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EFFICACY OF DIGITAL VIDEO INSTRUCTIONAL STRATEGY ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS: IMPLICATION FOR CURRICULUM SPECIALIST AND EDUCATIONAL EVALUATORS

EFICÁCIA DA ESTRATÉGIA DE ENSINO POR VÍDEO DIGITAL NO DESEMPENHO ACADÊMICO DE ALUNOS DO ENSINO MÉDIO EM MATEMÁTICA: IMPLICAÇÕES PARA ESPECIALISTAS EM CURRÍCULO E AVALIADORES EDUCACIONAIS

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Abstract
This study examined how effective digital video instruction is in enhancing mathematics achievement of secondary school students in Nsukka local government area of Enugu state, Nigeria; highlighting its implications for curriculum specialist and educational evaluators. It used a non-equivalent pretest-posttest control-group format, which is a type of quasi-experimental design. The study population consisted of 2,283 Senior Secondary School II (SSS II) students in Nsukka Local Government Area of Enugu State. From this population, a purposive sample of 120 students from two selected schools was chosen to take part in the research. The Mathematics Achievement Test (MAT), used for data collection, was vetted by experts in both Mathematics Education and Measurement and Evaluation to ensure face validity. Its reliability was confirmed with an index of 0.92, calculated through the use of Kuder-Richardson Formula 20 (KR-20). A pretest was given to participants in both groups prior to the start of the intervention, and a posttest was conducted after the six-week treatment period. Mean and standard deviation were applied to address the research questions, while analysis of covariance (ANCOVA) was used to test the hypotheses at the 0.05 significance level. To answer the research questions, the mean and standard deviation were utilized, and the hypotheses were tested at the 0.05 significance level using analysis of covariance (ANCOVA). The results showed that students taught mathematics using a digital video instructional strategy performed significantly better than those taught through traditional lectures. Additionally, no meaningful differences in achievement were observed between male and female students.

Keywords: Digital Video Instructional Strategy. Achievement. Mathematics. Gender.

Resumo
Este estudo analisou a eficácia do ensino por meio de vídeos digitais na melhoria do desempenho em matemática de alunos do ensino médio na área de governo local de Nsukka, no estado de Enugu, na Nigéria, destacando suas implicações para especialistas em currículo e avaliadores educacionais. Utilizou-se um formato de pré-teste e pós-teste com grupo de controle não equivalente, que é um tipo de desenho quase-experimental. A população do estudo consistiu em 2.283 alunos do 2º ano do ensino médio (SSS II) na área do governo local de Nsukka, no estado de Enugu. Dessa população, foi selecionada uma amostra intencional de 120 alunos de duas escolas selecionadas para participar da pesquisa. O Teste de Desempenho em Matemática (MAT), utilizado para a coleta de dados, foi avaliado por especialistas tanto em Educação Matemática quanto em Medição e Avaliação para garantir a validade aparente. Sua confiabilidade foi confirmada com um índice de 0,92, calculado por meio da Fórmula 20 de Kuder-Richardson (KR-20). Um pré-teste foi aplicado aos participantes de ambos os grupos antes do início da intervenção, e um pós-teste foi realizado após o período de tratamento de seis semanas. A média e o desvio padrão foram aplicados para abordar as questões de pesquisa, enquanto a análise de covariância (ANCOVA) foi utilizada para testar as hipóteses no nível de significância de 0,05. Para responder às questões de pesquisa, utilizaram-se a média e o desvio padrão, e as hipóteses foram testadas no nível de significância de 0,05 por meio da análise de covariância (ANCOVA). Os resultados mostraram que os alunos que aprenderam matemática por meio de uma estratégia de ensino com vídeo digital tiveram um desempenho significativamente melhor do que aqueles ensinados por meio de aulas expositivas tradicionais. Além disso, não foram observadas diferenças significativas no desempenho entre alunos do sexo masculino e feminino.

