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BIOLOGY TEACHERS' PERCEPTIONS AND ATTITUDES TOWARDS INTEGRATION OF VIDEO-BASED LEARNING IN BIOLOGY CLASSROOMS IN ZARIA, KADUNA STATE

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ABSTRACT

The study focused on Assessing Biology Teachers Perceptions and Attitudes towards the fusion of Video-based knowledge acquisition in Biology classrooms in Zaria, Kaduna State. Four research objectives, four research inquiries and four null hypotheses guided the study. The literature in the study was organized under the following subheading-: Concept of Video-Based Learning, Theoretical Framework, Importance of TAM to the Present Study, Recent Developments and Relevance, Teachers' Perceptions of Video-Based Learning, Attitudes of Teachers Toward Technology Integration, Challenges of Integrating Video-Based Learning in Biology Classrooms, Importance of Video-Based Learning in Biology Education and Review of Empirical Studies, Quantitative research was adopted for the investigation. The sample for the study comprised of forty-six (46) biology teachers selective sampling. The instruments for data collection in this study was a questionnaire, titled "Teachers' Perceptions, Attitudes, and Issues related Video-Based Learning Questionnaire (TPACVLQ)", and analyzed using average value and variability. The findings showed that Biology teachers in Zaria, Kaduna State, possess a significantly high level of awareness and familiarity with video-based learning (P=0.01<0.05), Biology teachers in Zaria, Kaduna State, perceive video-based learning as significantly effective in enhancing students' understanding of Biology concepts (P=0.01<0.05), Biology teachers in Zaria, Kaduna State, exhibit a significantly positive attitude toward the integration of video-based learning into Biology instruction (P=0.01<0.05) and there are indeed significant challenges hindering the potent adoption of video-assisted instruction Biology classrooms in Zaria, Kaduna State (P=0.01<0.05). The researchers recommends that Government and educational stakeholders should spend in infrastructural development by improving electricity supply and internet connectivity in secondary schools, particularly in underserved areas like Zaria, among others.

Introduction

Education serves as the cornerstone for societal advancement, with science education playing a pivotal role in fostering innovation and critical thinking. Recent initiatives underscore the global emphasis on strengthening science curricula. For instance, China's Ministry of Education has mandated primary and secondary schools to enhance science education, aiming to bolster scientific

and technological innovation (Reuters, 2025). Similarly, the 2023 Trends in International Mathematics and Science Study (TIMSS) highlighted that while Australian students achieved their highest mathematics scores to date, significant disparities persist, particularly among socioeconomically disadvantaged groups (Wernert, 2024). These developments emphasised the critical need for robust science education frameworks to equip students with the skills necessary to navigate and contribute to an increasingly complex world. Innovative approaches to science education have demonstrated significant benefits, particularly for underserved students. Prioritizing hands-on science education provides these students with equitable opportunities for achievement and long-term success (National Math and Science Initiative, 2024). Additionally, integrating creative activities and encouraging inquiry have been shown to enhance students' interest and self-perception in science, suggesting that incorporating creativity and opportunities to ask questions can be just as important as doing experiments for generating interest in and a sense of participating in science (Finn et al., 2023). These strategies not only deepen understanding but also foster essential skills, contributing to a more inclusive and effective science education landscape.

Biology, as a core science subject, plays a vital role in fostering students' understanding of life processes, ecological interactions, and the principles governing living organisms. It is fundamental in preparing students for careers in medicine, biotechnology, environmental science, and other science-related fields. However, traditional methods of teaching Biology, which often rely heavily on textbooks, teacher-centered instruction, and rote memorization, have been criticized for their inability to stimulate students' interest and enhance conceptual understanding (Adebayo & Yusuf, 2021). With the advancement of digital learning tools, educators have begun exploring innovative instructional strategies to improve students' learning experiences. One such strategy is video-based learning, which involves the use of multimedia resources, such as educational videos, animations, simulations, and recorded lectures, to improve teaching and learning. Multimedia learning is particularly useful in Biology classrooms, as it allows students to visualize abstract concepts, observe biological processes in real-time, and engage with content in an interactive manner (Eze & Nnamdi, 2022).

