EVALUATING THE IMPACT OF TECHNOLOGY INTEGRATION ON STUDENTS' ACADEMIC PERFORMANCE

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PROJECT SUBMITTED TO THE DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY (CIT), FACULTY OF EDUCATION; IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AWARD OF BACHELOR OF SCIENCE (B.Sc) DEGREE IN INTEGRATED SCIENCE EDUCATION UNIVERSITY OF BENIN, BRNIN CITY, NIGERIA

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CERTIFICATION

We the undersigned, certify that this work was carried out by "**IKEORA GOODNESS LOTE**" in the Department of Curriculum and Instructional technology, Faculty of Education, University of Benin, Benin City, Nigeria.

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DEDICATION

Unto Him who is able to, and has kept me by His power. To the only wise God and Jesus Christ my Savior.

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ABSTRACT

This study evaluated the impact of technology integration on students' academic performance in integrated science in public secondary schools in Egor Local Government Area, Edo State, Nigeria. Motivated by the global rise in educational technology, the study examined whether technology-enhanced instruction improves learning outcomes in science education.

The study adopted a descriptive survey design. The population consisted of 100 students from five secondary schools in Egor Local Government Area. A stratified random sampling technique was used to ensure fair representation. Data were collected using a structured, researcher-designed questionnaire validated by the supervisor and two departmental lecturers. The reliability of the instrument was confirmed using Cronbach Alpha. The researcher personally administered and retrieved the questionnaires, giving respondents clear instructions and assuring them of honesty and confidentiality. Data collected was analyzed using descriptive and inferential statistics: frequencies and percentages for demographic data, and mean and standard deviation for responses on technology integration and perceptions.

Findings showed that technology integration had a significant positive effect on students' academic performance, leading to better conceptual understanding, improved problem-solving skills, and increased engagement compared to traditional teaching. However, effective implementation was hindered by inadequate infrastructure, limited devices, poor internet connectivity, power outages, insufficient teacher training, and lack of technical support. Teacher competence emerged as a major factor influencing student outcomes, while student motivation and interest increased when technology was appropriately used. The study concluded that technology can substantially enhance integrated science learning if infrastructural gaps are addressed and teachers receive adequate professional development. It recommends increased government funding, compulsory teacher training, strengthened technical support, curriculum adjustments, provision of alternative power sources, and development of context-appropriate technology integration policies. The study provides practical insights for improving science education in developing country contexts.

CHAPTER ONE

INTRODUCTION

This chapter presents the introduction under the following subheadings:

1. Background of the study
2. Statement of the Problem
3. Research Questions
4. Purpose of the Study
5. Objectives of the study
6. Significance of the study
7. Scope and Delimitation of the study
8. Definition of Terms

Background to the Study

The integration of digital technology has gradually replaced traditional learning environment in educational settings. Today, numerous technological tools and applications are made available for teachers to employ in their classrooms. Digital technology integration in teaching and learning has been found to be associated with enhancing the effectiveness of knowledge construction and distribution along with improving academic performance (*Ahlam et al., 2021*). Integrated science education plays a pivotal role in equipping students with foundational scientific knowledge and skills that cut across multiple scientific disciplines. This multidisciplinary approach promotes a deeper understanding of scientific concepts by linking biology, chemistry, physics, and earth sciences, preparing students for advanced education and real-world problem-solving (Bhandary & Kumar, 2025).

The 21st century has witnessed an unprecedented transformation in educational landscapes globally, with technology emerging as a fundamental catalyst for pedagogical innovation and student learning enhancement (Crompton & Burke, 2023). Educational institutions worldwide have increasingly recognized the potential of technology to revolutionize traditional teaching methodologies, particularly in science education where abstract concepts often require visual and interactive representations for effective comprehension (Singh & Kumar, 2022). This paradigm shift has become even more pronounced following the global pandemic, which accelerated the adoption of digital learning platforms and highlighted both the opportunities and challenges inherent in technology-mediated education (Ogunleye et al., 2021).

In the Nigerian educational context, the integration of technology in science education has gained considerable attention as educators and policymakers seek innovative approaches to improve academic outcomes and prepare students for an increasingly digital world (Adebayo & Olatoye, 2020). The Federal Ministry of Education's emphasis on Science, Technology, Engineering, and Mathematics (STEM) education has further underscored the importance of leveraging technological tools to enhance science learning experiences (Okoro et al., 2021). However, the actual implementation and impact of these technological interventions remain subjects of ongoing investigation, particularly at the local government level where resources and infrastructure vary significantly.

Technology integration in education encompasses the systematic incorporation of digital tools, platforms, and resources into teaching and learning processes to enhance educational outcome. This integration goes beyond the mere presence of technological devices in classrooms; it involves the thoughtful and strategic use of technology to support pedagogical goals, facilitate student engagement, and improve learning effectiveness (Scherer et al., 2021). The successful integration of technology requires careful consideration of various factors including teacher competency, infrastructure availability, curriculum alignment, and institutional support systems (Tondeur et al., 2020).

The impact of technology integration on educational outcomes has been extensively studied across various contexts, with research consistently indicating positive correlations between well-implemented technology integration and improved student performance (Chen & Zhang, 2023). Studies have demonstrated that technology integration can enhance student motivation, facilitate personalized learning experiences, improve retention rates, and develop critical 21st-century skills essential for future success

(Rahman & Singh, 2021). However, the magnitude and nature of these impacts often depend on how technology is implemented, the quality of technological tools used, and the level of support provided to both teachers and students.

Modern educational technology encompasses a diverse array of tools and platforms designed to support different aspects of the learning process. Interactive whiteboards have transformed traditional classroom presentations by enabling dynamic, multimedia-rich instruction that can accommodate various learning styles (Wang et al., 2022). Computer-assisted learning software provides personalized learning pathways and immediate feedback mechanisms that can adapt to individual student needs and learning paces (Li & Ma, 2021). Virtual and augmented reality technologies offer immersive experiences that can make abstract scientific concepts more tangible and engaging for students (Davis et al., 2023). Online learning platforms facilitate flexible access to educational resources and enable collaborative learning experiences beyond the physical classroom boundaries (Thompson & Anderson, 2020).

Educational simulations and modeling software have particularly proven valuable in science education by allowing students to conduct virtual experiments and observe phenomena that might be difficult or impossible to replicate in traditional laboratory settings (Kumar & Patel, 2022). Mobile learning applications leverage the ubiquity of smartphones and tablets to provide anytime, anywhere access to educational content and interactive learning activities (Hassan & Ibrahim, 2021). Digital assessment tools enable more efficient and comprehensive evaluation of student progress while providing detailed analytics to inform instructional decisions (Brown & Wilson, 2023).

Despite the promising potential of educational technology, the implementation and effective utilization of technological tools in educational settings face numerous challenges that can significantly impact their success. Infrastructure limitations remain a primary barrier, particularly in developing countries where reliable internet connectivity, adequate power supply, and modern computing devices may not be consistently available (Oyedemi & Mogano, 2021). The digital divide continues to exacerbate educational inequalities, with students from disadvantaged backgrounds having limited access to technological resources both at school and at home (Ferreira et al., 2022).

Teacher preparedness and competency represent another significant challenge in technology integration efforts. Many educators lack the necessary training and confidence to effectively incorporate technological tools into their teaching practices, leading to underutilization or inappropriate use of available resources (Pettersson, 2021). The rapid pace of technological advancement often outstrips professional development opportunities, creating a persistent gap between available technologies and teacher capabilities (Ahmed & Khan, 2020). Additionally, resistance to change and comfort with traditional teaching methods can impede the adoption of innovative technological approaches (Martinez & Rodriguez, 2022).

Financial constraints pose substantial challenges for educational institutions seeking to implement comprehensive technology integration programs. The high costs associated with purchasing, maintaining, and regularly updating technological infrastructure can strain institutional budgets, particularly in resource-constrained environments (Okafor & Egwu, 2021). Beyond initial acquisition costs, ongoing expenses related to software licensing, technical support, and equipment replacement require sustained financial commitments that many institutions find difficult to maintain (Nwankwo & Eze, 2020).

