

Secondary Schools Teachers' Attitude Towards Using Multimedia in Science Instruction in Sokoto Metropolis

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Abstract

This study examined secondary school science teachers' attitudes towards the use of multimedia in science instruction in Sokoto metropolis, Nigeria. A descriptive survey research design was adopted. The target population comprised 280 science teachers, from which 162 were sampled using the Krejcie and Morgan table. Simple random sampling was employed. Data were collected using the Secondary Schools Teachers' Attitude Towards Using Multimedia in Science Instruction Questionnaire (SSTAMSIQ), structured across three sections: teachers' attitudes, frequency of multimedia use, and challenges. Face and content validity were established through expert review. The instrument was pilot-tested on 30 teachers from a non-participating school prior to final administration. Cronbach's Alpha reliability coefficient was 0.82. Data were analysed using mean and standard deviation. Findings revealed that teachers held a positive attitude towards multimedia use (grand mean = 3.42, SD = 0.71). The frequency of multimedia use was moderate (grand mean = 2.72, SD = 0.92). Teachers faced significant challenges including poor internet access, inadequate ICT infrastructure, insufficient training, and technical difficulties (grand mean = 3.38, SD = 0.70). The study concludes that despite positive attitudinal disposition, effective multimedia integration is constrained by structural and capacity barriers. Strengthening ICT infrastructure, providing regular training, and improving institutional support are recommended.

Keywords: Multimedia; science instruction; teachers' attitude; ICT integration; secondary schools

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Introduction

The integration of Information and Communication Technology (ICT) into education has fundamentally reshaped contemporary pedagogical practices globally, and Nigeria is increasingly part of this transformation. Among available ICT tools, multimedia encompassing video, audio, animations, simulations, and digital presentations has emerged as a particularly potent instrument for enhancing science instruction (Owusu et al., 2024). In science education, where abstract concepts and experimental processes demand vivid illustration, multimedia offers affordances that traditional chalk-and-board approaches cannot replicate (Anaduaka & Olaifa, 2025).

Secondary school science education in Nigeria continues to grapple with persistent challenges including low student achievement, inadequate laboratory facilities, and high dropout rates (Tukura & Falode, 2020). Multimedia adoption has been proposed as a viable strategy to address these challenges. However, the attitude of teachers critical gatekeepers of classroom technology use remains a key determinant of whether multimedia tools are effectively deployed. Teachers' attitudes have been shown to directly influence both the frequency and quality of multimedia adoption (Wijnen et al., 2024). Even when positive, attitudinal acceptance does not automatically lead to deep instructional integration without accompanying structural support (Blundell et al., 2020).

In Sokoto metropolis, the discourse on multimedia integration in secondary school science instruction remains underexplored. Teachers continue to face substantial infrastructural, institutional, and capacity-related barriers (Al-Qaysi et al., 2023), compounded by digital access gaps disproportionately affecting northern Nigerian schools (Olanrewaju et al., 2021). This study therefore investigated secondary school science teachers' attitudes, multimedia use frequency, and challenges in Sokoto metropolis, providing empirically grounded evidence to guide policy and practice.

This study is anchored on the Technology Acceptance Model (TAM), originally proposed by Davis (1989) and validated extensively in contemporary studies. TAM posits that technology acceptance is driven by perceived usefulness and perceived ease of use. Kolade et al. (2024) applied TAM to assess ICT adoption among university lecturers and confirmed that these constructs significantly predicted both attitudes and actual integration

behaviour. Applied to this study, TAM explains why some Sokoto science teachers maintain positive multimedia attitudes while others remain reluctant depending on how useful and accessible they perceive available tools to be. The constructivist learning framework further complements TAM, affirming that multimedia tools, by enabling multi-modal, interactive engagement with science content, support active knowledge construction (Mir et al., 2025; Kusuma et al., 2021).