The fusion of video-based learning in Biology learning spaces offers numerous educational benefits, including strengthening real-world applications and increased comprehension of complex concepts. However, the successful adoption of this instructional approach is heavily influenced by teachers' perceptions and attitudes toward its effectiveness (Ogundipe & Ogunleye, 2020). Factors such as technological proficiency, perceived usefulness, availability of resources, and institutional support play pivotal roles in shaping educators' willingness to embrace online

video learning. For instance, a study examining teachers' perceptions of using videos for teaching and learning found that educators recognize the potential of instructional videos to enrich the learning experience but often face challenges related to resource availability and institutional backing (Gambari et al., 2014).

In regions like Zaria Local Government Area, Kaduna State, where traditional teaching methods remain prevalent, assessing Biology teachers' attitudes toward screen-based learning is essential. Understanding their perspectives can shed light on the challenges and opportunities associated with integrating this innovative approach into the instructional areas. Researches (Adesoji & Adesoji, 2022; Ogundipe & Ogunleye, 2020) indicates that teachers' adoption of technology in Biology education is often hindered by factors such as limited access to necessary technological tools, insufficient training, and a lack of institutional support. Review focusing on the role of technology in Nigerian secondary schools highlighted that while educators acknowledge the benefits of ICT in enhancing Biology instruction, the absence of adequate resources and support structures poses significant barriers to effective implementation (Ogundipe & Ogunleye, 2020). Moreover, teachers' technological proficiency significantly impacts their readiness to incorporate video-mediated instruction into their teaching practices. Educators who are more comfortable and skilled with technology are more likely to perceive video-enhanced instruction as beneficial and are thus more inclined to integrate it into their schoolrooms. Conversely, those with limited technological skills may feel apprehensive about adopting such methods, fearing potential challenges in implementation. Study on factors affecting the use of ICT in teaching Biology in senior secondary schools found that teachers' confidence and competence in using technology were critical determinants of their willingness to adopt innovative instructional strategies.

Institutional support also plays a crucial role in facilitating the adoption of online video learning. Schools that provide adequate resources, such as access to multimedia equipment and reliable internet connectivity, create an environment conducive to the integration of video-based instruction. Additionally, professional development opportunities that enhance teachers' technological skills and pedagogical strategies can further encourage the use of video-based learning. Without such support, even teachers who recognize the value of video-mediated instruction may struggle to implement it effectively (Ogundipe & Ogunleye, 2020). Research suggests that institutional barriers, including insufficient infrastructure and lack of administrative encouragement, significantly impede the adoption of technology-enhanced teaching methods in Biology education (Gambari et al., 2014). While video-based learning holds promise for enriching Biology education, its successful integration depends on a complex interplay of factors influencing teachers' perceptions and attitudes. Promoting a favourable attitude among educators towards

video-based instruction requires addressing issues with technology competence, resource accessibility, and institutional support. Educational stakeholders can create plans to successfully incorporate video-based learning into biology classes and raise the standard of science instruction overall by comprehending and addressing these factors.

Statement of the Problem

The teaching of Biology in many secondary schools in Zaria Local Government Area, Kaduna State, is often characterized by limited instructional resources, traditional lecture-based methods, and minimal student engagement in practical activities. As a result, students find it difficult to grasp complex biological concepts, leading to low student success and a declining interest in Biology (Nwankwo & Okafor, 2020).

While video-based learning has been recognized globally as an effective pedagogical tool that enhances students' understanding and retention of scientific concepts, its adoption in Nigerian secondary schools remains relatively low. Several factors may contribute to this, including teachers' attitudes toward technology, lack of access to digital resources, poor infrastructure, and insufficient training on the use of multimedia tools (Akinwale & Nwachukwu, 2021). However, there is limited research on how Biology teachers in Zaria Local Government Area perceive video-based learning and their readiness to integrate it into their trainingrooms. This study seeks to assess the perceptions and attitudes of Biology teachers toward video-based learning, identify the barriers to its integration, and explore possible strategies for promoting its adoption in secondary schools within Zaria Local Government Area, Kaduna State.