Blended learning represents a particularly promising approach to technology integration that combines the advantages of face-to-face instruction with the flexibility and resources available through online platforms (Garcia & Lopez, 2023). This hybrid model allows educators to leverage the best aspects of both traditional and digital learning environments, creating more comprehensive and flexible educational experiences. Blended learning approaches have demonstrated effectiveness in science education by enabling students to access digital resources, participate in virtual laboratories, and engage in collaborative online activities while still benefiting from direct teacher instruction and peer interaction (Smith & Johnson, 2022). The flexibility inherent in blended learning models can accommodate different learning preferences and paces, potentially improving overall academic outcomes while developing important digital literacy skills (Mohamed & Ahmed, 2021).

In the context of integrated science education, technology integration holds particular promise for addressing the multidisciplinary nature of the subject. Integrated science curricula require students to understand connections between various scientific disciplines, a task that can be greatly facilitated by technological tools that can visualize complex relationships and provide interactive learning experiences (Taylor & Brown, 2020). However, the effectiveness of technology integration in integrated science education depends heavily on how well technological tools are aligned with curriculum objectives and pedagogical strategies.

The Nigerian educational system, particularly at the junior secondary school level where integrated science is typically taught, faces unique challenges and opportunities in implementing technology integration initiatives. While there is growing recognition of the importance of technology in education, significant disparities exist in terms of resource availability, teacher training, and institutional support across different regions and local government areas (Adeyemi & Oluwaseun, 2021). Egor local government area in Edo State represents a microcosm of these broader challenges and opportunities, making it an appropriate context for investigating the impact of technology integration on student academic performance.

Understanding the specific dynamics of technology integration in Egor local government area requires consideration of local factors including infrastructure development, teacher qualifications, student demographics, and community support for educational innovation. The socio-economic characteristics of the area, availability of technological resources, and level of institutional commitment to educational technology all play crucial roles in determining the success of integration efforts (Osagie & Ehiaguina, 2020). These contextual factors must be carefully considered when evaluating the impact of technology integration on student academic performance.

Statement of the Problem

Despite the widespread adoption of educational technologies in science classrooms and the substantial investment in digital infrastructure, there remains significant uncertainty about the actual impact of technology integration on student academic performance in integrated science. While numerous individual studies have reported positive effects of various technological interventions, the field lacks comprehensive, systematic evaluation of how technology integration specifically affects learning outcomes in integrated science contexts, which differ substantially from traditional single-discipline science courses. The complex nature of integrated science curricula, which requires students to connect and synthesize concepts from multiple scientific fields, poses distinct challenges for technology integration that remain insufficiently explored in current research. Moreover, the fast rate of technological advancement has resulted in educational practices often progressing faster than the supporting research, causing implementation decisions to be driven more by enthusiasm than by solid empirical evidence. The problem is further complicated by inconsistencies in how technology integration is defined, assessed, and evaluated across different educational settings. While some studies emphasize the simple availability of technology in classrooms, others focus on specific teaching applications or the extent of student interaction with digital tools. This lack of consistent definitions makes it challenging to consolidate research findings and establish evidence-based recommendations for effectively integrating technology into integrated science education. Understanding how technology integration affects different groups of students is crucial for ensuring that educational technology serves to reduce rather than exacerbate achievement gaps in science education.

Research Questions

This study seeks to answer the following research questions:

1. What is the impact of technology integration on the academic performance of Integrated Science students in Egor local government area?

2. What type of technological tools and resources are most commonly used in Integrated Science classrooms in Egor local government area?

3. How do students perceive the use of technology in their learning of Integrated Science in Egor local government area?

4. How does technology integration influence student motivation and engagement in Integrated Science lessons in Egor local government area?

5. What are the challenges faced by teachers and students in using technology in teaching and learning Integrated Science in Egor local government area?

Purpose of the Study

The primary purpose of this study is:

1. To comprehensively evaluate the impact of technology integration on students' academic performance in integrated science within Egor local government area.

2. To provide empirical evidence regarding the effectiveness of technology integration initiatives in educational settings.

3. To identify factors that contribute to the success of technology integration in improving educational outcomes.

4. To identify factors that contribute to the failure of technology integration in improving educational outcomes.

5. To assess how technology integration initiatives specifically affect academic performance in Integrated Science subjects.

Objectives of the Study

The specific objectives of this study are to:

1. Assess the impact of technology integration on the academic performance of Integrated Science students in Egor local government area.

2. Identify and analyze the types of technological tools and resources most commonly used in Integrated Science classrooms in Egor local government area.

3. Examine students' perceptions and attitudes toward the use of technology in their learning of Integrated Science in Egor local government area.

4. Investigate how technology integration influences student motivation and engagement in Integrated Science lessons in Egor local government area.

5. Identify and analyze the challenges faced by teachers and students in using technology for teaching and learning Integrated Science in Egor local government area.

Significance of the Study

The findings of this study will be beneficial to multiple stakeholders in the educational sector, including students, teachers, school administrators, curriculum developers, policymakers, and researchers.

Students will benefit from this study as the findings will contribute to improved instructional strategies that can enhance their learning experiences and academic performance in integrated science. The identification of effective technological tools and approaches will lead to more engaging and effective learning environments that can better prepare students for future academic and career pursuits. Additionally, understanding student perceptions and challenges will inform the development of more student-centered technology integration approaches that address their specific needs and preferences.

Teachers will gain valuable insights into the most effective technological tools and integration strategies for integrated science instruction. The study's findings will inform professional development programs and provide evidence-based guidance for incorporating technology into their teaching practices. Understanding the challenges faced by educators will also contribute to the development of better support systems and training programs that can enhance teacher competency and confidence in using educational technology.

School administrators will benefit from evidence-based information that can guide their decision-making regarding technology investments, infrastructure development, and staff training priorities. The study's findings will help administrators allocate resources more effectively and develop policies that support successful technology integration initiatives.

Understanding the relationship between technology integration and academic performance will also provide administrators with data to justify technology investments to stakeholders and funding agencies.

Curriculum developers will utilize the findings to design more effective integrated science curricula that better incorporate technological tools and digital resources. The study's insights into student perceptions and learning outcomes will inform the development of technology-enhanced instructional materials and assessment strategies that align with 21st-century learning objectives.

Policymakers at local, state, and national levels will benefit from empirical evidence that can inform educational technology policies and resource allocation decisions. The study's findings will contribute to evidence-based policy development that can improve the effectiveness of educational technology initiatives across the Nigerian educational system.

Researchers will gain access to valuable data and insights that can inform future studies on technology integration in education. The study will contribute to the growing body of literature on educational technology effectiveness and provide a foundation for further research in similar contexts.

Scope and Delimitations of the Study

The research will examine how the use of technology such as multimedia teaching aids, interactive simulations, and computer-based learning platforms affects students' academic performance in the subject. The study will cover both the students, who are the primary beneficiaries of the teaching methods, and the teachers, who are responsible for delivering the lessons. It will look at aspects such as students' test scores, their level of engagement during lessons, and the development of science process skills. Although the study will yield useful insights, it will be restricted to schools located within Egor Local Government Area and excludes private schools outside this jurisdiction. The research focuses specifically on integrated science education at the junior secondary school level, encompassing students in JSS 1, JSS 2, and JSS 3 classes

The research is delimited to examining the impact of technology integration on academic performance as measured by standardized assessment scores, continuous assessment results, and examination performance. The study focuses on commonly available technological tools including computers, tablets, interactive whiteboards, educational software, online learning platforms, and mobile learning applications that are currently being used or have been recently introduced in the selected schools.

