ( $r = 0.89$ ) as well as challenges ( $r = -0.60$ ), but not with benefits or ease of use. There was a significant relationship between acceptability and benefits ( $r = 0.55$ ), and challenges ( $r = -0.69$ ), but not with ease of use and suitability. A significant relationship was found between benefits and challenges ( $r = -0.68$ ).



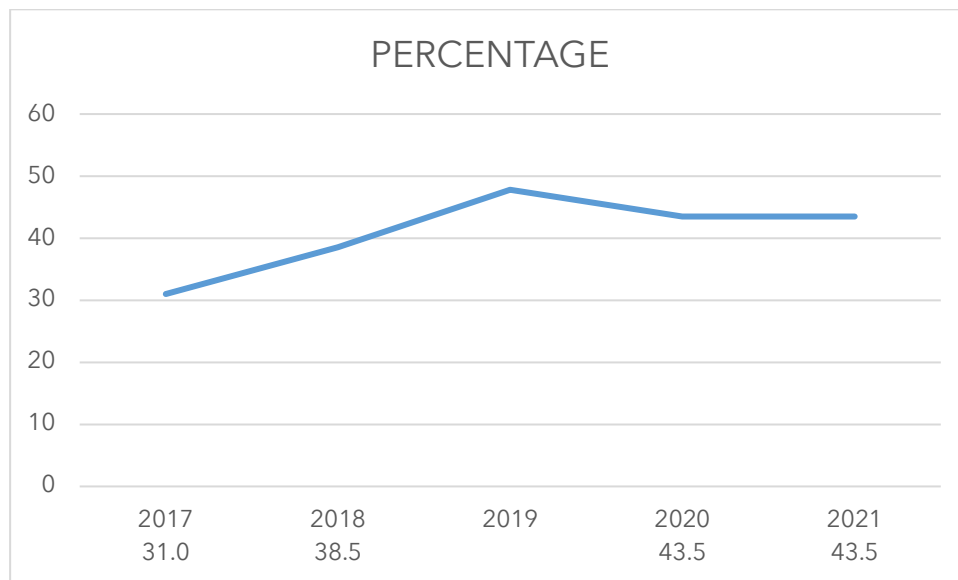
**Table 11**

Summary of Table

Indicators	Mean	Standard Deviation
Ease of use	1.72	0.44
Suitability	1.81	0.38
Acceptability	1.89	0.22
Benefits	1.91	0.22
Challenges	1.08	0.23

**Figure 3**

Mathematics Achievement Dynamics. Line graph of mathematics achievement indicators in Osun State (2017-2021) with trend line



## Thematic analysis

### 1. Ease of use of the package

*I find the instructional package interesting, and it was easy for me to use. It has music and pictures, which makes it interesting and easy for me to use. I was able to watch the video and learn a great deal (Transcript 1).*

*The Interactive video allowed me to learn different shapes in mathematics very well (Transcript 2).*



*The video made understanding mathematics (Transcript 3).*

*The package is easy for me to use, and I was able to press the button and watch the lesson by pressing the lesson button (Transcript 4).*

*I like the package because it allows me to watch and use it myself; I can use it without my teacher (Transcript 5).*

*I like watching the package because it helps me to learn mathematics.*

## **2. Suitability of the instructional package?**

*I enjoy using the instructional package. (Transcript 1-Primary 5 pupil).*

*The instructional package helped me to know mathematics. The package helped me to understand mathematics more. (Transcript 2).*

*I would like to share what I have learnt with my friends. My teacher should be using the instructional package to teach us in the class (Transcript 3).*

*My teacher should be using a computer to teach us. I enjoy using the instructional package to learn mathematics (Transcript 4).*

*The instructional package is good for us to use in the class. Our teacher should allow us to use the computer laboratory so that we can learn (Transcript 5).*

Most of the participants said that this package is suitable for use and should be used in the classroom and at home

## **3. Acceptability of the package**

*My school should allow us to visit the computer laboratory every day so that we can use computers to enhance our learning (Transcript 1).*

*My teacher should allow us to use the video in the class (Transcript 2).*

*I will tell my teacher to allow us to use the instructional package every time.*

*(Transcript 3-Primary 5 pupil).*

*The instructional package should be used at home (Transcript 4).*



The participants reported that schools should utilise the instructional package to facilitate learning. The instruction should be used in school to facilitate learning.

#### **4. Benefits of the use of the instructional package**

*I was able to see pictures and images of different shapes. The instructional package helped me to understand mathematics better (Transcript 1).*

*I was able to see different shapes singing and dancing; my teacher should allow us to use the instructional package in class (Transcript 2).*

*I will tell my teacher to allow us to use the instructional package every time (Transcript 3).*

The qualitative interviews revealed that most participants responded that the instructional package was helpful in them. The participants stated that the instruction gave them an understanding of mathematics.

