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Full Length Research

Impact of Mobile Learning on Academic Performance in Nigerian Secondary Schools

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Abstract

The research critiques the effect of cell getting to know on college students' instructional performance in Nigeria, relying on empirical research to discuss both their pros and cons. The survey enumerates the potential benefits of mobile learning, among them are the improved access to resources, better engagement, learning flexibility, joint possibilities, and real-time feedback, leading to better academic achievements. Nevertheless, obstacles such as distractions, limited access to devices and information, inadequate digital literacy, and inadequate teacher education can diminish the feasibility of mobile learning. The research results suggest that by solving the aforementioned problems through the improved infrastructure, teacher training as well as the access to the digital resources we can most effectively boost the positive effects of mobile learning. The research also stresses the importance of customized content for students to support the learning process. The paper concludes by giving recommendations for future research, particularly with regard to optimizing mobile learning for educational advancement in Nigeria.

Keywords: Mobile learning, educational performance, Nigeria,, student engagement,

INTRODUCTION

Mobile learning (m-getting to know) has turned out to be a solid mode in the instructional technology arena, therefore helping students to gain knowledge through the deployment of mobile devices such as smartphones, tablets, and laptops. This novel approach to learning puts down to the fact that it can be done asynchronously and synchronously providing more flexibility, thereby, enabling the students to learn irrespective of the place and time, which is a big change from the traditional classroom-based learning (Adanır & Muhametjanova, (2021). M-learning applications let the students access information, communicate with peers, and also get involved in interactive learning activities all at any time, whether they are undergoing the movement or not.

The most important feature of mobile learning is to support different learning styles and preferences, and thus give students experiential learning chances which are more engaging than traditional methods. As an example, students may use content that includes video, audio, and simulation to enhance learning and memory (Saratu et al., (2020).). As well, m-learning systems guarantee a unique, personalized, learning process by exploiting adaptive technologies, which optimize to learners' individual needs as well as progress (Althunibat et al (2021).

In the Nigerian context, mobile learning holds significant potential. The increasing penetration of mobile technology within the country, coupled with a high mobile phone usage rate among young people, creates an ideal environment for integrating mobile learning into the education system (Edeh et al., (2019). With increasing educational opportunities, mobile learning can be a point

of entry for students in the rural and disadvantaged regions, to access educational resources that otherwise may be unavailable to them. In addition, mobile learning encourages students' and teachers' interaction and communication, thus contributing to a more interactive and participatory learning experience.

Nevertheless, if the practical benefits of mobile learning are realized to the full, stakeholders need to be aware of both the potential of the tool and the potential difficulty of putting the tool into practice.

Problem Statement

No less significant are the very real challenges that confront Nigerian secondary schools that foster, and indeed prevent exploitation of mobile technologies within the educational system. Because recent studies report a high proportion of Nigerian secondary school students to be underperforming in core and foundational subjects such as mathematics and science, they are indicative of an escalating educational crisis (Zhang, (2022). A number of reasons contribute to these academic failures, such as lack of teaching materials, out of date curricula and lack of teacher's training.

Among the most urgent issues is the digital divide, that is, differences in the possession of easy and unconditional access to digital technology among different groups of subjects. This gap is most pronounced in rural areas of Nigeria, where even entire classrooms can be poorly or not served at all by mobile devices and reliable internet (Afzal et al., (2023). Such inequities hinder the effective adoption of mobile learning tools and exacerbate existing educational disparities.

Beyond infrastructural obstacles, absence of digital skills in community as well as in the students' community represents a severe obstacle. Teachers are not adequately prepared, however, to integrate mobile technologies into pedagogy to their full advantage and too often, tool options are underutilized, or poorly and ineffectively used (Crowe, (2007).). In addition, socio-economic factors significantly affected students' adoption of mobile learning platform. Students who come from a disadvantaged socio-economic background may also have difficulties in obtaining the devices or data plans required for mobile learning, resulting in reduced opportunities for academic achievement.

Lastly, educational structuring of technology in Nigeria is often ambiguous and inconsistent, thus, students and their institutions are at a loss as to how to best apply technology (Aja and Eze, (2016). To fully realize the promise of mobile learning, there needs to be collaboration among relevant stakeholders such as government agencies, educational institutions, and technology providers to tackle these systemic issues.