Multimedia instruction encompasses text, images, audio, video, and animations working together to facilitate learning. In Nigerian secondary schools, Adekunle and Olorunfemi (2022) found that multimedia instructional strategies yielded significantly higher student performance in organic chemistry. Anaduaka and Olaifa (2025) reported enhanced motivation and achievement through multimedia mathematics instruction in the Federal Capital Territory, while Muhammad-Thani et al. (2024) confirmed similar gains for computer science students in Ilorin. Internationally, Dou and Feng (2025) conducted a meta-analytic review confirming that multimedia-assisted science instruction produced statistically significant learning outcome gains compared to conventional teaching. Owusu et al. (2024) corroborated these findings in Ghanaian secondary schools, where regular multimedia use was associated with higher student engagement and improved performance.

Teachers' attitudes towards multimedia are multidimensional, covering affective, cognitive, and behavioural components. Wijnen et al. (2024) found that teachers with positive digital tool attitudes were significantly more innovative in their instructional strategies. In Nigeria, Tukura and Falode (2020) and Ogundele and Olatunde-Aiyedun (2021) consistently reported moderately positive ICT attitudes among secondary school science teachers, noting that structural barriers constrained actual use. Blundell et al. (2020) cautioned that surface attitudinal acceptance rarely translates to deep technology integration without competence development and institutional reinforcement. Jibril and Adedokun-Shittu (2024) found that Nigerian teachers who received TPACK-focused professional development showed stronger positive attitudes and more frequent technology integration. Regarding frequency, Ogunlade and Adedokun (2020) and Suleiman and Bello (2024) documented irregular multimedia use in Osun and Zamfara State secondary schools respectively, with infrastructure inadequacy and low teacher competence as leading causes. Antonietti et al. (2022) confirmed

internationally that teacher self-efficacy mediates the relationship between attitudes and actual frequency of technology use.

Dahiru, M. (2025) identified inadequate ICT infrastructure, poor electricity, insufficient training, and high device costs as persistent multimedia use barriers in developing countries. In Nigeria, Olanrewaju et al. (2021) documented that digital gaps disproportionately affected northern Nigerian secondary schools. Joshi and Khatiwada (2024) confirmed electricity instability, poor connectivity, and limited professional development as dominant first-order obstacles globally. At the institutional level, Nhlumayo (2024) and Yang et al. (2025) established that proactive technology leadership by school principals through resource provision, modelling, and collaborative cultures is pivotal to reducing multimedia use barriers. The absence of such leadership in many Nigerian public schools significantly deepens existing challenges (Ismaila & Ibrahim, 2023).

Objectives of the Study

The study specifically sought to:

- I. Determine the attitude of secondary school science teachers towards the use of multimedia in science instruction in Sokoto metropolis.
- II. Ascertain the frequency of multimedia use among secondary school science teachers in Sokoto metropolis.
- III. Identify the challenges faced by secondary school science teachers in using multimedia tools in Sokoto metropolis.

Research Questions

The following research questions guided the study:

- I. What is the attitude of secondary school science teachers towards the use of multimedia in science instruction in Sokoto metropolis?
- II. What is the frequency of multimedia use among secondary school science teachers in Sokoto metropolis?
- III. What challenges do secondary school science teachers face in using multimedia tools in Sokoto metropolis?

Methodology

The study used a descriptive survey research design (Creswell & Creswell, 2023). The study was carried out in Sokoto metropolis the capital of Sokoto State in Nigeria North-West geopolitical zone chosen because of limited research attention given to the integration of ICT in secondary school science education in the region.

The target population consisted of 280 science teachers in senior secondary schools in Sokoto metropolis. The sample size for the study was determined using Krejcie and Morgan's (1970) sample size determination table. The population was sampled using simple random sampling technique; all the members of the population had equal chance of being selected. The participants were teachers of Biology, Chemistry and Physics.

To facilitate subgroup analysis, respondents were asked to provide information on gender, teaching experience, qualification level, and school type. Of the 158 usable responses, 97 (61.4%) were male and 61 (38.6%) were female. Regarding teaching experience, 42 (26.6%) had 1-5 years, 64 (40.5%) had 6-10 years, and 52 (36.7%) had above 10 years of experience. In terms of qualification, 29 (18.4%) held NCE, 93 (58.9%) held B.Sc/B.Sc (Ed), and 36 (22.8%) held postgraduate degrees. The participants (100%) were from public secondary schools in Sokoto metropolis. The detailed distribution is presented in Table 1.