Palavras-chave: *Estratégia de Ensino por Vídeo Digital. Desempenho. Matemática. Gênero.*

1 INTRODUCTION

Mathematics remains a foundational subject in the school curriculum due to its critical role in developing logical reasoning, problem-solving skills, and its application across science, technology, and everyday life. The Federal Ministry of Education (2013) indicated that, "Mathematics is a compulsory subject offered at both the primary and secondary school levels in Nigeria". For secondary school students aspiring to pursue higher education, mathematics is essential for grasping concepts in various other disciplines. As a result, obtaining a satisfactory grade in mathematics like credit is required for admission into tertiary institutions for any course of study. Despite its importance, students' achievement in mathematics has consistently been below expectations, as reflected in West Africa Examination Certificate (WAEC) results (WAEC Chief Examiners' Reports, 2020–2024).

One of the persistent challenges in Mathematics education that may contribute to students' poor achievement is the over-reliance on traditional lecture-based instruction, which often lacks interactivity and fails to cater to diverse learning styles (Usman, 2008; Ezenwosu & Nworgu, 2013; Okoyefi, 2014). As a result, students may find Mathematics abstract, difficult to relate to real-life contexts, and ultimately disengaging (Obioma & Ohuche, 2010). To address this issue, research have suggested an application of technology-enhanced methods, including digital video instructional strategy that is students' centered approach, which combine visual, auditory, and narrative elements to support concept understanding and retention.

Digital video instruction, through platforms such as animations, recorded lessons, and simulations, offers dynamic representations of abstract mathematical concepts, enabling learners to visualize processes and engage more actively with the content (Mayer, 2009; Kay, 2012). Studies have shown that video-based instruction can significantly improve students' understanding and academic achievement, particularly when used to supplement or replace passive lecture methods (Brame, 2016; Abanikannda, 2016). Integrating digital video into Mathematics instructions will not only promotes conceptual clarity and student engagement but also delivers measurable learning gains, making it a powerful strategy for modern classrooms. In the Nigerian context, research has begun to highlight the positive impact of digital video approach on students'

performance in mathematics and other science-related subjects. For example, researchers (Osokoya, 2007; Adegbija, 2010; Tyoor, 2017; Olagunju & Fajemidagba, 2019) found in their various researches video-based instructional approaches yield better achievement outcomes and enhance motivation in students compared to traditional methods applicable to various subjects.

Research has also shown that video-taped instruction significantly enhances the academic performance of students with special needs and those who learn at a slower pace (Zakaria, Solfitri, Daud & Abidin, 2013). Additionally, it has been found to yield improved outcomes for students with typical learning abilities, who are the focus of this study. Given the increasing integration of digital tools into education, particularly in the wake of global shifts toward remote and blended learning, it is essential to evaluate the efficacy of digital video instructional strategies in improving mathematics achievement at the secondary school level. Such research will offer important insights for teachers, education policymakers, and curriculum designers on how best to leverage technology to enhance learning outcomes. However, a key concern regarding learner-centered strategies in the classroom is whether they benefit male and female students equally is a question that raises important considerations about gender differences and achievement in Mathematics.

Gender refers to the psychosocial characteristics and roles associated with being male or female. According to Keightley (2011), gender encompasses the societal study of masculinity and femininity as they are attributed to different sexes, with men and women being distinguished by traits labeled as masculine or feminine. In Bronfenbrenner's (2005) view, gender refers to the socially defined roles and interactive dynamics that shape the relationships between males and females. The influence of gender on students' achievement in science, particularly in Mathematics, has long been a subject of interest and concern among researchers and science educators. Previous research examining student achievement has produced mixed findings regarding gender-related differences. For example, Danjuma and Bajon (2022) and Gambari, Falode and Yusuf (2014) reported no significant difference in academic outcomes between male and female students taught physics and history using computer-assisted instructional packages. Meanwhile, Eraikhuemen (2003) found a pronounced gender gap in mathematics performance, whereas Ukwungwu (2001) reported that male students

significantly outperformed their female counterparts in Physics. This study also investigated gender differences in students' achievement in Mathematics, prompted by the inconsistent and contradictory results reported in various previous studies on academic achievement.