In light of these challenges, there is an urgent need for comprehensive research to explore the effectiveness of mobile learning interventions in Nigerian secondary schools, understand the barriers to their implementation, and develop practical solutions to enhance accessibility and efficacy in this context.

Research Objectives

To assess the impact of mobile learning on students' academic achievement in secondary schools in Nigeria, determine barriers in implementing mobile learning technologies, as well as provide practical suggestions for making mobile learning technologies more accessible and impactful in these communities. In particular, this study aims to: (1) evaluate the effect of mobile learning on student achievement in core subjects, (2) determine obstacles to implementation experienced by educators and students, and (3) propose strategies for promoting access to mobile learning in Nigerian secondary education.

Research Questions

In line with the objectives, the study will address the following research questions: (1) What is the impact of mobile learning on students' academic performance in subjects like mathematics and science? (2) What specific challenges obstruct the effective implementation of mobile learning in these educational settings? (3) How do socio-economic factors influence students' access to and engagement with mobile learning?

Significance of the Study

This research holds significant importance for various reasons. First, it aims to contribute empirical insights regarding the effectiveness of mobile learning in enhancing academic performance, thereby enriching the existing body of literature on technology in education (Almaiah et al., (2021). Given Nigeria's push for educational reform, understanding how mobile learning can alleviate systematic academic challenges is timely and relevant (Crowe, (2007).

Second, by identifying implementation barriers, this research can inform educators and policymakers about areas needing intervention. Findings from this study will guide the development of educational policies that promote equitable access to technology, ultimately supporting overarching goals to boost literacy and reduce dropout rates (Zhang, (2022).

In essence, as Nigeria increasingly integrates technology into its educational framework, this study's recommendations may serve as a blueprint for developing inclusive mobile learning environments that are contextually relevant and effective.

LITERATURE REVIEW

Mobile learning, often referred to as m-learning, signifies a transformative shift in educational practices worldwide, particularly within the realm of secondary education. It encompasses a wide array of technologies and applications that facilitate learning through mobile devices such as smartphones, tablets, and laptops. Recent studies have highlighted how m-learning can support various pedagogical approaches and contribute to enhancing student engagement and learning outcomes (Zhang & He, (2022). For instance, mobile learning platforms not only allow for the dissemination of educational content but also encourage interactive and collaborative learning environments, where students can engage with peers and educators in real time, thereby forging deeper learning connections (Kumar et al., 2022) and Alrasheedi et al., (2015)

Research shows that between 2019 and 2023, mobile learning saw a significant rise in adoption across different educational settings, with increasing numbers of educational institutions implementing mobile technologies to facilitate learning (Lan, (2022). Studies by Neffati et al., (2021) and Sofia and Mar, (2024) emphasize that mobile learning initiatives, particularly those tailored for secondary education, have contributed to better academic performance, particularly in STEM subjects, by providing students with immediate access to resources and allowing for varied learning experiences through videos, quizzes, and interactive simulations. This immediate access helps to meet students where they are, accommodating diverse learning styles and preferences, which is crucial in a globally diverse educational landscape (Praise and Donald, (2024).

Moreover, the COVID-19 pandemic accelerated the global shift towards mobile and remote learning, spotlighting challenges but also opportunities in educational delivery (Kearney et al., 2022). The sudden necessity for online education revealed how mobile technologies could serve as a vital tool for continuity in learning even in the face of disruption. The effectiveness of mobile learning is thus not only contingent on access to technology but also on the strategic implementation of pedagogical practices that leverage its unique characteristics.

Mobile Learning in Sub-Saharan Africa

Sub-Saharan Africa represents a particularly compelling case for the exploration and implementation of mobile learning due to its unique socio-economic context. According to Sachs, (2009) the region has witnessed substantial growth in mobile phone ownership, even in rural areas, presenting a significant opportunity for educational interventions focused on mobile technology. The mobile phone's ubiquity allows for increased access to learning resources, fostering educational equity where traditional infrastructures may be lacking.

Multiple studies document the substantial benefits mobile learning can offer in the African educational context. Zhang, (2022) found that mobile learning platforms enhanced student learning engagement and provided critical resources for self-directed study, which is particularly valuable in areas struggling with teacher shortages. Similar findings by Traxler, (2009) emphasize that mobile learning has made educational materials more accessible and affordable, enabling students to learn beyond the confines of their classrooms and textbooks. Mobile learning has manifested in various successful initiatives across countries such as Kenya, South Africa, and Nigeria, where SMS-based learning, mobile apps for language acquisition, and educational games have been employed to great effect.