Table 1: Demographic Profile of Respondents (N = 158)

Variable	Category	Frequency	Percentage (%)
Gender	Male	97	61.4
	Female	61	38.6
Teaching Experience	1-5 years	42	26.6
	6-10 years	64	40.5
	Above 10 years	52	32.9
Qualification Level	NCE	29	18.4
	B.Sc/B.Sc (Ed)	93	58.9
	M.Ed/M.Sc	36	22.8
School Type	Public	158	100
	Private	0	0

Data were collected using the Secondary Schools Teachers' Attitude Towards Using Multimedia in Science Instruction Questionnaire (SSTAMSIQ), structured in three sections: Section A (5 items on teachers' attitudes, 4-point Likert scale: SA=4, A=3, D=2, SD=1); Section B (5 items on frequency of use, 5-point scale: Always=5, Often=4, Sometimes=3, Rarely=2, Never=1);

and Section C (5 items on challenges, 4-point Likert scale). The instrument was adapted from Wijnen et al. (2024), Owusu et al. (2024), Dou and Feng (2025), and Al-Qaysi et al. (2023).

Face and content validity were established through expert review by three lecturers in Science Education and one evaluation specialist at Sokoto State University, who assessed the clarity, relevance, and appropriateness of all items.

The instrument was pilot-tested on 30 teachers from a non-participating school before final administration. The pilot test was conducted to assess item clarity, identify ambiguous statements, and estimate the time required for completion. Necessary revisions were made based on pilot feedback before final administration. Cronbach's Alpha reliability coefficient was subsequently computed and yielded a value of 0.82, indicating high internal consistency.

Prior to data collection, two research assistants were trained by the principal researcher over a two-day orientation session. Training covered the purpose of the study, ethical protocols, questionnaire administration procedures, and approaches for addressing respondents' queries without introducing bias. Questionnaires were personally administered to participants across sampled schools over a three-week period with the support of the trained research assistants. Of 162 questionnaires distributed, 158 were returned and found usable, representing a 97.5% response rate.

Data were analysed using mean and standard deviation. For Sections A and C (4-point scale), a benchmark mean of 2.50 was adopted as the decision rule; for Section B (5-point scale), a benchmark of 3.00 was used. Items with mean scores at or above the respective benchmarks were considered positively endorsed.

Results

Research Question 1: Teachers' Attitude Towards Multimedia in Science Instruction

Table 2 presents the analysis of teachers' attitudes towards multimedia in science instruction.

Table 2: Mean and Standard Deviation of Teachers' Attitude Towards Multimedia in Science Instruction (N = 158)

S/N	Item	Mean	SD	Remark
1	I believe that social media enhances the teaching of science subjects	3.38	0.74	Positive
2	Using multimedia tools makes science lessons more interesting for students.	3.61	0.63	Positive
3	Social media improves students' understanding of scientific concepts.	3.44	0.69	Positive
4	I feel confident using multimedia tools in my teaching.	3.22	0.78	Positive
5	Integrating social media into teaching is beneficial for effective learning.	3.45	0.71	Positive

All five items in Table 2 recorded mean scores above the 2.50 benchmark, yielding a grand mean of 3.42 (SD = 0.71). This indicates that secondary school science teachers in Sokoto metropolis hold a positive attitude towards multimedia use in science instruction. Item 2 'Using multimedia tools makes science lessons more interesting for students' recorded the highest mean score of 3.61 (SD = 0.63), reflecting near-unanimous agreement on multimedia's motivational value. Item 4 'I feel confident using multimedia tools in my teaching' recorded the lowest mean of 3.22 (SD = 0.78), signalling residual uncertainty about personal competence despite the overall positive disposition.

Research Question 2: Frequency of Multimedia Use

Table 3 presents the analysis of the frequency of multimedia use among respondents.