2 THEORETICAL FRAMEWORK

This study is grounded in Jerome Bruner's (1966) constructivist theory of learning. Bruner's theory emphasizes that learning process is dynamic, where learners build their meaning by building on their previous experiences. Constructivism's core principles include: establishing real-world environments or real-world situations that use context to make learning relevant; emphasizing practical solutions to real-world issues. In problem-solving techniques, the instructor acts as a mentor or facilitator. Through the construction of new concepts, these cognitive structures enable the learner to go beyond the provided information. In this situation, the learner relies on existing knowledge and past experiences, organizing them to interpret current concepts and address new challenges by combining what has already been learned with expected new understanding. The theory, however, encourages curiosity, exploration, initiative, creativity, and self-discovery in learners. The theory is applicable to the study, as the digital video instructional strategy focuses on guiding and supporting students while allowing them to develop their own understanding of key concepts.

3 OBJECTIVE OF THE STUDY

The study's goal was to ascertain how well digital video instruction affected the academic performance of secondary school students in Mathematics in Nigeria's Enugu state's Nsukka Local Government Area: implication for educational evaluators. More specifically, the study established the;

1. mean Mathematics achievement scores of students taught through digital video versus those taught through traditional lecture;
2. influence of gender on students' mean achievement scores in Mathematics;

3. interaction effect of instructional strategies and gender on students' mean achievement scores in Mathematics.

4 RESEARCH QUESTIONS

The study was structured around the following research questions;

1. What are the average math achievement scores of students who were taught through digital video versus those who were taught through traditional lecture methods?
2. What is the influence of gender on students' mean achievement scores in Mathematics?
3. What is the interaction effect of instructional strategies and gender on students' achievement scores in Mathematics?

5 HYPOTHESES

The following null hypotheses were examined in the study at 0.05 alpha level.

- **H_{O1}:** There is no significant difference in the mean achievement scores of students taught Mathematics using Digital Videos instructional strategy and those taught using conventional lecture method
- **H_{O2}:** The mean achievement scores of male and female students in mathematics do not differ significantly.
- **H03:** The interaction effect of teaching strategies and gender on the mean achievement scores of students in Mathematics is not significant.

6 METHODOLOGY

The study employed a quasi-experimental approach, using a non-equivalent groups design with both pre-test and post-test measures. The research was carried out in Nsukka Local Government Area of Enugu State, Nigeria. It focused on a population of 2,283 Senior Secondary School Two (SSS II) students studying Mathematics across 32

public secondary schools in the region. A total of 120 Senior Secondary School Two (SSS II) Mathematics students, comprising 50 males and 70 females, were used as the sample for the study. The participants were chosen using a purposive sampling method. Data relevant to the study were gathered with the use of the Mathematics Achievement Test (MAT), designed by the researchers. The instrument underwent face validation by three experts: two from the Mathematics Education unit and one from the Measurement and Evaluation unit, all within the Department of Science Education at the University of Nigeria, Nsukka. In addition, the content validity of the Mathematics Achievement Test (MAT) was established using a carefully developed table of specifications. The reliability of the instrument was confirmed with a coefficient of 0.92, calculated using the Kuder-Richardson 20 (KR-20) formula.

7 EXPERIMENTAL PROCEDURE

The researchers prior to the treatment trained four Mathematics teachers as research assistants. This was done to help the teachers have adequate knowledge of the instructional package prepared for the study. The training session was aligned with the objectives of the study, highlight on the topics taught during the experiment, the use of treatment package, methods and procedures for administration of the research instrument and the overall conduct of the experiment. The training lasted for four days during which the contents were discussed and the test run conducted at the end of the training. The research assistants were instructed to strictly use the treatment package prepared for the study. The researchers employed the services of the Mathematics teachers sampled for the study as research assistants to avoid experimental bias that may arise from the students. Two classes each were randomly assigned to the treatment and control groups out of the four intact classes sampled for the study. Digital Videos instructional strategy was used for students in group 1 (Experimental Group) while conventional lecture method was used for students in group 2 (Control Group).