Objectives of the Study

The main objective of this study is to assess Biology teachers' perceptions and attitudes toward the integration of video-based learning in Biology training rooms in Zaria Local Government Area, Kaduna State. Specifically, the study seeks to:

1. Examine Biology teachers' awareness and familiarity with video-based learning.
2. Assess their perceptions regarding the effectiveness of video-based learning in teaching Biology.
3. Investigate the attitudes of Biology teachers toward the adoption of video-based learning.
4. Identify the challenges that hinder the integration of video-based learning in Biology classrooms.

Research Questions

This study is guided by the following research questions:

1. What is the level of awareness and familiarity of Biology teachers with video-based learning?
2. How do Biology teachers perceive the effectiveness of video-based learning in improving students' understanding of Biology?
3. What are the attitudes of Biology teachers toward the integration of

video-based learning in Biology instruction?

4. What challenges hinder the adoption of video-based learning in Biology classrooms in Zaria, Kaduna State?

Research Hypotheses

$H0_1$: There is no significant level of awareness and familiarity with video-based learning among Biology teachers in Zaria, Kaduna State.

$H0_2$: Biology teachers do not perceive video-based learning as significantly effective in improving students' understanding of Biology.

$H0_3$: Biology teachers do not exhibit a significantly positive attitude toward the integration of video-based learning in Biology instruction.

$H0_4$: There are no significant challenges hindering the adoption of video-based learning in Biology classrooms in Zaria, Kaduna State.

Methodology

The research employed a descriptive survey design to assess Biology teachers' perceptions and attitudes toward video-based learning. This design allowed for the collection of data from a large sample, providing a comprehensive overview of teachers' views and experiences. It helped to identify trends and patterns in how teachers perceived the fusion of video-enhanced learning into their teaching practices. The respondents include Biology subject specialist located in Zaria, Kaduna State, with a total of forty-six (46) teachers. In this study, the entire population was used as the sample size. This approach, known as a census survey, was appropriate because the population was small and accessible, ensuring comprehensive data collection without the risk of sampling bias (Creswell, 2014). Using the whole population eliminated errors associated with sampling techniques and provided a complete representation of the study group. According to Saunders, Lewis, and Thornhill (2019), using a full population sample is particularly beneficial when the study aims for in-depth analysis and precise conclusions applicable to the entire group. Therefore, this study adopted a census approach to ensure the accuracy and generalizability of the results. A structured instrument was utilised to collect data on teachers' perceptions, attitudes, and challenges regarding video-based learning. The instrument was titled "Teachers' Perceptions, Attitudes, and Challenges regarding Video-Based Learning Questionnaire (TPACVLQ)." It was a 33-item questionnaire designed utilising a five-point Likert scale, comprising Strongly Agree (SA), Agree (A), Undecided (UN), Disagree (D), and Strongly Disagree (SD). The questionnaire was divided into two sections. Section A captured the bio-data of the respondents, while Section B contained items assessing the level of understanding of Biology teachers with video-based learning. Section C focused on the perception of the effectiveness of video-based learning in improving students' understanding of Biology. Section D addressed the attitudes of Biology teachers toward the integration of video-based learning in Biology instruction, and Section E explored the challenges

hindering the adoption of video-based learning in Biology classrooms in Zaria, Kaduna State. The questionnaire was certified by the project supervisor and two (2) other experienced science educators from the Biology Department, Federal University of Education, Zaria. All corrections and observations were implemented on the instrument before it was administered to the respondents. The researchers obtained a letter of introduction from the department of biology to the Ministry of Education, Science and Technology, Zaria Zone, Kaduna State, seeking permission to visit various schools in the study area and administer the questionnaire to the respondents. The questionnaire was personally distributed by the researchers in the selected schools. Ten (10) minutes were given to respondents to complete the questionnaire, and it was collected on the spot to ensure a higher response rate. Respondents were assured of confidentiality, and the entire data collection process took a minimum of two (2) weeks. The data collected from the field were analyzed by utilizing summary statistics such as frequencies, simple percentages, average**,** dispersion**,** and t-test. These statistical tools helped to summarize and interpret the data effectively.

