FROM RESEARCH TO CLASSROOM PRACTICE: TEACHER-PERCEIVED BARRIERS TO MULTIMEDIA INTEGRATION IN BASIC SCIENCE IN ENUGU STATE

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Abstract

The gap between research evidence and classroom practice limits the effective use of educational technologies in science education. Despite evidence that multimedia enhances student achievement in science, its use in Nigerian Basic Science classrooms remains limited. This study examines teacher-perceived barriers to multimedia integration in junior secondary schools in Enugu State, aiming to identify pathways to translate research into practice. Using a descriptive survey design and three research questions to guide the study, data were collected from all 32 Basic Science teachers in the 31 public secondary schools in Nsukka Local Government Area through an observation checklist and a structured questionnaire with a reliability coefficient of 0.97). Findings indicated a lack of multimedia facilities and identified barriers, including inadequate infrastructure, poor power supply, weak internet services, insufficient training, and insufficient support. Teachers suggested solutions like improved funding, regular training, technical support, and reliable electricity. The study concludes that while multimedia can enhance Basic Science teaching, systemic challenges must be addressed by the government, school administrators, and teacher education providers to translate research evidence into sustainable classroom practice.

Keywords: Multimedia Integration; Basic Science; Teacher Perceptions; Educational Technology; Nigeria

Introduction

The integration of multimedia technologies into classroom instruction has become increasingly important in contemporary education, particularly in science teaching, where abstract concepts often challenge learners' understanding. Multimedia tools such as text, images, audio, animations, and video support multi-sensory learning, promote interactivity, and enhance students' engagement and comprehension. In science classrooms, these tools help translate complex ideas into concrete visual experiences, thereby improving retention and academic performance (Fabeku & Enyeasi, 2024; Achiette Asu & Ude, 2024).

Basic Science occupies a strategic position in the Nigerian education system. It is designed to present scientific concepts in a unified manner and serves as the foundation for later specialization in Physics, Chemistry, and Biology (Adedoyin & Soykan, 2020; Fatima & Umar, 2019). The subject also plays a key role in developing learners' scientific literacy, inquiry skills, and attitudes toward science, as emphasized in Nigeria's National Policy on Education (Federal Republic of Nigeria, 2013). However, classroom practice in many junior secondary schools remains dominated by teacher-centred, lecture-based approaches that limit students' engagement and understanding of abstract scientific concepts (Mbonu-Adigwe et al., 2021).

Multimedia-based instruction has been widely documented as an effective strategy for addressing these challenges. Empirical studies across Nigeria and other contexts consistently show that the use of videos, animations, simulations, and interactive digital resources significantly improves students' achievement, retention, and attitudes toward science (Achiette Asu & Ude, 2024; Fabeku & Enyeasi, 2024; Mbonu & Okoli, 2021; Kassa, 2024). In Basic Science specifically, multimedia-supported instruction has been found to enhance students' science process skills and conceptual understanding (Mbonu-Adigwe et al., 2021; Fatima & Umar, 2019). These findings align with Mayer's Cognitive Theory of Multimedia Learning (CTML), which posits that learners understand concepts more effectively when information is presented through both verbal and visual channels rather than text alone (Mayer, 2021).

Despite these documented benefits, the integration of multimedia in Nigerian Basic Science classrooms remains uneven and often superficial. When multimedia is used, it is frequently limited to teacher-led slide presentations or video demonstrations, with minimal opportunities for student interaction, inquiry, or collaborative learning (Nkwocha, 2023; Okwudishu & Ndubuisi, 2021; Onyia & Okeke, 2022). Deeper

forms of integration, such as interactive simulations, student-created multimedia tasks, and technology-supported investigations, depend strongly on teachers' digital competence, access to functional resources, technical support, and supportive school leadership (Oguezue & Wakil, 2025).

Research on teacher-perceived barriers consistently identifies inadequate electricity supply, limited multimedia facilities, insufficient ICT training, weak technical support, and heavy workload as major constraints to classroom integration (Adeyemi & Yusuf, 2020; Bello & Akinyemi, 2022; Okeke, 2019). These challenges directly influence teachers' willingness and ability to adopt multimedia tools, as explained by the Technology Acceptance Model (TAM), which emphasizes perceived usefulness and perceived ease of use as key determinants of technology adoption (Teo, 2019). In resource-constrained settings, infrastructural and institutional barriers often reduce teachers' perceptions of multimedia as both useful and easy to use, even when they acknowledge its pedagogical value (Abiodun et al., 2023).

Although several Nigerian studies have examined the effectiveness of multimedia in science instruction, relatively few have focused on teacher-perceived, context-specific barriers and teacher-informed solutions within Basic Science classrooms, particularly in the Nsukka Local Government Area of Enugu State. Most prior research emphasizes student outcomes or broad national trends, leaving a gap in localized evidence explaining why multimedia remains underutilized despite its proven effectiveness. Addressing this gap is essential for designing practical, context-sensitive interventions that can support teachers and improve Basic Science instruction.