Prior to the start of the treatment after the training of the teachers used for the study, students were pre-tested by administering the research instrument (MAT) to determine their initial achievement levels. The study lasted for six weeks. Week one was dedicated to training of the research assistants, Week 2 was for the pre-test, Weeks 3-5

was used for the actual treatment, and Week 6 was used for the post-test. The experiment took place within the normal classrooms setting. This implies that their regular classroom time was used in an intact setting. Students exposed to the experimental group (digital video instructional strategy) was taught using the digital video package prepared for the study while students exposed to the control group (conventional lecture method) were taught using lecture method. At the end of the experiment, the instrument (MAT) was re-administered to the students in both experimental and control groups for post-testing. The pre-test and post-test scores were then collected and analyzed. Data collected were analysed using descriptive and inferential statistical tools. In particular, the research questions were addressed using means and standard deviations, and hypotheses were tested at the 0.05 level of significance using Analysis of Covariance (ANCOVA).

8 RESULTS

8.1 Research question one

What are the average math achievement scores of students who were taught through digital video versus those who were taught through traditional lecture methods?

Table 1

Mean and standard deviation scores of students who were taught through digital video versus those who were taught through traditional lecture methods

Groups		Pre-test		Post-test		Mena Gain Scores	Mean Gain Difference
	N	Mean	SD	Mean	SD		
Experimental Group	61	17.39	3.85	31.07	7.08	13.07	5.04
Control Group	59	16.61	3.76	24.64	4.18	8.03	

*N= Number of respondents; SD=standard deviation; M=mean

Result in Table 1 shows that students who were taught Mathematics using Digital Videos instructional strategy had a mean achievement score (M = 17.39, SD = 3.85) at the pretest and had a mean achievement score (M = 31.07, SD = 7.08) at the posttest. Meanwhile, students who were taught Mathematics using conventional lecture method had a pretest mean achievement score (M = 16.61, SD = 3.76) and a posttest mean

achievement score of (M = 24.64, SD = 4.18). The mean gain scores of 13.07 and 8.03 were recorded for students in Digital Videos and conventional lecture method groups respectively. The result indicates that the students in Digital Videos group had a higher mean achievement score compared to students in conventional lecture method group.

8.2 Research question two

What is the influence of gender on students' mean achievement scores in Mathematics?

Table 2

Mean and standard deviation scores of male and female students in Mathematics

Gender		Pre-test		Post-test		Mean Gain Scores	Mean Gain Difference
	N	Mean	SD	Mean	SD		
Male	50	16.96	3.23	27.38	6.45	10.42	0.83
Female	70	17.04	3.48	28.29	6.81	11.25	

Table 3 indicates that male students achieved a pretest mean score (M = 16.96, SD = 3.23) and a posttest score of (M = 27.38, SD = 6.45). Conversely, female students recorded a pretest mean score (M = 17.04, SD = 3.48) and a posttest mean achievement score (M = 28.29, SD = 6.8). The findings show that the mean post-test achievement scores in mathematics increased for both male and female students. However, female students achieved marginally higher mean scores than their male counterparts, with a slight mean gain difference of 0.83 favoring the females.

8.3 Research question three

What is the interaction effect of instructional strategies and gender on the mean achievement scores of students in Mathematics?