Results

Answering Research Questions

Research Question One: What is the level of awareness and familiarity of Biology teachers with video-based learning?

Table 1: Level of Awareness and Familiarity of Biology Teachers with Online Video-Learning

S/N	ITEMS	SA	A	UN	D	SD	X	S.D	Remark
1	I am familiar with video-based learning as an instructional tool in Biology.	18	28	0	0	0	4.39	0.49	Accepted
2	I have received training on how to use video-based learning in Biology lessons.	16	30	0	0	0	4.35	0.48	Accepted
3	I regularly explore new video-based learning resources for my biology classes.	10	36	0	0	0	4.22	0.42	Accepted
4	I am confident in integrating video-based learning into my teaching methods.	32	14	0	0	0	4.70	0.46	Accepted
5	My school provides access to video-mediated instruction tools and platforms.	30	16	0	0	0	4.65	0.48	Accepted
6	I believe digital video education can enhance the teaching and learning of Biology.	40	6	0	0	0	4.87	0.34	Accepted
7	I have used video-based learning materials in my classroom in the past year.	20	26	0	0	0	4.43	0.50	Accepted

8	I know how **to evaluate** the outcome of digital video education materials in Biology instruction	25	21	0	0	0	4.54	0.50	Accepted
9	I collaborate with colleagues to share and develop video-based learning strategies for Biology lessons	26	10	0	10	0	3.91	1.41	Accepted
10	I face challenges in using video-based learning due to technical or infrastructure limitations	30	16	0	0	0	4.65	0.48	Accepted
	Cumulative Mean						4.47	0.56	Accepted

Benchmark: Mean ≥3.0 = Accepted; Mean < 3.0= Rejected

The results presented in Table 4.2 indicate that Biology teachers exhibit a high level of awareness and familiarity with video-based learning as an instructional tool. All items in the table recorded mean scores above the benchmark of 3.0, with a cumulative mean of 4.47, signifying overall agreement with the positive statements about video-based learning. Notably, teachers strongly believed in the efficiency of multimedia learning to enhance Biology teaching and learning ($\bar{X}$ = 4.87), and expressed confidence in integrating it into their teaching methods ($\bar{X}$ = 4.70). The standard deviations were generally low, with an average of 0.56, indicating consistency in responses, except for item 9 which had a higher standard deviation (1.41), reflecting varied opinions about collaboration with colleagues. Additionally, while respondents acknowledged challenges related to infrastructure ($\bar{X}$ = 4.65), they still showed active engagement, such as using the tools ($\bar{X}$ = 4.43) and evaluating their effectiveness ($\bar{X}$ = 4.54). These findings suggest that Biology teachers not only recognize the value of video-based learning but are also adequately prepared and willing to implement it in their classrooms.

Research Question Two: How do Biology teachers perceive the effectiveness of digital video education in improving students' understanding of Biology?

Table 2: Perception of the Effectiveness of Video-Based Learning in Improving Students' Understanding of Biology