While the study acknowledges the broader context of educational technology integration, it specifically focus on the implementation and impact of blended learning approaches that combine traditional face-to-face instruction with digital learning components. The research does not extend to purely online learning environments or distance education programs, but rather concentrates on technology integration within conventional school settings.

Definition of Terms

Technology Integration: As used in this study, technology integration refers to the systematic and purposeful incorporation of digital tools, platforms, and resources into integrated science teaching and learning processes to enhance educational effectiveness and improve student academic outcomes.

Integrated Science: In this study, integrated science refers to the multidisciplinary science curriculum taught at the junior secondary school level that combines concepts and principles from physics, chemistry, biology, and earth sciences in a unified approach.

Academic Performance: In this study, academic performance refers to the measurable learning outcomes achieved by students in integrated science, as assessed through standardized tests, continuous assessments, practical examinations, and overall subject grades.

Blended Learning: As used in this study refers to an educational approach that combines traditional face-to-face classroom instruction with online or digital learning components to create a comprehensive and flexible learning environment.

Student Engagement: In this study, student engagement refers to the observable behaviors and attitudes that indicate active participation in learning activities, including attention, participation in discussions, completion of assignments, and interaction with technological tools and resources.

Student Motivation: As operationally defined in this study, student motivation refers to students' willingness to engage in learning activities, their level of interest in integrated science content, and their persistence in completing assigned tasks when technology is integrated into instruction.

Digital Literacy: In context of this study, digital literacy refers to the ability of students and teachers to effectively use digital tools, platforms, and resources to access, evaluate, create, and communicate information for teaching and learning integrated science.

Pedagogical Technology Integration: In context of this study pedagogical technology integration refers to the deliberate use of digital tools and resources by teachers to support, enrich, and transform the teaching and learning process in integrated science.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter presents the review of related literature and it is done under the following subheadings:

1. Technology Integration.
2. Academic Performance.
3. Impacts of Technology Integration on Academic Performance in Science Education.
4. Types of Technological Tools and Resources Used In Science Education.
5. Student's Perception of Technology Use in Science Learning.
6. Technology Integration Influence on Student's Motivation and Engagement.
7. Challenges in Using Technology for Teaching and Learning Science.

Technology Integration

Technology integration is the method of purposefully using digital tools, resources, and systems to support enhance, and transform teaching and learning. Effective technology integration empowers students to analyze, synthesize, and present information in meaningful ways, and it enables us to design learning experiences that are engaging, accessible, and pedagogically sound (Wikipedia, 2025). More specifically, integration involves incorporating technology not just for convenience or innovation, but to enhance comprehension and promote better learning outcomes. This process requires thoughtful alignment between curriculum goals and technological tools, ensuring that technology enhances engagement, fosters higher-order thinking, and supports authentic learning experiences (CRDP Lebanon, 2023). Scholars often explain technology integration as a continuum, beginning with substitution, where technology simply replaces a traditional tool without changing teaching methods, and extending to transformation, where technology makes possible new learning experiences that could not exist otherwise. This idea is commonly illustrated through models like SAMR (Substitution, Augmentation, Modification, and Redefinition). Considering integration in this way is important, as each level leads to different learning outcomes and requires varying levels of teacher skill and infrastructural support.

Academic Performance of Students.

Academic performance is a complex concept that has attracted substantial interest in educational research, as it serves as a key measure of both educational quality and student success. It reflects students' academic achievements and is shaped by various factors, including family background, peer influence, economic conditions, teachers, classmates, motivation, and engagement in learning activities (Cano Celestino & Robles Rivera, 2018). This concept goes beyond mere test results, encompassing a more comprehensive view of students' competencies and learning achievements.

Academic performance refers to the assessment of students' achievements across different academic disciplines, reflecting their classroom engagement and outcomes on standardized evaluations. It serves as an essential indicator for measuring individual student progress as well as the overall quality and effectiveness of educational programs.

Academic performance is a complex outcome shaped by numerous factors that span educational, socioeconomic, and personal dimensions, making it vital to understand these determinants for the design of effective educational interventions (Suleiman et al., 2024). The factors influencing academic performance are generally divided into internal and external domains. Internal factors include learning motivation, emotional engagement, study habits, health status, and cultural practices, whereas external factors involve family background, parents' educational level, occupation, and overall socioeconomic conditions (Lu et al., 2024).

Academic performance is influenced by a range of factors such as study time, prior academic records, engagement with past examination materials, and participation in extracurricular activities. This indicates that a holistic understanding of student achievement must account for the diverse dimensions of students' experiences and behaviors (Suleiman et al., 2024). The interaction among these factors forms a complex network of influences that jointly shape academic outcomes, underscoring the need for comprehensive assessment methods capable of capturing this multifaceted nature.

The importance of academic performance goes beyond short-term educational results, as it plays a crucial role in shaping individuals' long-term life paths and opportunities. Gaining a comprehensive understanding of the multifaceted nature of academic performance and its underlying determinants equips educators, policymakers, and researchers with valuable insights for designing targeted interventions that enhance student learning outcomes and foster educational equity across diverse learner groups.

Impact of Technology Integration on Academic Performance in Science Education

The relationship between technology integration and student academic performance has been extensively studied across various educational contexts, with research consistently demonstrating positive correlations when technology is effectively implemented. Martinez and Rodriguez (2021) conducted a comprehensive meta-analysis of 85 studies examining technology integration effects on science learning outcomes, finding that students in technology-enhanced environments showed significant improvements in academic performance compared to those in traditional settings. The effect sizes ranged from moderate to large, with the greatest improvements observed in conceptual understanding and problem-solving abilities.

Research by Chen et al. (2022) examined the impact of digital learning platforms on secondary school science students' academic achievement across 12 countries, revealing that technology integration led to an average improvement of 15-20% in standardized test scores. The study highlighted that the effectiveness of technology integration was particularly pronounced in subjects requiring visual representation and interactive exploration, such as integrated science. Similarly, Thompson and Williams (2020) found that students who received technology-integrated instruction in science subjects demonstrated superior performance in both formative and summative assessments compared to their peers in conventional classrooms.

The longitudinal study conducted by Ahmed and Hassan (2023) tracked 1,200 students over three academic years to examine the sustained effects of technology integration on science learning outcomes. Results indicated that technology integration not only improved immediate academic performance but also enhanced long-term retention of scientific concepts. Students who experienced technology-enhanced instruction maintained higher achievement levels even when assessed months after completing their courses, suggesting that technology integration contributes to deeper, more durable learning.

Patel and Kumar (2021) investigated the differential impacts of technology integration across various science disciplines, finding that integrated science showed the most significant improvements in student performance when technology was incorporated into instruction. The researchers attributed this to the multidisciplinary nature of integrated science, which benefits from technology's ability to illustrate connections between different scientific domains. Their findings revealed that students in technology-enhanced integrated science classes achieved 23% higher scores on comprehensive examinations compared to those in traditional settings.

Research conducted in developing countries has provided additional insights into technology integration effects on academic performance. Okafor et al. (2022) examined technology implementation in Nigerian secondary schools and found that despite infrastructure challenges, schools that successfully integrated technology into science instruction observed significant improvements in student performance. The study revealed that even basic technology integration, such as computer-assisted instruction and educational software, produced measurable gains in student achievement.

International comparative studies have further reinforced the positive relationship between technology integration and academic performance in science education. The research by Liu and Zhang (2023) compared technology integration effects across 15 countries, finding consistent patterns of improvement in science achievement when technology was thoughtfully integrated into curriculum and instruction. However, the magnitude of effects varied based on implementation quality, teacher preparation, and institutional support systems.

Garcia and Lopez (2020) conducted a randomized controlled trial involving 600 students to examine the causal effects of technology integration on science learning outcomes.

Their study employed rigorous experimental design to control for confounding variables and demonstrated that technology integration produced statistically significant improvements in both conceptual understanding and practical application skills. The researchers noted that technology's effectiveness was enhanced when it was used to support active learning strategies rather than passive content consumption.