Table 3

Mean and standard deviation of interaction effect of instructional strategies and gender on students' achievement in Mathematics

Groups	Gender	N	Mean	Std. Dev.
Experimental Group	Male	25	30.24	5.93
	Female	36	31.64	7.81
Control Group	Male	25	24.52	5.72
	Female	34	24.74	2.62

Result of the analysis in Table 3 revealed that male students exposed to experimental group had higher mean achievement scores of (M = 30.24, SD = 5.93) as against their male counterparts exposed to the control group that had mean achievement scores of (M = 24.52, SD = 5.72). On the other hand, female students exposed to the experimental group had higher mean achievement scores of (M = 31.64, SD = 7.81) while their female counterparts in the control group had mean achievement scores of (M = 24.74, SD = 2.62). The results do not suggest ordinal interaction effect between teaching strategies and gender on students' achievement in Mathematics. This is because, the achievement mean score of male students in both groups were higher than their counterpart.

8.4 Hypothesis one

There is no significant difference in the mean achievement scores of students taught Mathematics using Digital Videos instructional strategy and those taught using conventional lecture method.

Table 4

Summary of Analysis of covariance (ANCOVA) of students' achievement in Mathematics when exposed to digital video instructional strategy and conventional lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1269.530[a]	4	317.383	9.147	.000	.241
Intercept	3610.759	1	3610.759	104.057	.000	.475
PreAch	3.262	1	3.262	.094	.760	.001
Method	1161.957	1	1161.957	33.486	.000	.226
Gender	19.144	1	19.144	.552	.459	.005
Method * Gender	11.077	1	11.077	.319	.573	.003

Error	3990.462	115	34.700
Total	98725.000	120	
Corrected Total	5259.992	119	

The analysis's outcome, shown in Table 4, shows that the instructional strategy has a significant impact on students' performance in Mathematics; F (1, 115) = 33.486, P = .000. As a result, the null hypothesis, which claimed that there was no discernible difference between students who received mathematics instruction via digital video and those who received it via traditional lecture, was rejected. This is due to the obtained p-value (.000) being less than the set significance level of 0.05. Consequently, the researchers concluded that a significant difference exists between the mean achievement scores of students taught Mathematics with digital videos and those taught using the traditional lecture approach.

8.5 Hypothesis two

The mean achievement scores of male and female students in mathematics do not differ significantly.

The analysis presented in Table 4 was also used to test the second hypothesis, which showed that gender did not have a significant effect on students' Mathematics achievement; F (1, 115) = .552, P = .459. Since the exact probability level of.459 is higher than the level of significance set at 0.05, the null hypothesis—that there is no significant difference between the mean achievement scores of male and female students in mathematics—was accepted. The researchers therefore, conclude that there is no significant difference in the mean achievement scores of male and female students in Mathematics. Thus, the researchers draw the conclusion that there is no discernible difference between male and female students' mean achievement scores in mathematics.

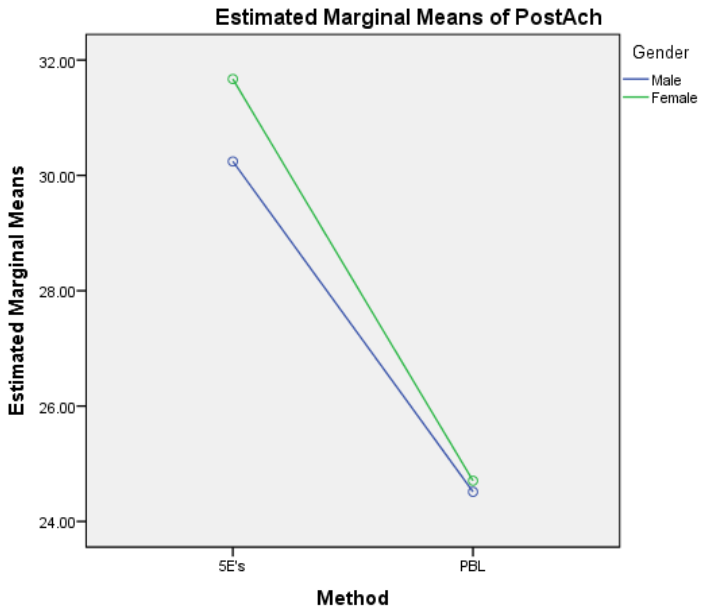
8.6 Hypothesis three

The interaction effect of teaching strategies and gender on the mean achievement scores of students in Mathematics is not significant.