S/N	ITEMS	SA	A	UN	D	SD	X	S.D	Remark
1	Video-based learning simplifies complex Biology concepts for students.	10	6	20	10	0	3.00	1.00	Accepted
2	Using videos in Biology classes increases students' interest in learning.	20	26	0	0	0	4.43	0.50	Accepted
3	Video-based learning is more effective than traditional textbook-based teaching.	20	26	0	0	0	4.43	0.50	Accepted
4	Visual demonstrations in videos help students understand abstract biological processes.	30	16	0	0	0	4.65	0.48	Accepted
5	Video-based learning enhances students' retention and recall of Biology concepts.	16	20	10	0	0	4.13	0.72	Accepted
6	Students perform better in assessments when video-based learning is used.	20	26	0	0	0	4.43	0.50	Accepted
7	Video-based learning can effectively replace practical laboratory experiments.	20	26	0	0	0	4.43	0.50	Accepted
8	Video-based learning helps cater to different learning styles, such as visual and auditory learners.	20	16	10	0	0	4.22	0.76	Accepted
9	Students are more likely to participate in class discussions after watching educational Biology videos	36	10	0	0	0	4.78	0.42	Accepted
10	Video-based learning encourages independent learning and self-paced study among students	30	16	0	0	0	4.65	0.48	Accepted
	Cumulative Mean						4.32	0.59	Accepted

Benchmark: Mean ≥3.0 = Accepted; Mean < 3.0= Rejected

The data in Table 4.3 show that Biology teachers perceive video-based learning as an effective tool for improving students' understanding of Biology concepts. All items recorded mean scores above the benchmark of 3.0, with a cumulative mean of 4.32, indicating a strong overall agreement. Teachers overwhelmingly agreed that video-based learning increases students' interest ($\bar{X}$ = 4.43), helps with understanding abstract processes ($\bar{X}$ = 4.65), and promotes class participation ($\bar{X}$ = 4.78). The item with the lowest mean ($\bar{X}$ = 3.00) indicated some mixed views on whether video-based learning simplifies complex concepts, suggesting that this benefit might vary depending on the

topic or implementation. The average standard deviation of 0.59 reflects moderate consistency in responses, with most responses tightly clustered around the mean. Overall, these findings suggest that teachers acknowledge the educational value of video-based learning in enhancing interactive learning, comprehension, and education attainment in Biology.

Research Question Three: What are the attitudes of Biology teachers toward the integration of video-mediated instruction in Biology instruction?

Table 3: Attitudes of Biology Teachers Toward the Integration of Video-Based Learning in Biology Instruction

S/N	ITEMS	SA	A	UN	D	SD	X	S. D	Remark
1	I find video-based learning to be an innovative teaching strategy.	20	26	0	0	0	4.43	0.50	Accepted
2	I believe that traditional teaching methods are better than video-based learning.	10	10	10	16	0	2.87	1.25	Rejected
3	I feel motivated to use video-based learning if given proper training.	30	16	0	0	0	4.65	0.48	Accepted
4	I think video-based learning should be included in the biology curriculum.	30	16	0	0	0	4.65	0.48	Accepted
5	I enjoy using video-based learning tools when teaching Biology.	35	11	0	0	0	4.76	0.43	Accepted
6	I am willing to integrate video-based learning into my biology lessons.	30	16	0	0	0	4.65	0.48	Accepted
7	I feel confident in recommending video-based learning to my colleagues.	30	16	0	0	0	4.65	0.48	Accepted
8	I believe video-based learning can make Biology lessons more engaging for students	20	16	0	10	0	4.00	1.00	Accepted
9	I think video-based learning helps improve students' understanding of complex Biology concepts.	35	10	0	1	0	4.65	0.60	Accepted
10	I prefer using a combination of traditional and video-based learning methods for effective teaching.	30	16	0	0	0	4.65	0.48	Accepted
	Cumulative Mean						4.27	0.68	Accepted

Benchmark: Mean ≥3.0 = Accepted; Mean < 3.0= Rejected

The results in Table 4.4 reveal that Biology teachers generally hold a positive attitude toward integrating video-based learning into their instructional practices. With a cumulative mean of 4.27, all items were accepted except one (Item 2), which had a mean score of 2.87, indicating disagreement with the idea that traditional methods are superior to video-based learning. The highest mean score ($\bar{X}$ = 4.76) was recorded for the statement, "I enjoy using video-based learning tools when teaching Biology," demonstrating strong enthusiasm among teachers for this method. Other highly rated items include motivation with training, curriculum inclusion, and willingness to recommend the approach. The average standard deviation of 0.68 shows moderate variability in responses, especially on items where personal preference and exposure to technology may differ. Overall, these findings suggest that Biology teachers are open, confident, and willing to adopt video-based learning, recognizing its potential to enhance student engagement and understanding when properly supported and blended with traditional teaching methods.