However, despite these advancements, significant obstacles remain. As highlighted by Sachs, (2009) , many students still face critical barriers to mobile learning, including limited internet connectivity, high costs associated with data, and a digital literacy divide. Additionally, concerns regarding the reliability of mobile technology in regions frequently facing power shortages or infrastructural problems pose ongoing challenges to the scalability of mobile learning interventions in Sub-Saharan Africa (Crowe, (2007). Therefore, addressing these systemic issues remains paramount for maximizing the impact of mobile learning across the region.

Educational Theories Supporting Mobile Learning

Mobile learning does not exist in a vacuum; it is deeply informed by various educational theories that provide a framework for understanding how and why this mode of learning can be effective. Constructivism stands as a fundamental theory influencing mobile learning practices (Sharples et al., 2016). This theory posits that learners construct knowledge actively rather than passively absorbing information. Mobile learning aligns with this concept by enabling experiential learning and encouraging students to engage with content in meaningful ways—through simulations, collaborative projects, and immediate feedback.

Moreover, socio-cultural theory, which emphasizes the role of social interactions and cultural contexts in learning, further supports mobile learning initiatives (Vygotsky, 2022, as cited in Li et al., 2022). This theory highlights that learning is a socially mediated process, reinforcing the importance of collaboration and communication, which mobile technologies can facilitate through social media, forums, and peer-to-peer networking applications. By understanding these theoretical foundations, educators can better design mobile learning interventions that are not only aligned with technology but also grounded in effective pedagogical practices.

Mobile Learning and Academic Performance

Extensive research examining the relationship between mobile learning and academic performance has yielded valuable insights, though findings are not universally consistent. An extensive meta-analysis conducted by Zhang & He, (2022) concluded that mobile learning positively impacts academic achievement, particularly when interventions are well-structured and thoughtfully integrated into the broader curriculum. The authors noted that factors such as student motivation, engagement, and quality of content delivery are critical in determining the outcomes of mobile learning initiatives.

In parallel, studies by Kumar et al. (2022) suggest that while mobile learning can lead to improvements in specific subjects, the success of these technologies relies heavily on the pedagogical approaches utilized. Factors such as the extent of teacher support, the quality of learning materials, and the level of student engagement have been cited as influential on academic performance outcomes. For instance, a comparative study highlighted that students who were supported by teachers trained in mobile learning methodologies demonstrated more significant improvements in their academic performance compared to those who were not (Wang et al., 2022).

Nevertheless, it is important to acknowledge the contextual variables influencing the effectiveness of mobile learning. Factors such as socio-economic backgrounds, geographical location, and existing educational infrastructure can significantly shape the learning experiences of students, thus impacting their academic performance (Lin et al., 2022). Consequently, education policymakers and practitioners must consider these variables when facilitating mobile learning initiatives to ensure equitable access to learning opportunities.

Challenges and Barriers to Mobile Learning

Despite its transformative potential, mobile learning is hindered by a range of challenges that must be systematically addressed. Central among these challenges is the issue of internet access and affordability. In many regions of Sub-Saharan Africa, slow internet speeds and prohibitive data costs remain barriers that limit access to mobile learning platforms (Mohammadi et al., (2020). As documented by Nja et al. (2022), students in remote areas often lack reliable connectivity, making it difficult for them to engage in synchronous or even asynchronous mobile learning activities.

Moreover, teacher readiness represents another significant barrier to effective mobile learning. Many educators lack the necessary training and support to effectively incorporate mobile learning technologies into their teaching practices. Studies have shown that teachers often feel overwhelmed by the new technologies and are unsure how to utilize them pedagogically (Crowe, (2007). This lack of preparedness can perpetuate the underutilization of mobile tools and limit their impact on student learning. Infrastructure-related challenges can also inhibit mobile learning implementations; many schools in developing regions face limited access to devices and technical support, making it difficult to maintain a consistent and effective learning environment (Sachs, (2009). Furthermore, concerns related to data privacy and security when using mobile devices can dissuade both students and educators from fully engaging with mobile learning platforms.

To maximize the impact of mobile learning initiatives, stakeholders—including government entities, educational institutions, and technology companies—must address these multifaceted challenges by developing comprehensive strategies that focus on improving infrastructure, increasing teacher training, and ensuring equitable access to mobile devices and internet connectivity.