The result of the analysis in Table 4 was also used to test hypothesis three. The Table shows that the exact probability value of .573 associated with teaching strategies and gender is greater than 0.05 level of significance; (F (1, 115) = .315, P = .573). Thus, the null hypothesis of no significant interaction effect of teaching strategies and gender on students' mean achievement scores in Mathematics was accepted. The researchers therefore, conclude that the interaction effect of teaching strategies and gender on students' achievement in Mathematics is not significant. The finding was further interpreted using the screen plot as shown in figure 1 below.

Figure 1

Interaction effect of teaching strategies and gender on students' mean achievement score in Mathematics.



The profile plot shows that there is no interaction effect of instructional strategies and gender on students' mean achievement scores in Mathematics. This is indicated by the separate lines for the male and female students' achievement in Mathematics in the respective instructional strategies.

9 DISCUSSION OF FINDINGS

9.1 Effect of digital video instructional strategy on students' academic achievement in Mathematics

The finding of this study revealed that digital video instructional strategy significantly enhanced secondary school students' academic achievement in Mathematics. This indicates that students who were taught Mathematics using digital video instructional strategy performed significantly better than those taught using conventional instructional approaches. The improvement in students' achievement may be attributed to the visual and auditory features of digital videos, which make abstract mathematical concepts easier to understand. Digital video lessons provide demonstrations, animations, and step-by-step explanations that enable students to visualize mathematical procedures and problem-solving processes, thereby enhancing comprehension and retention of concepts. The significant improvement observed in the study may also be linked to the interactive and learner-centred nature of digital video instruction. Digital videos allow learners to control the pace of their learning by pausing, replaying, or reviewing complex sections of the lesson. This flexibility enables students to revisit difficult concepts until they gain full understanding, which ultimately improves their academic performance. According to Richard E. Mayer (2009), multimedia learning environments that combine visual and verbal information enhance learners' understanding because they engage multiple cognitive processes involved in learning.

The finding of this study is in agreement with earlier studies which reported that multimedia and video-based instructional strategies improve students' academic achievement in Mathematics and science-related subjects. For instance, Ibrahim A. Abubakar and Suleiman A. Bada (2015) found that the use of video-based instruction significantly improved students' academic performance in Mathematics compared to traditional teaching methods. Similarly, Khadijeh Kayalar and Sevil Kayalar (2017) reported that video-supported instruction enhances students' understanding of difficult concepts and promotes better academic achievement. The study's finding also aligns with the result reported by Tyoor, Kyari, Dogo, Tyoor and Liman (2024) whose study revealed that video-based instructional strategy significantly enhanced students' achievement and

retention in Algebra. The finding of the study also agrees with the report of Norris and Coutas (2014) and Rashid and Asghar (2016) that technology enhanced students' achievement when used for instructional delivery. This result supports earlier studies (Osokoya, 2007; Tyoor, 2019), which similarly found that using video-based instructional strategies significantly boosts the achievement levels of students. This finding aligns with the results of Osokoya (2007), who examined the impact of video instruction on secondary school students' performance in History and found that digital video was effective in enhancing students' learning of the subject.

9.2 Gender influence on students' mean Mathematics achievement score

The finding of this study revealed that there was no statistically significant difference between male and female students' academic achievement in Mathematics. This implies that both male and female students performed almost equally when exposed to the same learning conditions. The result suggests that gender does not significantly influence students' ability to understand and perform in Mathematics when appropriate instructional strategies and learning opportunities are provided. The absence of a significant difference in achievement between male and female students may be attributed to equal access to learning resources, similar classroom experiences, and exposure to the same teaching methods. When instructional strategies are effectively implemented and learning environments are supportive, both male and female students tend to develop similar levels of understanding and competence in Mathematics. This indicates that students' academic success in Mathematics is more dependent on instructional quality, learning engagement, and availability of learning resources than on gender differences.