Research Question Four: What challenges hinder the adoption of video-assisted instruction in Biology teaching environments in Zaria, Kaduna State?

Table 4: Challenges Hindering the Adoption of Screen-Based Learning in Biology Classrooms in Zaria, Kaduna State

S/N	ITEMS	SA	A	UN	D	SD	X	S. D	Remark
1	Lack of access to reliable electricity hinders the use of video-based learning.	35	11	0	0	0	4.76	0.43	Accepted
2	Poor internet connectivity affects the availability of video-based resources.	25	21	0	0	0	4.43	0.50	Accepted
3	Insufficient funding prevents schools from acquiring video-based learning tools.	30	16	0	0	0	4.65	0.48	Accepted
4	Many Biology teachers lack the necessary training to use video-mediated instruction effectively.	16	30	0	0	0	4.35	0.48	Accepted
5	Limited availability of video content relevant to the Biology syllabus is a challenge.	17	20	0	9	0	3.76	1.06	Accepted
6	School policies do not actively support the integration of video-based learning	20	19	0	9	0	3.85	1.00	Accepted
7	Technical issues, such as malfunctioning projectors and software, discourage the use of video-based learning.	35	11	0	0	0	4.76	0.43	Accepted

8	Overcrowded classrooms make it difficult to implement video-based learning effectively	20	26	0	0	0	4.43	0.50	Accepted
9	Lack of administrative support discourages the adoption of video-based learning in Biology lessons.	20	26	0	0	0	4.43	0.50	Accepted
10	Students' limited digital literacy affects their ability to engage with video-based learning materials.	30	16	0	0	0	4.65	0.48	Accepted
	Cumulative Mean						4.35	0.69	Accepted

Benchmark: Mean ≥3.0 = Accepted; Mean < 3.0= Rejected

Hypothesis Testing

Hypothesis One: There is no significant level of awareness and familiarity with online video learning among Biology teachers in Zaria, Kaduna State.

Table 5: One-Sample t-Test Summary for Biology Teachers' Awareness and Familiarity with Video-Based Learning

Variable	N	$\bar{X}$	SD	SE	t-cal	df	p-value	95% CI	Decision
Awareness and Familiarity with Video-Based Learning	46	4.47	0.56	0.083	17.78	45	0.001	(1.30, 1.64)	Sig.

The single-sample t-test conducted to test hypothesis One reveals that the mean score for Biology teachers' awareness and familiarity with video-based learning (M = 4.47) is significantly higher than the neutral test value of 3.0. The calculated t-value is 17.78, with a p-value less than 0.001. Additionally, the 95% margin of error for the mean difference ranges from 1.30 to 1.64, clearly excluding zero. Since the t-calculated exceeds the critical t-value of ±2.014 and the p-value is well below the 0.05 threshold, the null hypothesis (H_{01}) is rejected. This indicates that Biology teachers in Zaria, Kaduna State, possess a significantly high level of awareness and familiarity with video-enhanced learning**.**

Hypothesis Two: Biology teachers do not perceive video-based learning as significantly effective in improving students' understanding of Biology.

Table 4.7: One-group t-Test Summary for Biology Teachers' Perception of the Effectiveness of Video-Based Learning

Variable	N	X̄	SD	SE	t-cal	df	p-value	95% CI	Decision
Perceived Effectiveness of Video-Based Learning	46	4.32	0.59	0.087	15.17	45	0.001	(1.14, 1.50)	Sig.