Table 3: Mean and Standard Deviation of Frequency of Multimedia Use in Science Instruction (N = 158)

S/N	Item	Mean	SD	Remark
1	I use videos (e.g., YouTube) when teaching science.	2.55	1.01	Sometimes
2	I use WhatsApp or similar platforms to communicate academic content.	2.48	0.98	Rarely
3	I use PowerPoint or digital presentations in teaching science.	3.12	0.87	Often
4	I share learning materials with students through social media.	2.63	0.94	Sometimes
5	I encourage students to use online platforms for science learning.	2.82	0.80	Sometimes
	Grand Mean / Grand SD	2.72	0.92	Moderate

The grand mean of 2.72 (SD = 0.92) indicates a moderate frequency of multimedia use overall. Item 3 'I use PowerPoint or digital presentations in teaching science' recorded the highest mean of 3.12 (SD = 0.87), confirming digital presentations as the most commonly deployed tool, likely attributable

to their offline accessibility. Item 2 'I use WhatsApp or similar platforms to communicate academic content' recorded the lowest mean of 2.48 (SD = 0.98), falling below the benchmark, indicating that social media platforms are rarely employed for academic content delivery.

Research Question 3: Challenges in Using Multimedia Tools

Table 4 presents the challenges teachers face in using multimedia tools in science instruction.

Table 4: Mean and Standard Deviation of Challenges Faced in Using Multimedia Tools (N = 158)

S/N	Item	Mean	SD	Remark
1	Lack of internet access limits my use of multimedia tools.	3.51	0.66	Agree
2	My school lacks adequate ICT facilities for teaching.	3.48	0.68	Agree
3	I have not received sufficient training on multimedia usage.	3.32	0.74	Agree
4	Using multimedia tools requires too much preparation time.	3.19	0.76	Agree
5	Technical problems discourage me from using multimedia in teaching.	3.40	0.66	Agree
Grand Mean / Grand SD		3.38	0.70	Agree

All five challenge items exceeded the 2.50 benchmark, with a grand mean of 3.38 (SD = 0.70), confirming that significant challenges confront science teachers in Sokoto metropolis. Item 1 'Lack of internet access limits my use of multimedia tools' was the most prominently endorsed barrier (mean = 3.51, SD = 0.66), followed closely by inadequate ICT facilities (mean = 3.48, SD = 0.68). Insufficient training (mean = 3.32) and technical problems (mean = 3.40) were also strongly endorsed. Preparation time burden was the least prominent barrier, though still above the benchmark (mean = 3.19, SD = 0.76).

Discussion

The finding that secondary school science teachers in Sokoto metropolis hold a positive attitude towards multimedia use in science instruction aligns with Wijnen et al. (2024), who reported positive teacher attitudes towards digital tools among secondary school teachers with regular technology exposure. Similarly, Tukura and Falode (2020) and Ogundele and Olatunde-Aiyedun (2021) found moderately positive ICT attitudes among Nigerian science teachers. The relatively lower confidence score on personal multimedia competence (Item 4) is consistent with observations by Blundell et al. (2020)

and Kolade et al. (2024), who cautioned that a positive attitude alone does not guarantee integration it must be matched by infrastructure, training, and institutional support.

The moderate frequency of multimedia use is consistent with Owusu et al. (2024) and Suleiman and Bello (2024), who reported moderate and irregular multimedia use patterns in Ghanaian and northern Nigerian secondary schools respectively. The predominance of PowerPoint presentations aligns with findings from Muhammad-Thani et al. (2024), who noted that offline-compatible tools are more sustainable in contexts with unreliable power and internet supply. Antonietti et al. (2022) confirmed internationally that frequency of technology use is closely mediated by teacher self-efficacy and institutional enablement both of which remain constrained in Sokoto public secondary schools.

The challenges identified corroborate Al-Qaysi et al. (2023) and Joshi and Khatiwada (2024), who identified poor connectivity, absent infrastructure, and limited training as persistent first-order barriers to multimedia integration in developing-country schools. Olanrewaju et al. (2021) specifically documented that northern Nigerian schools bear a disproportionate share of these digital gaps. The training deficit echoes Jibril and Adedokun-Shittu (2024), while the institutional dimension is consistent with Nhlumayo (2024) and Yang et al. (2025), who established that schools lacking proactive technology leadership have significantly lower rates of effective multimedia adoption.