This finding is consistent with the view of Janet Shibley Hyde (2005), whose Gender Similarities Hypothesis suggests that males and females are similar on most psychological variables, including cognitive abilities related to academic performance. According to Hyde, gender differences in academic achievement are often minimal, especially when both groups have equal educational opportunities. This findings outcome is consistent with previous findings by Mbonu and Okoli (2019) as well as Abidoye (2015), which indicated that both male and female students perform comparably when taught through technology-assisted instructional approaches. The finding also supports

the findings of Adediran (2024) whose study revealed no significant major gender effects on the teaching skills of pre-educators. The study also align with the findings of Osokoya (2007) whose findings revealed no significant impact on student performance with video-taped instruction, indicating that this method is effective for learners regardless of gender. The results of this study are also consistent with those of Oludipe (2012), Arisi (2011), Ngban and Ibu (2009), Maliki, and Abdulrahman (2008), who found that gender had no significant effect on students' learning outcomes. However, the gender-related findings contradict those of Okonkwo (2012), who reported that science and technology are predominantly male-dominated fields, with females generally avoiding participation in these areas.

9.3 Interaction effect instructional strategies and gender on students' mean achievement score in Mathematics

The findings of the study revealed that the interaction effect of instructional strategies and gender on students' achievement in Mathematics was not statistically significant. This implies that the effectiveness of the instructional strategies used in the study did not depend on whether the students were male or female. In other words, both male and female students benefited similarly from the instructional strategies employed in the teaching of Mathematics. The result suggests that gender did not moderate the influence of the instructional strategies on students' academic achievement. The absence of a significant interaction effect indicates that the instructional strategies adopted in the study were equally effective for both male and female students. This may be attributed to the fact that well-designed instructional strategies often provide equal learning opportunities for all students regardless of gender. When teaching approaches are learner-centered, interactive, and engaging, they tend to address the diverse learning needs of students, thereby minimizing any gender-based differences in academic performance.

The finding is also consistent with the study by Sara M. Lindberg, Janet Shibley Hyde, and Marcia C. Linn (2008), which reported that male and female students tend to perform similarly in Mathematics when exposed to similar learning conditions and instructional support. Their study concluded that effective instructional approaches can reduce or eliminate gender disparities in mathematics achievement. The finding is also in

agreement with the finding of Abidoye (2015) and Joseph, John, Eric, Yusuf, and Olubunmi (2015) whose study found no significant gender differences in achievement when students were taught using computer-assisted or video-based instructional methods. Similarly, Dani (2014) observed that technological tools in teaching physics did not produce varying effects based on gender, suggesting that technology-enhanced strategies can be applied effectively across different student demographics.

10 CONCLUSIONS

The study concludes that integrating digital video instructional strategy into Mathematics teaching served as an effective approach for improving students' academic achievement while promoting gender equity in the classroom. Therefore, teachers are encouraged to incorporate digital video instructional materials into their instructional practices to enhance students' engagement, understanding, and overall academic performance in Mathematics. Based on the findings and conclusions, the study recommends that;

1. Teachers should incorporate digital video materials into their math instruction to boost student achievement, with benefits observed equally across both genders;
2. For mathematics teachers, the Ministry of Education and associated science education stakeholders should routinely host workshops and in-service training aimed at creating and successfully utilizing digital video instructional packages to teach difficult mathematical concepts;
3. The government should ensure reliable internet access to support the adoption of technology-assisted teaching and intervention strategies;
4. Mathematics teachers and students should be encouraged to adopt digital video instructional package as a learning tool for teaching Mathematics topics, as this can enhance the effectiveness of Mathematics learning;
5. Curriculum planners and developers should integrate video-based instructional strategies directly into the secondary school Mathematics curriculum.