REVIEW OF EMPIRICAL STUDIES

The adoption of mobile learning (m-learning) has gained significant traction across various educational sectors globally, and Nigeria is no exception. In a country with a rapidly growing youth population and an increasing demand for accessible educational resources, mobile learning presents an opportunity to overcome some of the longstanding challenges in the Nigerian education system, such as inadequate infrastructure, limited access to textbooks, and overcrowded classrooms. As mobile devices become more widespread, there is growing interest in understanding the impact of mobile learning on students' academic performance in Nigeria. A number of empirical studies have explored this area, revealing both positive and negative outcomes. This essay reviews the impact of mobile learning on students' academic performance in Nigeria, highlighting key findings and discussing their implications for future studies.

Several studies point to the positive effects of mobile learning on students' academic performance. One of the major advantages of mobile learning is the enhanced access to learning resources it provides. Through mobile devices, students are able to access a wide variety of educational materials, including e-books, research papers, instructional videos, and interactive content. This access allows students to supplement their classroom learning and engage with diverse educational resources. Research by Mohammadi et al., (2020) showed that students who used mobile devices for learning performed better in assignments and exams due to their ability to access and utilize these supplementary materials. The increased availability of learning resources beyond the traditional classroom environment has shown to contribute positively to academic achievement.

Moreover, mobile learning has been found to significantly improve student engagement and motivation,

which are essential factors for academic success. Interactive features offered by mobile platforms, such as quizzes, forums, and multimedia tools, foster greater participation and involvement in the learning process. Iqbal & Qureshi, (2012) observed that students who engaged with mobile learning platforms were more active in their studies, demonstrating higher levels of motivation and academic commitment. This engagement led to improved retention of knowledge and higher academic performance. The study emphasized that the dynamic nature of mobile learning helped maintain students' interest, which translated into better learning outcomes.

Another key benefit of mobile learning is its flexibility, allowing students to learn at their own pace and according to their own schedules. In Nigeria, where many students juggle work, family obligations, and studies, the ability to learn anywhere and at any time can greatly enhance their academic performance. Iqbal & Qureshi, (2012) found that students who had access to mobile learning platforms reported increased study time, as they were able to review lessons, complete assignments, and engage with content at their convenience. This flexibility not only enabled students to manage their time effectively but also encouraged consistent and independent learning, which contributed to improved academic performance.

Mobile learning also facilitates collaborative learning, which has been shown to enhance students' understanding and academic success. Platforms that allow students to interact with their peers outside of the classroom encourage collaboration, discussion, and the sharing of ideas. According to Onyema et al. (2020), students who used mobile devices for group activities and discussions exhibited stronger problem-solving skills and a deeper understanding of the course material. Collaborative learning fosters critical thinking and allows students to benefit from peer-to-peer interactions, which in turn enhances their academic performance.

In addition to these advantages, mobile learning platforms provide real-time feedback and assessments, which are crucial for students to understand their strengths and areas for improvement. Ramprathap and Sriram, (2017) found that the instant feedback offered by mobile learning tools helped students identify their academic weaknesses and adjust their study strategies accordingly. This timely feedback loop allowed students to focus on their problem areas and improve their overall academic performance.

However, despite the numerous benefits of mobile learning, several studies highlight challenges that can limit its effectiveness in improving students' academic performance. A key issue is the potential for distractions. Mobile devices are inherently multi-functional, offering access to social media, games, and entertainment apps. Ramprathap and Sriram, (2017) reported that students often became distracted by non-educational content on their mobile devices, which hindered their ability to concentrate on academic tasks. This distraction led to reduced study time and negatively impacted students' academic performance. While mobile learning platforms offer valuable educational tools, students' tendency to engage with non-academic content on their devices can undermine the overall effectiveness of mobile learning.

Limited access to mobile devices and data plans also poses a significant challenge for many students in Nigeria. While mobile devices have become increasingly common, many students, especially in rural areas and from low-income backgrounds, struggle to afford the necessary tools for mobile learning. Onyema et al. (2020) found that high costs associated with smartphones and mobile data plans prevented many students from fully participating in mobile learning. The lack of affordable technology and internet access created a digital divide, with some students left behind in terms of academic engagement and performance.