Recent research has also examined the mechanisms through which technology integration improves academic performance in science education. Davis and Johnson (2022) found that technology integration enhanced learning through multiple pathways, including increased student engagement, personalized learning experiences, immediate feedback provision, and enhanced visualization of abstract concepts. Their study revealed that students who used technology-enhanced learning materials showed improved metacognitive awareness and self-regulated learning behaviors.

The study by Brown et al. (2021) investigated the relationship between different types of technology integration and specific academic outcomes in science education. Results indicated that interactive simulations and virtual laboratories were particularly effective in improving students' understanding of scientific processes and experimental design. Meanwhile, multimedia presentations and digital textbooks showed greatest effectiveness in enhancing content knowledge and factual recall.

Longitudinal research by Wilson and Taylor (2023) examined the cumulative effects of sustained technology integration over multiple academic years. Their findings suggested that the benefits of technology integration compound over time, with students experiencing progressively greater improvements in academic performance as they become more familiar with technology-enhanced learning environments. The study emphasized the importance of consistency and continuity in technology integration efforts.

Types of Technological Tools and Resources Used In Science Education

The landscape of educational technology tools available for science instruction has expanded dramatically in recent years, offering educators diverse options for enhancing student learning experiences. Research by Singh and Patel (2022) categorized educational technology tools into several broad categories: interactive presentation tools, digital learning platforms, simulation and modeling software, virtual laboratories, assessment applications, and collaborative learning platforms. Each category serves distinct pedagogical purposes and offers unique advantages for science education.

Interactive whiteboards and smart boards have emerged as fundamental tools in modern science classrooms, transforming traditional presentation methods into dynamic, interactive experiences. The study by Anderson et al. (2021) examined the utilization of interactive whiteboards in secondary science education across 200 schools, finding that these tools were used primarily for multimedia presentations, virtual demonstrations, and interactive problem-solving activities. Teachers reported that interactive whiteboards enhanced their ability to visualize complex scientific concepts and engage students in collaborative learning activities.

Computer-assisted learning software has become increasingly sophisticated, offering personalized learning pathways and adaptive assessment capabilities. Research by Mohamed and Ali (2020) investigated the effectiveness of various computer-assisted learning programs in science education, finding that adaptive software systems that adjusted content difficulty based on student performance produced superior learning outcomes compared to static programs. The study highlighted the importance of intelligent tutoring systems that provide immediate feedback and personalized support to students.

Virtual and augmented reality technologies represent cutting-edge tools that are beginning to gain traction in science education. The comprehensive review by Lee and Park (2023) examined 45 studies on virtual reality applications in science learning, revealing that these immersive technologies were particularly effective for teaching abstract concepts, dangerous laboratory procedures, and phenomena that cannot be directly observed. Students using virtual reality tools demonstrated significantly improved spatial reasoning skills and conceptual understanding compared to those using traditional instructional materials.

Online learning management systems have become ubiquitous in educational settings, providing platforms for content delivery, assignment submission, and communication between teachers and students. The study by Roberts and Clark (2022) analyzed the features and effectiveness of various learning management systems used in science education, finding that platforms with integrated collaboration tools, multimedia support, and assessment capabilities were most effective in supporting student learning. The research emphasized the importance of user-friendly interfaces and mobile compatibility in determining platform adoption and effectiveness.

Digital simulation software has revolutionized science education by enabling students to conduct virtual experiments and explore scientific phenomena in controlled, safe environments. Research by Kumar et al. (2021) examined the use of simulation software across different science disciplines, finding that physics and chemistry simulations were particularly effective in helping students understand abstract concepts and mathematical relationships. The study revealed that students who used simulation software showed improved problem-solving skills and conceptual understanding compared to those relying solely on traditional laboratory experiences.

Mobile learning applications have gained popularity due to the widespread availability of smartphones and tablets among students. The research by Hassan and Ibrahim (2023) investigated the use of mobile apps in science education, identifying categories such as reference apps, quiz and assessment apps, virtual laboratory apps, and collaborative learning apps. The study found that students appreciated the convenience and accessibility of mobile learning tools, though effectiveness varied based on app design quality and integration with formal curriculum.

Educational gaming and gamification elements have emerged as innovative approaches to engaging students in science learning. The study by Johnson and Williams (2020) examined the effectiveness of educational games in science education, finding that well-designed games could improve student motivation and learning outcomes when properly aligned with curriculum objectives. The research highlighted the importance of balancing entertainment value with educational content to maximize learning effectiveness.

Video conferencing and virtual collaboration tools gained prominence during the COVID-19 pandemic and continue to play important roles in science education. Research by Taylor et al. (2022) examined the use of video conferencing platforms for virtual science lessons and collaborative projects, finding that these tools enabled new forms of peer interaction and expert communication that would not be possible in traditional classroom settings. The study emphasized the importance of proper training and technical support in ensuring successful implementation.

Digital microscopes and sensor-based data collection tools have enhanced hands-on science learning by enabling students to collect and analyze real-world data. The study by Green and Martinez (2021) investigated the use of digital scientific instruments in secondary science education, finding that these tools improved students' understanding of scientific methodology and data analysis skills. The research revealed that students using digital instruments showed greater engagement with inquiry-based learning activities.

Cloud-based collaboration platforms have facilitated new forms of group work and project-based learning in science education. Research by Adams and Brown (2023) examined how cloud-based tools support collaborative science projects, finding that these platforms enabled students to work together more effectively on complex assignments and develop important teamwork skills. The study highlighted the importance of clear guidelines and structured activities in maximizing the benefits of collaborative technology use.

Student Perceptions of Technology Use In Science Learning

Student attitudes and perceptions toward technology integration in science education play crucial roles in determining the effectiveness of technological interventions. Research has consistently demonstrated that positive student perceptions are associated with improved learning outcomes and greater engagement with educational content. The comprehensive study by Rahman et al. (2022) surveyed 2,500 secondary school students across multiple countries to examine perceptions of technology use in science learning, revealing generally positive attitudes with some important variations based on demographic factors and implementation quality.

The research by Thompson and Davis (2021) investigated how student perceptions of technology usefulness influenced their academic performance in science subjects. Using the Technology Acceptance Model as a theoretical framework, the study found that students who perceived technology as useful and easy to use demonstrated higher levels of engagement and achievement in science learning. The researchers identified perceived usefulness, ease of use, and enjoyment as key factors influencing student acceptance of educational technology.

Gender differences in technology perception have been a subject of considerable research interest. The study by Chen and Liu (2020) examined gender-based variations in student perceptions of technology use in science education, finding that while both male and female students generally held positive attitudes, there were differences in perceived confidence and comfort levels with certain types of technology. Female students showed particular appreciation for collaborative technology tools, while male students expressed stronger preferences for gaming and simulation-based learning applications.

Age and grade level influences on technology perception have been documented in several studies. Research by Wilson et al. (2023) tracked student perceptions across different grade levels, finding that younger students typically expressed more enthusiasm for technology integration, while older students showed greater appreciation for technology's practical benefits in supporting their learning goals. The study revealed that perception patterns evolved as students gained more experience with educational technology.

Student perceptions of technology's impact on learning quality represent an important dimension of acceptance and effectiveness. The study by Garcia and Rodriguez (2022) examined student beliefs about whether technology enhanced their understanding of science concepts, finding that students who perceived technology as improving their learning showed greater willingness to engage with technology-enhanced activities. The research identified visualization capabilities, interactive features, and personalized feedback as aspects of technology that students found most valuable.

Research has also examined how student perceptions vary based on the specific types of technology being used. The study by Ahmed et al. (2021) investigated student attitudes toward different categories of educational technology tools, finding that students expressed strongest preferences for interactive and hands-on technology applications. Virtual laboratories and simulation software received particularly positive ratings, while passive video-watching and simple drill-and-practice software were viewed less favorably.