The single-sample t-test result for hypothesis Two indicates that the mean perception score of Biology teachers (M = 4.32) is significantly higher than the neutral benchmark of 3.0. The calculated t-value is 15.17 with a p-value less than 0.001, and the 95% confidence interval (1.14 to 1.50) does not include zero, confirming statistical significance. Given that the t-calculated exceeds the critical value of ±2.014 and the p-value is well below the 0.05 level, the null hypothesis (H_{02}) is rejected. This implies that Biology teachers in Zaria, Kaduna State, perceive video-based learning as significantly effective in enhancing students' understanding of Biology concepts.

Hypothesis Three: Biology teachers do not exhibit a significantly positive attitude toward the integration of video-based learning in Biology instruction.

Table 6: Single-Sample t-Test Summary for Biology Teachers' Attitudes Toward *Integration of Video-enhanced Learning*

Variable	N	X̄	SD	SE	t-cal	df	p-value	95% CI	Decision
Attitudes Toward Integration of Video-Based Learning	46	4.27	0.68	0.100	12.70	45	0.001	(1.07, 1.53)	Sig.

The findings of the one-group t-test for Hypothesis Three shows that the sample mean of 4.27 is significantly higher than the test value of 3.0 (neutral point), with a calculated t-value of 12.70 and a p-value less than 0.001. The 95% margin error for the mean difference ranges from 1.07 to 1.53, confirming that the difference is statistically important. Since the calculated t-value exceeds the critical t-value (±2.014) and the p-value is below the 0.05 significance level, the null hypothesis (H_{03}) is rejected. This indicates that Biology teachers in Zaria, Kaduna State, exhibit a significantly positive attitude toward the integration of video-mediated learning into Biology instruction.

Hypothesis Four: There are no significant challenges hindering the adoption of video-based learning in Biology classrooms in Zaria, Kaduna State.

Table 4.9: One-group t-Test Summary for Challenges Hindering the Adoption of Video-Based Learning

Variable	N	X̄	SD	SE	t-cal	df	p-value	95% CI	Decision
Challenges Hindering Adoption of Video-Based Learning	46	4.35	0.69	0.102	13.24	45	0.001	(1.14, 1.56)	Sig.

The findings of the single-sample t-test for Hypothesis Four shows that the sample mean score of 4.35 for challenges hindering the adoption of video-based learning is significantly higher than the test value of 3.0, which represents the neutral point on the 5-point Likert scale. The calculated t-value of 13.24 is greater than the critical t-value (±2.014), and the p-value is less than 0.001, indicating a statistically significant difference at the 0.05 level. The 95% confidence interval for the mean difference ranges from 1.14 to 1.56, which does not include zero. Based on this result, the null hypothesis (H_{04}) is rejected. This suggests that there are indeed important challenges hindering the effective adoption of online video learning in Biology classrooms in Zaria, Kaduna State. These challenges may include inadequate infrastructure, limited digital literacy, insufficient teacher training, or lack of technical support.

Discussion of Findings

The findings reveal that Biology teachers in Zaria, Kaduna State, possess a significantly high level of awareness and familiarity with video-based learning (P=0.01<0.05). This aligns with global trends highlighting increased exposure of educators to digital technologies in teaching. Mata and Stoica (2019) observed a similarly positive orientation among both pre-service and in-service Biology teachers towards internet-based educational tools, indicating a growing acknowledgement of technology's value in pedagogy. This growing familiarity among Zaria teachers likely stems from increased exposure to ICT and a recognition of the pedagogical utility of multimedia resources such as instructional videos. Ghavifekr and Rosdy (2015) supported this view, emphasising that teacher preparedness and access to digital tools are foundational to successful technology integration. Oladipo and Ajayi (2021) similarly noted that Nigerian Biology teachers were generally aware of video-based learning, although infrastructural limitations often hinder its practical application.