#### **5. Challenges pupils encounter when using the instructional package**

Participants were asked about the challenges they face when using the instructional package. The qualitative analysis revealed

*Most times, if there is no light, we cannot use the instructional package*

*(Transcript 1).*

*Sometimes our teacher does not allow us to go to the computer laboratory to watch the video.*

*(Transcript 2).*

*My teacher does not allow us to watch the instructional video unless he is present.*

*(Transcript 3).*

Most of the participants reported that the instructional package is straightforward to use.

#### **Sample and Participants**

The study sample consisted of five primary pupils from the Osun Senatorial District. Purposive sampling was used to select one school from the local government, based on the fact that the school was equipped with computer devices and a power supply. Each local government in Osun State has



one model school, which is also equipped with computer devices. Twenty pupils were randomly selected from a pool of forty pupils in the school.

To determine the content and face validity of the instrument, it was administered to lecturers in the Department of Science and Technology Education. The questionnaire was given to experts to determine the suitability of the language used and to remove any vague statements. It was administered to 20 pupils who were not part of the research to determine the reliability of the instrument. The reliability coefficient of the instrument was calculated using Cronbach Alpha with the reliability coefficient.

The instruments used were Ease of use of IVIP with a:

- reliability coefficient of ( $r=0.77$ ), the Suitability of IVIP with a
- reliability coefficient of ( $r=0.75$ ), and the Acceptability of IVIP with a
- Reliability coefficient of ( $r=0.78$ ), Benefits of IVIP with a  
reliability coefficient of ( $r=0.76$ ), challenges of IVIP, with a  
reliability coefficient of ( $r=0.75$ ).

An interactive video-based instructional package was subjected to validation using face and content validity by experts in the Educational Technology Unit and the Mathematics Education Unit at the University of Ibadan. The inter-rater reliability was estimated using Cohen's Kappa.

The development of the interactive video-based instructional package in this study was based on five stages, adopting the ADDIE model. At the Analysis stage, pupils' characteristics are outlined to justify the proposed package. In contrast, at the Design stage, scripts are written based on the contents, storyboards are designed, media are used, and videos are rendered. At the development stage, an interface was created that clearly reflected the menu, and learning objectives were clearly stated. Engaging content and quizzes were created using various tools, including authoring tools, video editing tools, and graphic design tools. At the implementation stage, the prototype was evaluated by experts in educational technology and Mathematics, and was trial-tested on pupils. Finally, at the evaluation stage, the various components were evaluated before developing the final package.

### ***Schools' selection and pre-experimental activities***

A letter introducing the researcher to the schools was obtained from the Head of the Science and Technology Education Department at the University of Ibadan and presented to the school authorities as a means of expressing the researcher's intent and the purpose of the study. The researcher explained the essence of the research, the benefits the teachers and pupils would derive from it, and the duration of the study, while also soliciting their utmost support and cooperation.



### ***Training of teachers, pupils' orientation and installation of the Interactive video-based instructional package***

The second and third weeks were dedicated to training the teachers. They were trained on how they would use the Interactive video-based instructional package.

### ***Implementation of the Instructional package***

Weeks four to nine were used to test the instructional package on the pupils. Pupils were exposed to an Interactive video-based instructional package.

### **Discussions**

#### ***Effectiveness of Interactive Video-based Instructional Packages in Mathematics Education***

Interactive video-based learning is a digital learning tool that combines videos with other interactive elements to deliver quality content and facilitate active engagement among learners. It allows learners to be actively engaged with the content and participate in the learning process. The analysis revealed that the interactive video-based instructional package (IVIP) had a significant effect on pupils' achievement in mathematics. This indicates that the interactive video-based instructional package (IVIP) had a weighted mean of 1.72, which exceeds the criterion of 1.50. The effectiveness of the interactive video-based instructional package (IVIP) over the traditional in enhancing pupils' post-achievement mean score in mathematics may be because the instructional packages contain more direct instruction and they are easy to use, which makes it easier for users to learn through exploration.

Additionally, learners are actively involved in the teaching and learning process, constructing their own ideas and knowledge. These findings on the ease of use of the interactive video-based instructional package support the assumption of constructivist learning theory that learning occurs when pupils are actively involved and participate in real-world activities. In addition, learning is an individual activity, as individuals attempt to make sense of the information they perceive, leading to the construction of meaning from that information (Bada & Olusegun, 2015). The effectiveness of the interactive video-based instructional package (IVIP) is in agreement with the observations of Joel, Ashipala, and Kamenye (2020), Xu and Frydenberg (2021), and Usman *et al.* (2023), who found that an interactive video-based instructional package improves mastery learning and intellectual ability when it is flexible and easy to use. This finding is also in consonance with Carol's (2011) research, which reported that the ease of use of software makes users more interested in a package. Oyarinde and Olaide (2020) investigated the effectiveness of an interactive video-based package on the mathematics achievement of deaf students, and the result shows that the package was significant.