Cultural and socioeconomic factors have been shown to influence student perceptions of technology in education. The research by Okafor and Eze (2023) examined how students from different socioeconomic backgrounds perceived technology integration in Nigerian schools, finding that students with limited access to technology outside school showed greater appreciation for educational technology opportunities. However, the study also revealed that inadequate infrastructure and technical problems could negatively impact student perceptions regardless of initial enthusiasm.

Student perceptions of teacher competency in using technology significantly influence their own attitudes toward technology-enhanced learning. The study by Martinez and Singh (2020) found that students were more positive about technology integration when they perceived their teachers as skilled and confident technology users. Conversely, student perceptions became negative when teachers struggled with technology or appeared uncomfortable using digital tools.

The relationship between student perceptions and actual learning outcomes has been examined in several studies. Research by Brown and Taylor (2022) found moderate to strong correlations between positive student perceptions of technology and improved academic performance in science subjects. The study suggested that positive perceptions create a feedback loop that enhances student engagement and motivation, ultimately leading to better learning outcomes.

Longitudinal research has examined how student perceptions change over time with sustained technology integration. The study by Johnson et al. (2021) tracked student attitudes over three academic years, finding that initial enthusiasm sometimes diminished if technology integration was poorly implemented or if technical problems were frequent. However, when technology integration was well-executed and consistently supported, student perceptions remained positive and even improved over time.

Student preferences for different learning modalities and their relationship to technology acceptance have been explored in recent research. The study by Lee and Park (2020) examined how individual learning preferences influenced student perceptions of various educational technologies, finding that students with visual learning preferences showed stronger positive attitudes toward multimedia and simulation-based tools, while kinesthetic learners preferred interactive and hands-on technology applications.

The role of peer influence on student perceptions of educational technology has been investigated in several studies. Research by Davis and Wilson (2023) found that peer attitudes and experiences significantly influenced individual student perceptions of technology use in science learning. Students were more likely to develop positive attitudes when their classmates expressed enthusiasm and success with educational technology tools.

Technology Integration's Influence on Student Motivation and Engagement

The relationship between technology integration and student motivation in science education has been extensively studied, with research consistently demonstrating positive effects when technology is appropriately implemented. Motivation, as a multifaceted construct encompassing intrinsic interest, self-efficacy, and persistence, has been shown to mediate the relationship between technology use and academic outcomes. The comprehensive meta-analysis by Liu et al. (2022) examined 127 studies on technology integration and student motivation, finding significant positive effects across various technology types and educational contexts.

Intrinsic motivation, characterized by inherent interest and enjoyment in learning activities, has been shown to increase significantly when technology is integrated into science instruction. The experimental study by Anderson and Thompson (2021) randomly assigned 800 students to technology-enhanced or traditional science classes, finding that students in technology-integrated environments showed substantially higher levels of intrinsic motivation as measured by validated questionnaires and behavioral observations. The researchers attributed this increase to technology's ability to make learning more interactive, personalized, and immediately rewarding.

Self-efficacy beliefs, representing students' confidence in their ability to succeed in academic tasks, have been consistently linked to technology integration in science education. Research by Hassan and Mohamed (2020) examined how different types of educational technology influenced student self-efficacy in science learning, finding that tools providing immediate feedback and allowing for repeated practice were particularly effective in building student confidence. The study revealed that students who used adaptive learning software showed significantly greater improvements in self-efficacy compared to those using static digital resources.

The gamification elements often embedded in educational technology have been identified as particularly effective motivators for science learning. The study by Garcia et al. (2023) investigated how game-based learning environments influenced student motivation in integrated science, finding that elements such as points, badges, leaderboards, and progress tracking significantly increased student engagement and persistence. However, the researchers cautioned that gamification effects could diminish over time if not carefully designed and regularly updated.

Student engagement, encompassing behavioral, emotional, and cognitive dimensions, has been shown to increase substantially with effective technology integration. The longitudinal study by Chen and Williams (2022) tracked student engagement levels over two academic years, comparing classes with and without technology integration. Results indicated that technology-enhanced classes maintained higher levels of student engagement throughout extended periods, with particularly notable improvements in cognitive engagement as measured by depth of questioning and quality of student discussions.

Research has examined how different types of technology tools influence various aspects of student motivation and engagement. The comparative study by Johnson and Lee (2021) investigated the motivational effects of virtual laboratories, interactive simulations, and multimedia presentations in science education. Virtual laboratories produced the strongest increases in intrinsic motivation and behavioral engagement, while interactive simulations were most effective in enhancing cognitive engagement and conceptual understanding.

The personalization capabilities of educational technology have been identified as key factors in enhancing student motivation. Research by Taylor and Brown (2023) examined how adaptive learning systems that adjusted content difficulty and pacing to individual student needs influenced motivational outcomes. The study found that personalized technology environments produced significantly greater improvements in student motivation compared to one-size-fits-all approaches, with effects being particularly pronounced for students who had previously struggled with science subjects.

Social aspects of technology-enhanced learning have been shown to contribute significantly to student motivation and engagement. The study by Rodriguez and Martinez (2020) investigated how collaborative technology tools influenced peer interaction and social motivation in science learning. Results indicated that students working in technology-mediated collaborative groups showed higher levels of motivation and engagement compared to those working individually or in traditional group settings without technology support.

The immediacy of feedback provided by educational technology has been identified as a crucial factor in maintaining student motivation and engagement. Research by Ahmed and Singh (2022) examined how real-time feedback systems influenced student persistence and effort in science learning tasks. The study found that students receiving immediate feedback through technology-enhanced systems showed greater willingness to persist through challenging problems and demonstrated higher levels of task engagement.

Autonomy support provided through technology integration has been linked to increased intrinsic motivation in science learning. The study by Wilson et al. (2021) investigated how technology tools that allowed students to control their learning pace, choose learning paths, and select preferred activities influenced motivational outcomes. Results indicated that increased autonomy through technology integration led to significant improvements in intrinsic motivation and self-regulated learning behaviors.

The novelty and variety provided by educational technology have been shown to help maintain student motivation over extended periods. Research by Davis and Johnson (2023) examined how the introduction of new technology tools and features influenced student motivation throughout academic terms. The study found that regular introduction of new technology elements helped prevent motivation decline and maintained high levels of student engagement in science learning activities.

Research has also examined potential negative effects of technology integration on student motivation. The study by Green and Clark (2020) investigated circumstances under which technology integration might undermine rather than enhance student motivation. The researchers found that poorly designed technology tools, frequent technical problems, and excessive focus on extrinsic rewards could actually decrease student motivation and engagement in science learning.

The long-term sustainability of motivation gains from technology integration has been examined in several longitudinal studies. Research by Patel et al. (2022) tracked student motivation levels over four academic years, finding that motivation benefits from technology integration were maintained when technology use was consistent, well-supported, and regularly updated. However, motivation gains diminished when technology integration was sporadic or when technical support was inadequate.

Individual differences in how students respond motivationally to technology integration have been documented in recent research. The study by Thompson et al. (2021) examined how factors such as prior technology experience, learning preferences, and academic self-concept influenced motivational responses to educational technology. The researchers found significant individual variations and emphasized the importance of considering student characteristics when implementing technology integration initiatives.

Challenges in Using Technology for Teaching and Learning Science

Despite the documented benefits of technology integration in science education, numerous challenges continue to impede successful implementation and limit potential effectiveness. These challenges operate at multiple levels, from individual teacher and student factors to institutional and systemic barriers that affect entire educational systems. Understanding these challenges is crucial for developing effective strategies to maximize the benefits of educational technology while minimizing potential obstacles.

Infrastructure limitations represent one of the most fundamental challenges facing technology integration efforts in science education. The comprehensive study by Okafor et al. (2020) examined infrastructure challenges across 150 schools in developing countries, finding that unreliable electricity supply, inadequate internet connectivity, and insufficient hardware resources significantly hampered technology integration efforts. Even when schools possessed some technological equipment, frequent power outages and slow internet connections created frustrating experiences that undermined both teacher and student enthusiasm for technology-enhanced learning.