In addition to awareness, Biology teachers in Zaria, Kaduna State, perceive video-based learning as significantly effective in enhancing students' understanding of Biology concepts (P=0.01<0.05). This perception is consistent with findings from various studies emphasising the pedagogical strengths of video instruction, especially in science subjects that involve abstract and complex content. Kassa et al. (2024) reported that multimedia-based teaching significantly enhanced student achievement in Biology

topics such as respiration and photosynthesis by simplifying difficult concepts and promoting learner engagement. Adeyemi and Sulaimon (2019) also found that videos were instrumental in helping students understand abstract topics like cellular respiration. Brown and Ellis (2021) highlighted the ability of videos to increase student attention through visual and auditory clarity, while O'Connor and Dwyer (2020) emphasised their role in sustaining interest and improving comprehension.

The findings further show that Biology teachers in Zaria, Kaduna State, exhibit a significantly positive attitude toward the integration of video-based learning into Biology instruction (P=0.01<0.05). This positive disposition is critical for the successful adoption of educational technologies. Mata and Stoica (2019) found that favourable teacher attitudes toward internet-based tools enhance the likelihood of integration into classroom practices. Similarly, Oladipo and Ajayi (2021) and Kim and Park (2020) documented teacher enthusiasm for using video resources, citing their instructional effectiveness despite limitations in infrastructure and training. Brown and Ellis (2021) reinforced the idea that teacher motivation often leads to proactive efforts to incorporate videos in lessons. Alenezi and Khan (2021) also acknowledged motivation as a key driver while stressing the need for systemic support to ensure sustainability.

Nonetheless, there are indeed significant challenges hindering the efficient adoption of video-based learning in Biology classrooms in Zaria, Kaduna State (P=0.01<0.05). The study identified unreliable electricity supply, limited internet access, scarcity of fund, and shortage of teacher training as major barriers, findings that resonate with wider literature on ICT unification in education**.** Oladipo and Ajayi (2021) highlighted similar challenges in Nigerian schools, especially the lack of infrastructure and professional development. Kim and Park (2020) reported that poor internet connectivity and insufficient digital skills limited effective ICT use in South Korea, while Sulaimon and Ibrahim (2020) observed comparable issues in Abuja. Alenezi and Khan (2021) noted that technological limitations and institutional resistance often obstruct digital innovation, advocating for targeted capacity-building interventions. Raza and Rauf (2020) and Dube and Ngwenya (2018) also pointed to inadequate digital infrastructure as a major constraint. Ghavifekr and Rosdy (2015) emphasised the importance of strategic teacher training, while Atkin and Davis (2020) and Murphy and Johnson (2020) called for institutional support, including access to curriculum-aligned video resources and technical tools, to overcome these barriers.

Conclusion

This study has shown that Biology teachers in Zaria possess a high level of awareness and familiarity with video-based learning, viewing it as a valuable instructional strategy for enhancing student understanding and engagement. The positive attitudes and motivation expressed by these teachers

reflect a broader shift in education toward integrating digital tools into classroom practice. Teachers recognize the benefits of video resources in simplifying complex biological concepts and maintaining learner interest, especially in areas that traditionally pose challenges to student comprehension. However, despite these favorable perceptions, several challenges impede the full integration of video digital education in secondary schools. Key barriers such as poor electricity supply, limited internet access, lack of funding, and inadequate teacher training continue to restrict the effective use of video tools in Biology instruction. While teachers are willing and ready to adopt such innovative approaches, these infrastructural and systemic limitations must be addressed to ensure successful implementation and sustainability of digital instructional methods.

Recommendations

Based on the findings, suggestions were proposed by the researchers:

1. Government and educational stakeholders should allocate more in infrastructural development by improving electricity supply and internet connectivity in secondary schools, particularly in underserved areas like Zaria.
2. Regular professional development should be designed for Biology teachers to enhance their digital literacy and pedagogical skills in using video-based instructional materials.
3. Schools should be provided with adequate funding and access to educational technology resources, including curriculum-aligned video content, projectors, and ICT facilities.
4. Education policymakers should develop and implement clear ICT integration frameworks that guide schools on how to effectively adopt and sustain video-based learning.

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