10.1 Implication for educational evaluators

There are several key implications for educational evaluators based on the findings of the study;

Shift in Evaluation Focus: Evaluators might need to expand their assessment frameworks to incorporate technology-supported teaching approaches. Conventional evaluation models that focus primarily on textbook use and lecture methods may no longer be adequate. As a result, evaluators should design or modify assessment tools to effectively measure the impact of digital video-based instruction, considering factors such as student engagement, understanding, knowledge retention, and the practicality of the instructional materials.

Data-Driven Decision Making: The study offers evidence that can assist evaluators in making informed recommendations regarding educational policies and curriculum development. Its findings can support the case for expanding the use of digital video in Mathematics teaching.

Develop Robust Evaluation Frameworks and Rubrics: Evaluators should develop well-defined and organized rubrics that assess both student learning outcomes and the quality of instructional videos. These rubrics should address aspects such as student engagement, accessibility, alignment with learning goals, and level of interactivity. Such tools help maintain consistency, transparency, and objectivity in evaluation across different evaluators and educational institutions.

Incorporate Learning Analytics and Real-Time Data: Digital videos can generate valuable learner data, including viewing duration, engagement levels, and quiz results. Evaluators should utilize these analytics to monitor usage trends and link them to student performance improvements. This approach enables data-informed evaluations of instructional effectiveness and highlights areas that may require enhancement.

The finding also implies that technology-supported instructional approaches can serve as reliable indicators of effective teaching and learning processes. Consequently, educational evaluators need to consider the integration and utilization of instructional technologies, such as digital video resources, as part of the criteria for evaluating instructional quality and programme effectiveness. This highlights the importance of

including technology-based instructional practices as components in the evaluation of curriculum implementation and classroom instruction.

10.2 Implication for curriculum specialist

Integration of Multimedia in Curriculum Design: Since digital video instructional strategy proves effective, curriculum specialists should consider integrating multimedia components; such as animations, tutorials, and simulations into the official Mathematics curriculum. This is video contents help explain abstract mathematical concepts visually and interactively, enhancing understanding and retention.

Support for Flipped and Blended Learning Models: Curriculum specialists should encourage the design of blended learning models (combining digital and face-to-face instruction) and flipped classrooms. This is because; the strategy increases student autonomy, supports differentiated learning, and maximizes classroom interaction time.

Champion Digital Skill Development in Educator Training: Effective curriculum design requires teacher competence in video selection, creation, and integration; curriculum planners should embed Technological Pedagogical Content Knowledge (TPACK) development; such as video scripting, slide design, and self-review into professional development streams

Need for Teacher Training and Curriculum Guides: Curriculum documents should be accompanied by guides for teachers on how to effectively use digital video strategies in instruction. Therefore, teachers must be prepared not only to deliver content, but also to select, adapt, and produce quality video materials aligned with curriculum goals.

AUTHORS' CONTRIBUTION

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Francis Elochukwu Ikeh; Mercy Ngozi Nwoye, Smart Ebinga Obem and Foluke Bosede Eze: Conceptualization, Methodology, Supervision, Project administration, writing and editing.

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Kenneth Chikwendu Ugwu; Ifeyinwa Awele Nji and Ibem Ukpai Ogele: Literature review, Instrument development, Writing – original draft preparation.

Nonyem Ifediora Okeke, Blessing Anapua and Ifeyinwa Awele Nji: Investigation, Data collection, Data organization, Writing – review & editing.

Francis Elochukwu Ikeh; Smart Ebinga Obem: Formal analysis, Software, Data analysis, Visualization of results, Interpretation of data

Kenneth Chikwendu Ugwu; Ibem Ukpai Ogele; Blessing Anapua and Ifeyinwa Awele Nji: Manuscript formatting, Technical editing.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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