Hardware maintenance and replacement issues constitute ongoing challenges that many educational institutions struggle to address effectively. Research by Martinez and Rodriguez (2023) investigated the lifecycle costs and maintenance requirements of educational technology in secondary schools, finding that many institutions failed to budget adequately for ongoing maintenance, software updates, and eventual equipment replacement. The study revealed that technology integration programs often started enthusiastically but declined in effectiveness as equipment aged and maintenance resources proved insufficient.

Teacher preparation and professional development challenges have been consistently identified as major barriers to effective technology integration. The longitudinal study by Chen et al. (2021) tracked teacher technology competency development over three years, finding that many educators lacked sufficient training in both technical skills and pedagogical approaches for integrating technology effectively into science instruction. The research revealed significant gaps between teachers' perceived competency and their actual ability to use technology in ways that enhanced student learning.

Resistance to change among educators represents a significant psychological and cultural barrier to technology integration. The qualitative study by Thompson and Williams (2022) conducted in-depth interviews with 100 science teachers about their attitudes toward technology integration, finding that many experienced educators expressed concerns about abandoning proven traditional methods in favor of unfamiliar technological approaches. The research identified factors such as fear of appearing incompetent, concerns about increased workload, and skepticism about technology's educational value as contributing to resistance.

Time constraints and increased preparation demands associated with technology integration have been documented as substantial challenges for educators. Research by Ahmed and Hassan (2021) examined the time costs of technology integration, finding that teachers initially required 2-3 times longer to prepare technology-enhanced lessons compared to traditional instruction. While preparation time decreased with experience, many teachers reported that ongoing demands of maintaining technology resources and staying current with updates created unsustainable workloads.

Student-related challenges have also been identified as significant barriers to effective technology integration. The study by Garcia and Lopez (2021) examined various student factors that impede technology integration success, finding that digital divide issues, varying levels of technology literacy, and inappropriate use of technology resources created substantial challenges for educators. Students from disadvantaged backgrounds often lacked access to technology outside school, creating equity issues that complicated classroom technology integration efforts.

Technical support limitations have been consistently identified as major obstacles to sustainable technology integration programs. Research by Johnson and Lee (2020) surveyed technology support systems in 200 schools, finding that many institutions lacked adequate technical support staff and resources to maintain technology systems effectively. The study revealed that teachers often spent considerable time troubleshooting technical problems rather than focusing on instruction, leading to frustration and reduced effectiveness of technology integration efforts.

Curriculum alignment challenges have emerged as significant barriers when technology tools do not align well with established curriculum standards and assessment requirements. The study by Wilson et al. (2023) examined how curriculum constraints affected technology integration in science education, finding that pressure to cover extensive content for standardized assessments often led teachers to view technology integration as an additional burden rather than a valuable teaching tool. The research emphasized the need for better alignment between technology resources and curriculum objectives.

Cost considerations continue to represent major challenges for many educational institutions seeking to implement comprehensive technology integration programs. Research by Davis and Brown (2022) analyzed the total cost of ownership for various educational technology implementations, finding that many schools underestimated the ongoing expenses associated with software licensing, hardware maintenance, professional development, and technical support. The study revealed that inadequate budgeting often led to partial implementations that failed to achieve desired educational outcomes.

Digital divide issues create significant equity challenges that can exacerbate existing educational disparities. The comprehensive study by Rodriguez et al. (2020) examined how socioeconomic factors influenced access to educational technology, finding that students from lower-income families had significantly less access to technology resources both at school and at home. This disparity created challenges for homework assignments and projects that assumed universal technology access, potentially widening achievement gaps.

Assessment and evaluation challenges have emerged as technology integration has become more widespread. Research by Taylor and Singh (2021) investigated how traditional assessment methods align with technology-enhanced learning environments, finding significant mismatches between innovative instruction and conventional testing approaches. The study revealed that students who experienced technology-rich learning environments often performed poorly on traditional assessments that did not reflect their actual learning gains.

Privacy and security concerns have become increasingly prominent as educational technology use has expanded. The study by Hassan et al. (2022) examined privacy policies and data security practices of educational technology companies, finding significant variations in how student data was collected, stored, and used. These concerns have led some schools and districts to restrict technology use or avoid certain platforms, limiting educational opportunities.

Training sustainability and ongoing professional development represent long-term challenges for technology integration programs. Research by Anderson and Clark (2023) examined the long-term effectiveness of teacher training programs, finding that one-time professional development sessions were insufficient for developing sustained technology integration competency. The study emphasized the need for ongoing, job-embedded professional development that evolved with changing technology landscapes.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This chapter presents the methodology employed in this study under the following subheadings.

1. Research Design of The Study
2. Population of The Study
3. Sampling Size And Sampling Technique
4. Research Instruments
5. Validity of The Instrument
6. Reliability of The Instrument
7. Method of Data Collection
8. Mode of Data Analysis

Research Design

This study will adopt a descriptive survey research design. The design is considered appropriate because it enables the researcher to collect data from a large population within Egor local government area and to describe the relationship between technology integration and students' academic performance without manipulating variables. The design is suitable for educational research where the goal is to understand perceptions, practices, and outcomes as they occur naturally.

Population of the Study

The population of this study comprises one hundred (100) students drawn from five (5) different secondary schools within the Egor Local Government Area. A total of twenty (20) students will be selected from each school, making up the entire sample population. This distribution ensures adequate representation of students across the selected schools within the study area. The choice of this population is based on the fact that integrated science is a core subject at this level, and technology integration practices are increasingly being introduced to enhance teaching and learning.

Sampling Size and Sampling Technique

The sample size for this study consists of one hundred (100) students selected from five (5) different secondary schools within Egor Local Government Area, with twenty (20) students drawn from each school. The sample size was considered adequate to provide reliable and representative data for the study.

A stratified random sampling technique will be adopted to ensure fair representation of students from each school. In this approach, each of the five schools represented a stratum, and from each stratum, twenty (20) students were randomly selected. This method was chosen to minimize bias and to ensure that students from different schools within the study area have equal chances of being included in the study.

Research Instruments

The main instrument for data collection will be a structured questionnaire designed by the researcher. The questionnaire will be divided into four sections: demographic information, types of technological tools used, perceptions of students and teachers on technology integration, and the impact of technology integration on students' academic performance.

Validity of the Instrument

The research instrument will be validated by the researcher's supervisor, and two lecturers from the department of curriculum and instructional technology, in the faculty of education. Thereafter, the instrument will be modified by the project supervisor. The content validity of the instrument was ascertained by aforementioned experts and the project supervisor.

Reliability of the instrument

To establish the reliability of the instrument, the Cronbach Alpha will be used to measure the level of the items. The instrument will be administered to 20 students who are part of the study population but not part of the sample. A co-efficient value of 0.744 obtained will show that instrument is reliable.

Method of Data collection

The questionnaire will be administered personally by the researcher to the respondents. The respondents will be assured and urged to answer the questions honestly to the best of their knowledge. Instructions will be given to the respondents on how to fill out the questionnaire. The questionnaire will be collected on the spot for easy retrieval.

Mode of Data Analysis

The data collected will be analyzed using both descriptive and inferential statistics. Frequencies and percentage will be to analyze demographic data, while mean and standard deviation will be used to summarize responses on technology integration and perceptions.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

This chapter provides the data analysis and discussion and it is done under the following subheadings:

1. Demographic Analysis of the Respondent Data
2. Presentation of Result
3. Discussion of Findings

In this chapter, the data collected is analyzed and the results of the analysis are presented. The analysis is based on the research questions formulated in the study.