Accordingly, this study investigates teachers' perceptions of the barriers to the effective integration of multimedia in the teaching of Basic Science in junior secondary schools in Nsukka Local Government Area of Enugu State, Nigeria, as well as the solutions they consider feasible within their context.

Theoretical Framework

This study is anchored on Mayer's Cognitive Theory of Multimedia Learning (CTML) and the Technology Acceptance Model (TAM).

CTML posits that learners understand concepts more effectively when information is presented through both verbal and visual channels rather than words alone (Mayer, 2021). Its dual-channel, limited-capacity, and active-processing assumptions suggest that well-designed multimedia reduces cognitive load and

enhances meaningful learning, particularly for abstract science concepts.

TAM (Davis, 1989) explains teachers' willingness to adopt technology based on perceived usefulness and perceived ease of use. In contexts where digital literacy is low and infrastructure is weak, teachers may resist multimedia integration despite recognizing its benefits (Abiodun et al., 2023; Oguezue & Wakil, 2025).

While CTML informs the instructional value of multimedia resources examined in Research Question One, TAM provides a framework for understanding teachers perceived barriers and proposed solutions addressed in Research Questions Two and Three. Together, CTML explains the learning value of multimedia, while TAM explains the behavioural factors influencing its adoption. This dual framework provides a strong theoretical basis for examining both instructional effectiveness and teacher readiness

Research Questions

This study was guided by the following research questions:

1. What multimedia facilities are available for teaching Basic Science in junior secondary schools?
2. What are the teacher-perceived barriers to multimedia integration in Basic Science?
3. What are the possible solutions to the factors militating against the effective integration of multimedia in Basic Science teaching?

METHODOLOGY

Research Design

This study adopted a **descriptive survey research design** to investigate the availability of multimedia facilities, challenges, and possible solutions to their integration in the teaching of Basic Science. Survey design was considered appropriate because it allows for the systematic collection of data from a representative group and enables the researcher to describe existing conditions as they naturally occur.

Area of the Study

The study was conducted in **Nsukka Local Government Area of Enugu State, Nigeria**, which hosts the University of Nigeria, Nsukka. The area comprises government and private schools, with 31 public secondary schools under the Post-Primary School Management Board (PPSMB), Nsukka Education Zone (2024). The choice of Nsukka was informed by the limited empirical evidence on

multimedia integration in Basic Science classrooms within the area.

Population and Sample

The population consisted of **all 32 Basic Science teachers** in the 31 public secondary schools in Nsukka Local Government Area (PPSMB, 2022). Private secondary schools were excluded because Basic Science teachers in public schools operate under uniform government policies and resource provisions, which enhanced comparability. Again, due to the manageable size of the population, **a census approach** was adopted; hence, all teachers were included in the study.

Instruments For Data Collection

Two instruments were used for data collection:

1. **Observation Checklist:** A 25-item checklist was used to determine the availability of multimedia facilities in schools.
2. **Questionnaire on Multimedia Facilities, Challenges, and Solutions in Basic Science (QMFCSBS)**: This researcher-developed questionnaire comprised two sections
   - i. **Section A:** Demographic information of respondents.
   - ii. **Section B:** Three clusters aligned with the research questions:
     - *Cluster 1 (15 items):* Teacher-perceived barriers to multimedia integration
     - *Cluster 2 (10 items):* Possible solutions to the identified challenges

The clusters were structured on a**four-point Likert scale**: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). Negatively worded items were reverse-scored.

Validity of the Instrument

Face validity was established through expert review by**three specialists in Science Education** at the University of Nigeria, Nsukka. Their recommendations were incorporated into the final version of the instrument.

Reliability of the Instrument

The internal consistency of the questionnaire was determined using Cronbach's Alpha through a pilot test involving 20 Basic Science teachers from Igbo-Etiti Local Government Area, which shares similar characteristics with Nsukka but lies outside the study area. An overall reliability coefficient of **0.97** was obtained for both Clusters B and C, indicating high internal consistency.

Data Collection Procedure

Approval was obtained from the Head of the Department of Science Education,

University of Nigeria, Nsukka, and from school principals. The questionnaires were administered face-to-face, and completed copies were retrieved immediately to ensure a high response rate.

Method of Data Analysis

Descriptive statistics were used to analyze the data as follows; Research Question 1: Frequencies and percentages were used. Facilities with an availability rate of 50% or above were considered available. Research Questions 2 and 3: Mean and standard deviation were employed. A mean score of 2.50 or above indicated agreement, while a mean below 2.50 indicated disagreement.

Results

Research Question One: What multimedia facilities are available for teaching Basic Science in Junior Secondary Schools?