## ***Students' Perception of Technological Innovations in Education***

The perception of students of an Interactive *video*-based instructional package has been proven to be accepted for use. This might be because the (IVIP) has been reported to be easy to use. The interactive video-based instructional package enables pupils to learn concepts and solve problems in Mathematics, which may have contributed to its acceptance. The results showed that the participants believed the package was suitable for use both in the classroom and at home. The interactive video-based instructional package (IVIP) had a weighted mean of 1.81, which is greater than the criterion of 1.50. This finding of the acceptability of the instructional package supports the assumption made by Low *et al.* (2023), who stated that the acceptability of a technology or software occurs when it meets the purpose or needs of the intended target audience.

The analysis of technology acceptance level utilises the Technology Acceptance Model (TAM), which measures how users perceive the ease of use of a software or technology and its perceived usefulness. The degree to which an individual believes using a particular system will enhance a subject or job is referred to as perceived usefulness. In contrast, the degree to which an individual believes that using technology is easy or requires minimal effort is referred to as perceived ease of use (Marikyan, Papagiannidis, & Stewart, 2023).

Some factors that may influence the usage of interactive video-based instructional include available resources and infrastructure, accessibility, digital competencies, and unstable electricity power supply (Mustapha *et al.*, 2020). Studies such as those by Arthur *et al.* (2022) and Thurm and Barzel (2022) have investigated the use of technology to improve mathematics performance, with results showing that it is highly effective in enhancing mathematics achievement. Additionally, it helped students pay more attention in the classroom and participate more effectively.

## ***Pedagogical Implications of Results***

The findings revealed that the pedagogical aspect of the interactive video-based instructional package (IVIP) was instructive. This means that the participants affirmed that the instructional package was pedagogically structured and acceptable for use. The result shows that the participants thought that the package was pedagogically satisfactory. This may be because the instructional package was interesting and engaging. Additionally, the interactive video-based instructional package was complemented by newer technologies that incorporate direct instruction in problem-solving. In addition, it may be because the interactive video-based instructional package features a multimedia environment that can captivate learners' interest. This finding on the pedagogical implications of the instructional package supports the assumption of Cash *et al.* (2023), who stated that the pedagogy of



instruction or software is essential to meeting learners' needs and facilitating learning in any learning environment.

The interactive video-based instructional package had an impact on mathematics teaching methodology, as it provided teachers with additional methods to utilise technology and the instructional package to enhance mathematics instruction. It helps students to visualise abstract mathematical concepts and helps them to be actively engaged with the learning material. This can lead to increased student interest, motivation and engagement in learning of Mathematics (Bright et al., 2024).

The use of interactive video-based instructional packages plays a crucial role in the teaching and learning process, as it helps teachers simplify concepts for students. In this context, the role of a teacher in technology-oriented learning is to observe, facilitate, and intervene as needed. The teacher can use an interactive video-based instructional package to supplement traditional classroom instruction since technology has been proven to have a positive effect on students' achievement in mathematics (Kelley et al., 2020). To keep up with and adapt to the latest technology, teachers must continually develop themselves.

## **Conclusion and Implications**

The findings on the interactive video-based instructional package confirm that it enhances pupils' achievement in Mathematics. Reports of this study have established that the interactive video-based instructional package is effective in primary schools compared to the traditional/conventional strategy. This study contributes to the ongoing usage of digital technology in restructuring education by providing empirical evidence on the effects of an interactive video-based instructional package.

Primary school teachers should prioritise the use of technology in primary schools, as there is evidence that pupils find the instructional packages flexible, suitable for use, resourceful, and helpful. Additionally, primary school teachers should adopt the use of interactive video-based instructional packages for teaching mathematics in primary schools in Nigeria. Additionally, Curriculum planners and developers in Nigerian primary schools should emphasise the importance of continuously utilising innovative approaches such as interactive video-based instructional packages in improving learning.

## **Limitations of the study**

While this study yields valuable results, its limitations include the mixed-methods approach and experimental design. The interactive video-based learning was only used for grade five pupils in primary schools, rather than using all classes, due to the technology facilities available. First, using this



class only may make the sample small, as it selects twenty primary school pupils rather than the entire primary school. Additionally, the bibliometric study focuses on Mathematics rather than all subjects.

### **Suggestions for Future Research**

Despite the effects and significance of the interactive video-based instructional package for mathematics instruction in Osun State primary schools, there are still several areas in which research can be conducted. For instance, it can be carried out in other states or geopolitical zones. Future research might extend the focus beyond Osun State and produce comparative data on contextual factors, such as infrastructure, teacher capacity, teacher technological knowledge, and linguistic diversity. Other Studies might expand this study to include other subjects such as English Language, Civic Education, Social Studies, Basic Science, among other topics in the primary school curriculum. Further studies could also investigate how combining an interactive video-based instructional package with other digital learning resources, such as computer programming, learning management systems, and gamified applications, can improve learning outcomes.

Additionally, further studies could investigate how training in the use of an interactive video-based instructional package impacts instructional practices, classroom management, and the sustainability of technology integration. Researchers may also explore pupils' cognitive load and learning analytics during interaction with the videos, using clickstream data, or real-time response systems to gain deeper insights into learning processes.

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### **Conflicts of Interest**

None

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