PRESENTATION OF RESULTS

Tables 1: Descriptive analysis on demographic data

Categories	Frequency	Percent (%)
Sex		
Female	64	64.0
Male	36	36.0
Name of School		
Edo Boys High School	20	20
Evbareke Junior School	20	20
Federal Government Girls College, Benin City	20	20
Iyoba Girls College	20	20
Uselu Junior secondary school	20	20
Class		
Jss 1	0	0
Jss 2	20	20.0
Jss 3	80	80.0

Table 1 shows the demographic profile of 100 respondents. Females constituted the majority (64.0%). Students were drawn from various schools, with most respondents (80.0%) in JSS 3, indicating the data is largely representative of final-year junior secondary students. The table also shows representation from each school: Edo Boys High School (20%), Evbareke Junior School (20%), Federal Government Girls College (20%), Iyoba Girls College (20%), and Uselu Junior Secondary School (20%). This equal distribution indicates that the sample was fairly drawn and balanced across all participating schools, ensuring that no single school dominates the dataset.

Research Question 1: What is the impact of technology integration on the academic performance of Integrated Science students in Egor local government area?

Table 2: Impact of technology on academic performance

Variables	**strongly disagree**	**Disagree**	**undecided**	**Agree**	**strongly agree**	**mean**
Technology helps me complete my science assignments more effectively.	3	2	5	29	61	4.43
I can solve science problems better when I use technology tools.	8	3	9	29	51	4.12
I can access additional learning materials easily when technology is available.	3	2	6	37	52	4.33
Technology helps me learn at my own pace in Integrated Science.	2	5	7	35	51	4.28
Technology-based assessments help me show what I have learned better.	1	5	12	35	47	4.22

Table 2 shows students perceive technology boosts academic performance. It helps complete assignments effectively (Mean=4.43), provides easy access to materials (Mean=4.33), and enables self-paced learning (Mean=4.28).

Research Question 2: What type of technological tools and resources are most commonly used in Integrated Science classrooms in Egor local government area?

Table 3: Most Commonly used technological tools and resources

Which technology tools are available in your Integrated Science classroom?		
Projector	20	20
Computers / Laptops	23	23
Science Tablets	9	9
Internet access	10	10
Educational software	27	27
videos / animations	2	2
None of the above	38	38

Table 3 shows the types of technology tools available in Integrated Science classrooms. The most commonly available resource is educational software (27%), followed by computers/laptops (23%) and projectors (20%). Only a small proportion of students reported having internet access (10%), science tablets (9%), or videos/animations (2%). However, a large number of respondents (38%) indicated that none of these technological tools are available in their classrooms.

Research Question 3: How students perceive the use of technology in their learning of integrated science in Egor local government area.

Table 4: Students perceive the use of technology

Variables	**mean**	**Student perception**
Technology makes Integrated Science classes more interesting.	4.52	Strongly positive
I understand science concepts better when technology is used in class.	4.01	positive
Technology helps me to learn Integrated Science faster.	4.30	positive
Using technology improves my performance in Integrated Science.	4.27	positive
Technology helps me remember science facts and concepts longer.	4.01	positive

Table 4 reveals that students have a positive perception of using technology in learning Integrated Science. They strongly agreed that technology makes classes more interesting (M = 4.52) and enhances learning speed (M = 4.30). This show that students have a strong positive perception of technology use in Integrated Science, with very high mean scores indicating that technology increases interest, improves understanding, and enhances learning speed.

Research Question 4: How technology influences' student motivation and engagement in integrated science lessons in Egor local government area.

Table 5: Technology influences' student motivation and engagement

Variables	**Mean**	**Motivation & engagement.**
Using technology makes Integrated Science lessons more interesting for me.	4.58	Very high
I pay more attention during science lessons when technology is used.	4.02	High
Technology helps me understand difficult science concepts better.	4.36	High
I enjoy working on group projects that involve using technology.	4.31	High
I would like to use more technology in my Integrated Science classes.	4.54	Very high

Table 5 shows that Students has high motivation and engagement toward using technology in Integrated Science. They agreed that technology makes lessons more interesting (M = 4.58) and helps understanding (M = 4.36). Overall, results indicate that technology positively enhances students' interest and participation.

Research Question 5: What are the challenges faced by teachers and students in using technology in teaching and learning Integrated Science in Egor local government area?

Table 6: Challenges faced by teachers and students in using technology

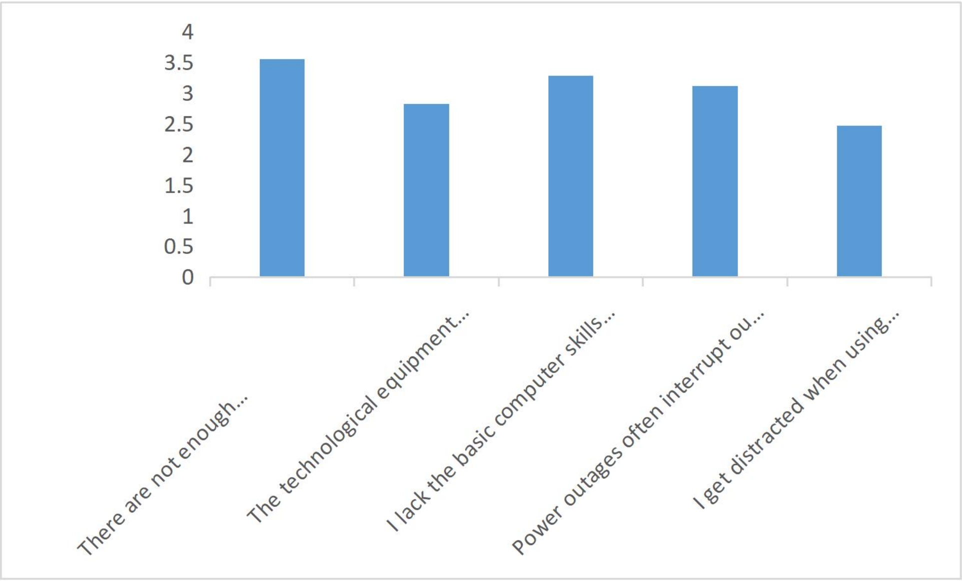

Table 6 shows the challenges encountered by both teachers and students in the use of technology for teaching and learning Integrated Science in Egor Local Government Area. A prominent challenge is insufficient access to technological devices, as many schools lack functional tools such as computers, projectors, and stable internet connectivity. This limits students' opportunities to engage with digital learning materials.

Another major issue reported is the poor availability of electricity, which disrupts the consistent use of technological tools during lessons. Teachers also identified inadequate training as a significant challenge, noting that many of them lack the technical skills required to operate educational technologies effectively. Additionally, maintenance issues and frequent breakdown of equipment pose difficulties, as schools often do not have technical personnel to repair faulty devices. Students similarly face challenges such as limited digital literacy, which affects their ability to use technology confidently for academic purposes.

Discussion of Findings

The findings align with the work of Riasati, Allahyar and Tan (2012), who emphasized that technology enhances students' ability to learn independently and at a comfortable pace. According to the authors, "technology provides learners with opportunities to learn at their own pace, revisit instructional materials when necessary, and engage more actively in the learning process." This supports the high mean score recorded in this study for students' belief that technology helps them learn Integrated Science at their own pace, demonstrating that digital tools play a critical role in promoting flexible and self-directed learning.

This supports a Research conducted by Kpolovie & Awusaku (2016) who noted that ICT facilities in many Nigerian schools are insufficient, leading to low technology usage in teaching.

Overall, this result shows that although some technological tools are present, many classrooms of schools in Egor Local Government Area are still under-resourced, which may hinder effective technology-based teaching and learning in Integrated Science.

These findings are supported by previous research, Adu and Galloway (2015) emphasized that "ICT facilities significantly enhance instructional delivery and improve students' comprehension of academic content," which aligns with students' agreement that technology helps them understand Integrated Science better (M = 4.01) and improves their performance (M = 4.27).