Table 1: Frequency and Percentage of Available Multimedia Facilities for Teaching Basic Science in Junior Secondary Schools

S/N	Multimedia Facilities	Frequency (N=32)	Percentage (%)	Remark
1.	Audio Systems & Microphones	24	75.0	Av
2.	Audio Tapes	8	25.0	NAv
3.	CD-ROMs	7	21.9	NAv
4.	Desktop computer	24	75	Av
5.	Digital Cameras/Camcorders	2	6.3	NAv
6.	Digital Library	0	0.0	NAv
7.	DVD Video Players	22	68.8	Av
8.	E-books	8	25.0	NAv
9.	E-journals	0	0.0	NAv
10.	Flash Drive	24	75.0	Av
11.	Google classroom	0	0.0	NAv
12.	Instructional Studios	0	0.0	Nav
13	Interactive White Board	0	0.0	Nav
14	Internet Facility/Network	24	75	Av
15.	iPad	7	21.9	Nav
16	Laptop	19	59.4	Av
17.	Modem	7	21.9	Nav
18.	Office Software	27	84.4	Av
19	Projector	23	71.9	Av
20.	Projector Screen	23	71.9	Av
21.	Radio	26	81.3	Av
22	Smart Phones	25	78.1	Av
23.	Television	24	75	Av
24.	Video Conferencing	0	0.0	Nav
25.	Virtual Classroom	0	0.0	Nav

N= Number of Teachers; Av = Available; Nav = Not Available

Table 1 shows the availability of multimedia facilities for teaching Basic Science in junior secondary schools in Nsukka Local Government Area. Facilities considered available (≥50%) included audio systems and microphones (75%), desktop computers (75%), DVD players (68.8%), flash drives (75%), internet/network facilities (75%), laptops (59.4%), office software (84.4%), projectors (71.9%), projector screens (71.9%), radios (81.3%), smartphones (78.1%), and televisions (75%). However, 13 facilities, including digital libraries, e-journals, interactive whiteboards, instructional studios, video conferencing tools, and virtual classrooms, recorded availability below 50%, indicating that most schools lacked advanced multimedia resources.

Research Question Two: What are the teachers-perceived barriers to multimedia integration in Basic Science?

Table 2: Mean Scores and Standard Deviation Ratings of Responses on the barriers to multimedia integration in Basic Science

S/N	Item Statement	Mean	SD	Remark
1.	Multimedia facilities are expensive	3.50	0.62	A
2.	Proper understanding of the value or possible benefits of using multimedia facilities	2.25	1.02	D
3.	Students find it difficult to operate the facilities	3.50	0.62	A
4.	Inadequate financial support from the government	3.88	0.34	A
5.	Teaching with multimedia could be boring	1.34	0.48	D
6.	Inadequate time allocated for the period used for teaching with the multimedia facilities	3.75	0.44	A
7.	Weak internet service	3.69	0.47	A
8.	Lack of confidence by the teacher in using multimedia facilities	1.06	0.25	D
9.	Lack of multimedia facilities	3.84	0.37	A
10.	Lack of maintenance of the facilities	1.43	0.88	D
11.	Technical issues surrounding the use of multimedia facilities	4.00	0.00	A
12.	Lack of training for teachers on multimedia usage	3.75	0.44	A
13.	Some of the facilities take time to set up	2.22	0.94	D
14.	Power disruptions/Absence of power supply	3.94	0.25	A
15.	Attitude of students towards the use of multimedia in teaching	2.19	0.90	D

A= Agree, D= Disagree

Results in Table 2 indicate that teachers identified several major barriers to multimedia integration. The strongest perceived challenges included inadequate government funding (M = 3.88), power outages (M = 3.94), lack of multimedia facilities (M = 3.84), weak internet services (M = 3.69), lack of training (M = 3.75), technical problems (M = 4.00), and insufficient time for multimedia-based lessons (M = 3.75).Items related to boredom (M = 1.34), teacher lack of confidence (M = 1.06), and poor maintenance (M = 1.43) were not considered significant barriers.

Research Question Three

What are the possible solutions to the factors militating against effective integration of multimedia in teaching Basic Science?

Table 3: Mean Ratings and Standard Deviation of Responses on the Possible Solutions to the Factors Militating the Effective Integration of Multimedia Facilities in Teaching Basic Science.