This study has several limitations that should be considered when interpreting its findings. First, the self-reported nature of attitudes and multimedia use frequency may be subject to social desirability and recall bias, potentially inflating positive responses. Second, the instrument conflates multimedia tools broadly with social media platforms in certain items, which may limit construct validity and precision in distinguishing between these categories. Third, the cross-sectional design employed prevents causal inferences about the relationship between teachers' attitudes and actual multimedia usage. Fourth, although demographic data were collected, the absence of more nuanced subgroup analyses across school type, gender, and experience levels limits the depth of interpretive conclusions. Fifth, no direct classroom observation was conducted to verify or triangulate self-reported usage frequency data. Future research should address these limitations through

mixed-methods designs incorporating classroom observations and qualitative interviews among secondary schools science teachers in Sokoto metropolis.

Conclusion

This study investigated secondary school science teachers' attitudes, multimedia use frequency, and challenges in Sokoto metropolis, Nigeria. Findings from 158 teachers revealed: (i) positive attitudes towards multimedia in science instruction (grand mean = 3.42, SD = 0.71); (ii) moderate frequency of multimedia use (grand mean = 2.72, SD = 0.92); and (iii) significant challenges notably poor internet access, inadequate ICT facilities, and insufficient training (grand mean = 3.38, SD = 0.70). The gap between attitudinal positivity and actual multimedia deployment is mediated by systemic structural, institutional, and capacity barriers. The study concludes that meaningful multimedia integration in Sokoto secondary school science education requires coordinated, sustained investment in infrastructure, professional development, and institutional leadership not merely attitude formation.

Recommendations

Based on the findings, the following recommendations are made:

- I. The Sokoto State Ministries of Education should prioritise provision of ICT infrastructure computers, projectors, and broadband internet in all public secondary schools.
- II. Structured in-service multimedia training programmes for science teachers should be designed and implemented, incorporating TPACK development as recommended by Jibril and Adedokun-Shittu (2024).
- III. School principals should model technology leadership by providing resources, encouraging collaborative professional learning, and recognising innovative multimedia use consistent with Nhlumayo (2024) and Yang et al. (2025).
- IV. The Federal Government of Nigeria should accelerate ICT provisions in the National Policy on Education, prioritising

underserved northern regions through renewable energy-powered ICT solutions.

- V. Pre-service teacher education at Sokoto State University should embed robust multimedia pedagogy modules to ensure newly qualified science teachers are digitally competent from entry.
- VI. Future research should employ quasi-experimental designs to test the causal impact of specific multimedia interventions on science learning outcomes in Sokoto, and explore how gender, teaching experience, and school ownership type moderate teachers' attitudes and multimedia use frequency.

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APPENDIX A

Secondary Schools Teachers' Attitude Towards Using Multimedia in Science Instruction Questionnaire (SSTAMSIQ)

Instructions: Please respond to all items honestly. Responses are strictly confidential and for academic purposes only. Tick (✓) the option that best represents your opinion.

SECTION A: Teachers' Attitude Towards Multimedia (SA=4, A=3, D=2, SD=1)

S/N	Item	SA	A	D	SD
1	I believe that social media enhances the teaching of science subjects.				
2	Using multimedia tools makes science lessons more interesting for students.				
3	Social media improves students' understanding of scientific concepts.				
4	I feel confident using multimedia tools in my teaching.				
5	Integrating social media into teaching is beneficial for effective learning.				

SECTION B: Frequency of Multimedia Use (Always=5, Often=4, Sometimes=3, Rarely=2, Never=1)

S/N	Item	Always	Often	Sometimes	Rarely	Never
1	I use videos (e.g., YouTube) when teaching science.					
2	I use WhatsApp or similar platforms to communicate academic content.					
3	I use PowerPoint or digital presentations in teaching science.					
4	I share learning materials with students through social media.					
5	I encourage students to use online platforms for science learning.					

SECTION C: Challenges in Using Multimedia Tools (SA=4, A=3, D=2, SD=1)

S/N	Item	SA	A	D	SD
1	Lack of internet access limits my use of multimedia tools.				
2	My school lacks adequate ICT facilities for teaching.				
3	I have not received sufficient training on multimedia usage.				
4	Using multimedia tools requires too much preparation time.				
5	Technical problems discourage me from using multimedia in teaching.				

Thank you for your cooperation.