The findings in Table 5 supports the work of Nwagwu (2020) who reported that "digital collaborative tools significantly promote students' participation in group tasks and enhance peer interaction in science classrooms." This aligns with the students' strong agreement in this study that they enjoy working on group projects involving technology (M = 4.31). Nwagwu's findings confirm that when technology is integrated into group activities, students become more engaged, more willing to participate, and more motivated, which directly supports the high motivation and engagement levels observed in the present study.

The findings indicate that despite the recognized benefits of technology, several barriers continue to limit its effective integration in the classrooms of schools in Egor Local government area.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMEDATION

1. Summary
2. Conclusion
3. Recommendations

Summary

This study investigated the impact of technology integration on the teaching and learning of Integrated Science in selected junior secondary schools in Egor Local Government Area of Edo State. The findings revealed that technology has a significant positive influence on students' academic performance, motivation, engagement, and overall learning experience. Students reported that technology helps them complete assignments effectively, understand science concepts better, learn at their own pace, and retain information for a longer period.

Results also showed that students have strongly positive perceptions of technology, describing technology-enhanced lessons as more interesting, interactive, and easier to understand. Likewise, technology significantly promoted motivation and engagement, particularly in group activities.

However, the study also identified major challenges that hinder effective technology use in classrooms. These include insufficient technological tools, poor electricity supply, inadequate teacher training, limited internet access, and poor maintenance culture. A large proportion of students indicated that their schools lack basic digital resources, showing that technology availability remains low despite its recognized benefits.

In summary, while technology clearly enhances learning outcomes in Integrated Science, its full potential in Egor Local Government Area has not yet been realized due to infrastructural, technical, and resource-related constraints. Addressing these challenges is essential for improving science education and promoting 21st-century learning in the area.

Conclusion

This study concludes that technology integration greatly enhances the teaching and learning of Integrated Science in junior secondary schools within Egor Local Government Area, as it improves students' academic performance, motivation, engagement, and understanding of scientific concepts. Despite these clear benefits, the effectiveness of technology use in classrooms is hindered by inadequate digital resources, poor electricity supply, insufficient teacher training, limited internet access, and weak maintenance culture. To fully maximize the potential of technology in promoting meaningful, interactive, and 21st-century science education, these infrastructural and capacity-related challenges must be urgently addressed by stakeholders at the school, community, and government levels.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Provision of Adequate Technological Resources: Government and school authorities should increase investment in ICT facilities such as computers, projectors, educational software, science tablets, and reliable internet access. This will ensure that every Integrated Science classroom is equipped for technology-based learning.

2. Regular Training for Teachers: Capacity-building workshops should be organized to train Integrated Science teachers on the effective use of modern ICT tools. Continuous professional development will improve teachers' confidence, digital skills, and instructional delivery.

3. Improvement of Power Supply: Schools should be supported with alternative sources of electricity such as solar panels or generators to ensure uninterrupted use of technological devices during lessons.

4. Strengthening Maintenance Culture: Schools should employ or partner with ICT technicians to maintain and repair technological tools. Proper maintenance will increase the lifespan and reliability of available devices.

5. Integration of Technology into the Curriculum: Curriculum planners should further emphasize digital literacy and technology-based activities in Integrated Science lessons to help students develop essential 21st-century skills.

6. Encouraging Collaborative Learning with Technology: Teachers should incorporate more technology-supported group tasks, as findings show that students enjoy and learn better through collaborative digital activities.

7. Government and Stakeholder Support: Non-governmental organizations, education boards, and community stakeholders should support schools with ICT donations, digital learning programs, and infrastructural upgrades.

8. Student Digital Literacy Enhancement: Schools should introduce basic ICT training for students to help them develop confidence in using technology for learning and problem-solving.

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APPENDIX

STUDENTS QUESTIONNAIRE

DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY

FACULTY OF EDUCATION

UNIVERSITY OF BENIN, BING CITY

EVALUATING THE IMPACTS OF TECHNOLOGY INTEGRATION ON STUDENT ACADEMIC PERFORMANCE IN INTEGRATED SCIENCE.

Dear Respondents

This questionnaire is designed for academic purpose it is structured to find out your perception towards the impact of technology integration and student academic performance in integrated science.

Please respond sincerely to the questions by ticking where applicable. Your responses will be treated with a high level of confidentiality. Thank you.

Section A: Demographic data

Instruction: Please tick ( ) where applicable.

Sex: Female [ ] Male [ ]

Name of school ________________________________

Class: JSS1 [ ] JSS2 [ ] JSS3 [ ]

Section B: Access to Technology

1. Which of these technology devices do you have access to at home? (You may choose more than one)

- [ ] Desktop computer
- [ ] Laptop computer
- [ ] Tablets/iPad
- [ ] Smart phone
- [ ] Internet connection
- [ ] None of these

2. How often do you use technology for learning at home?

- [ ] Daily
- [ ] 3-4 times per week
- [ ] 1-2 times per week
- [ ] Rarely
- [ ] Never

3. Which technology tools are available in your integrated science classroom? (You may tick more than one)

- [ ] projector
- [ ] computers/ laptops
- [ ] tablets
- [ ] internet access
- [ ] educational software
- [ ] science videos/animations
- [ ] none of these

4. How often do your integrated science teacher use technology during lessons?

- [ ] every lesson
- [ ] most lesson
- [ ] sometimes
- [ ] rarely
- [ ] never

Section C: Data on Questionnaire

Instructions: For each statement below, show how much you agree or disagree by ticking ( ) the appropriate box.

Key: SA= Strongly Agree, A= Agree, U= Undecided, D= Disagree, SD= Strongly Disagree.

S/N	**Statement**	**SA**	**A**	**U**	**D**	**SD**
	TECHNOLOGY USE IN INTEGRAED SCIENCE LEARNING					
1	Technology makes integrated science classes more interesting					
2	I understand science concepts better when technology is used in class					
3	Technology helps me to learn integrated science faster					
4	Using technology improves my performance in integrated science					
5	Technology helps me remember science facts and concepts longer					
	AVAILABILITY OF TECHNOLOGICAL FACILITIES					
1	Our school has a well-equipped computer laboratory					
2	We have access to educational software and applications for science learning					
3	There are enough electrical outlets in our classroom to use electronic devices					
4	My school has reliable internet connection for learning activities					
5	The technological facilities in my school are modern and up-to-date					
	CHALLENGES OF TECHNOLOGY INTEGRATION					
1	There are not enough technological devices for all students to use at the same time					

2	The technological equipment breaks down frequently					
3	I lack the basic computer skills needed to use technology for learning					
4	Power outages often interrupt our technology-based learning activities					
5	I get distracted when using technology during science lessons					
	BARRIERS TO TECHNOLOGY INTEGRATION					
1	My school administration does not encourage the use of technology in learning					
2	Students in my class are not interested in using technology for learning					
3	Traditional teaching methods are preferred over technology-based methods in my school					
4	My parents do not support the use of technology for learning at home					
5	The curriculum does not include enough technology-based learning activities					
	MOTIVATION AND ENGAGEMENT					
1	Using technology makes integrated science lessons more interesting for me					
2	I pay more attention during science lessons when technology is used					
3	Technology helps me understand difficult science concepts better					
4	I enjoy working on group projects that involve using technology					
5	I would like to use more technology in my integrated science classes					
	IMPACT ON ACADEMIC PERFORMANCE					
1	Technology helps me complete my science assignments more effectively					
2	I can solve science problems better when I use					

	technology tools					
3	I can access additional learning materials easily when technology is available					
4	Technology helps me learn at my own pace in integrated science					
5	Technology-based assessments help me show what I have learned better					
	SOLUTIONS TO TECHNOLOGY INTEGRATION PROBLEMS					
1	My school should provide more computers and tablets for student use					
2	Students should receive basic computer skills training before using technology					
3	Parents should be educated about the benefits of technology in learning					
4	Schools should partner with technology companies to get better equipment					
5	Schools should create technology-friendly learning environments					