S/N	Item Statement	Mean	SD	Remark
1.	Provision of funds to procure these multimedia facilities	3.81	0.40	A
2.	Training teachers to understand the benefits of multimedia usage in the classroom	3.50	0.51	A
3.	Provision of technical staff to guide teachers on how to use these multimedia facilities	3.97	0.18	A
4.	Stand-by generators should be provided to schools to reduce power outages	4.00	0.00	A
5.	Media facilities chosen should be friendly and easy to use	3.59	0.50	A
6.	More time should be allocated to the period for the use of these multimedia facilities	3.81	0.40	A
7.	Students should be allowed to carry out their research and assignments with the aid of multimedia	4.00	0.00	A
8.	Schools should allow multimedia gadgets such as cell phones, laptops, tablets, etc, inside the classroom to aid learning	1.43	0.87	D

9.	Teachers should be open-minded to new approaches to teaching	3.72	0.46	A
10.	Provision of multimedia facilities that are easy to set up	3.81	0.40	A

A= Agree, D= Disagree

Table 3 shows strong agreement on most proposed solutions. Teachers supported increased funding (M = 3.81), training (M = 3.50), provision of technical staff (M = 3.97), standby power supply (M = 4.00), user-friendly facilities (M = 3.59), extended instructional time (M = 3.81), and encouraging student use of multimedia (M = 4.00). The only rejected option was allowing personal devices in classrooms (M = 1.43), which teachers considered impractical.

Discussion of Findings

The findings of this study are presented under the following subheadings:

Availability of Multimedia Facilities

The findings indicate that multimedia facilities are only partially available in Basic Science classrooms in Nsukka LGA. While basic tools such as projectors, computers, and smartphones are present in many schools, more advanced digital resources are largely absent. This uneven distribution reflects persistent funding gaps, infrastructure challenges, and limited technical support in public schools. These results align with previous Nigerian studies (Nkwocha, 2023; Okwudishu & Ndubuisi, 2021; Abiodun et al., 2023), which also reported low availability of advanced multimedia tools. In contrast, experimental studies (Kassa, 2024; Fabeku & Enyeasi, 2024) found higher availability due to project-based funding and controlled environments, highlighting the gap between experimental settings and everyday school realities.

Teacher-Perceived Barriers

Teachers identified institutional and infrastructural barriers, including unreliable electricity, weak internet services, lack of training, and insufficient administrative support, as the main constraints to multimedia integration. This supports earlier findings by Yusuf et al. (2023). The difference between these results and those of experimental studies suggests that multimedia integration is sustainable only when schools receive consistent funding, training, and technical support.

Teacher-Suggested Solutions

Teachers also strongly supported solutions focused on funding, training, technical support, and infrastructure. Their rejection of unrestricted student device use

suggests concerns about classroom control, misuse, and policy limitations. Overall, the findings show that successful multimedia integration requires systemic support, not just the provision of tools.

Conclusion

This study examined teacher-perceived barriers to multimedia integration in the teaching of Basic Science in junior secondary schools in Nsukka Local Government Area, Enugu State. The results revealed limited availability of multimedia resources, alongside persistent challenges such as inadequate funding, lack of training, unreliable electricity, and weak institutional support. Although teachers recognized the value of multimedia, these constraints prevent its consistent classroom use. The study concludes that effective integration requires coordinated efforts involving infrastructure development, continuous professional training, policy support, and sustained funding.

Recommendations

In line with the theme **Bridging the Gap Between Research and Practice**, the following recommendations translate the findings of this study into actionable steps for key stakeholders in science and technology education.

1. Federal and State Ministries of Education, Universal Basic Education Boards, and Post-Primary School Management Boards should ensure the adequate provision of multimedia facilities such as projectors, computers, interactive boards, internet-enabled devices, and educational software in all secondary schools. This will enable teachers to translate research-based strategies into everyday classroom practice.
2. Teacher training institutions, education ministries, and school boards should organize regular workshops, in-service training, and refresher programmes focused on the pedagogical use of multimedia in science teaching. Training should emphasize not only technical skills but also how multimedia can improve conceptual understanding in Basic Science.
3. Government agencies, school proprietors, and ICT partners should provide a stable electricity supply (including solar power or standby generators) and reliable internet connectivity in schools. Without these basic infrastructures, research-backed multimedia practices cannot be sustained in real classroom contexts.
4. Federal, State, and Local Government authorities should prioritize multimedia integration in education budgets, ensuring funds are

specifically allocated for procurement, maintenance, and upgrading of digital teaching resources. This financial commitment is essential for moving multimedia use from theory to practice.

5. School administrators, principals, and professional development coordinators should ensure that teacher training is practical and classroom-oriented, with hands-on sessions where teachers design lessons, use real multimedia tools, and share best practices. This bridges the gap between research knowledge and actual teaching.

6. School principals and education stakeholders should motivate teachers through incentives, such as recognition awards, promotions, certificates, and opportunities for career advancement, for those who effectively integrate multimedia into their teaching. This encourages sustained adoption of research-informed practices.

7. Education policymakers, quality assurance units, and school leadership should establish monitoring, evaluation, and technical support systems to track multimedia usage in classrooms. Continuous feedback, mentoring, and support will ensure that multimedia integration is not a one-time intervention but a sustainable pathway for science and technology education.

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