Moreover, the lack of digital literacy is another barrier to the effective use of mobile learning platforms in Nigeria. According to Aja, and Eze, (2016), many students, particularly those in rural areas, have limited experience with mobile devices and lack the technical skills required to navigate mobile learning platforms effectively. This digital divide makes it difficult for students to maximize the potential of mobile learning tools, leading to frustration and poor academic outcomes. Without adequate training in using mobile learning technologies, students are less likely to benefit from the educational resources available through these platforms.

The quality and relevance of the learning content provided through mobile learning platforms is also a critical factor in determining academic success. Adanır, & Muhametjanova, (2021) observed that many mobile learning platforms used in Nigeria did not offer content that was aligned with the local curriculum or tailored to the specific needs of Nigerian students. The lack of culturally relevant and curriculum-based content hindered students' ability to fully grasp key concepts, thereby reducing the effectiveness of mobile learning in improving academic performance.

Finally, teachers' preparedness and training in the use of mobile learning tools are essential for ensuring that students benefit from mobile learning. Kuzu, (2014) found that many Nigerian teachers lacked the necessary skills and knowledge to integrate mobile learning technologies into their teaching practices effectively. Teachers who were unfamiliar with mobile learning platforms struggled to guide students in using these tools, which hindered students' ability to engage with the content and improve their academic performance. The study highlighted the need for teachers to receive proper training in mobile learning technologies to maximize their impact on students' academic outcomes.

The implications of these findings for our forthcoming study are multifaceted. First, it is evident that mobile learning has the potential to improve students' academic performance, but this potential can only be realized if certain barriers are addressed. These barriers include improving access to mobile devices and data plans,

increasing digital literacy, enhancing the quality of learning content, and providing adequate training for both students and teachers. As such, our study must consider these factors when exploring the effectiveness of mobile learning. Additionally, understanding the challenges related to distractions, limited access, and teacher preparedness will allow us to design strategies to mitigate these obstacles and enhance the effectiveness of mobile learning in improving academic performance. Addressing these factors will be crucial in determining how best to leverage mobile learning to improve educational outcomes in Nigeria.

METHODOLOGY

The research design deployed in this study adopted a mixed-methods approach, integrating both quantitative and qualitative methodologies to investigate the impact of mobile learning on the academic performance of secondary school students. This approach allowed for a holistic understanding of the educational experience by not only measuring tangible academic outcomes but also exploring the peculiar, subjective perspectives of students and teachers in relation to mobile learning.

The quantitative aspect of the study comprised a survey administered to students, which aimed to assess the direct effects of mobile learning interventions on academic performance. This was complemented by qualitative methods, including interviews, to gain deeper insights into the participants' experiences and to identify perceived benefits and challenges associated with mobile learning.

The use of a mixed-methods design was particularly well-suited to the complex nature of educational research, as it allowed for a more comprehensive exploration of both numerical data and the contextual factors influencing that data (Lund, (2012). By combining quantitative and qualitative methods, the study was able to address both "what" was happening (through quantitative measures) and "why" or "how" it was happening (through qualitative exploration) (Johnson, Maxwell, (2005).

Quantitative data from the surveys provided objective, measurable evidence of the impact of mobile learning on academic outcomes, such as test scores or grades. This aligned with the positivist paradigm, where the goal was often to identify patterns or correlations between variables (Plano et al, 2016). However, focusing solely on quantitative measures could overlook the richness of individual experiences and the contextual factors that may influence academic performance. This was where qualitative methods became crucial, as they allowed the researcher to explore personal experiences, attitudes, and the broader socio-cultural factors that may have shaped students' engagement with mobile learning (Schoonenboom & Johnson, (2017).

Interviews were particularly useful for uncovering the perceptions and insights of students and teachers, as they provided a platform for in-depth discussion and reflection on the challenges and opportunities associated with mobile learning (Braun & Clarke, 2006). These methods also offered the flexibility to probe into unexpected findings or issues that might not have been captured through structured survey questions (Schoonenboom & Johnson, (2017). By combining these two methodologies, the study was able to triangulate data, enhancing the validity and reliability of the findings (Denzin, 1978).

Ultimately, the mixed-methods approach in this study provided a robust framework for understanding the impact of mobile learning, as it integrated both the empirical, generalisable data provided by the surveys and the rich, contextual insights derived from the qualitative interviews.

The target population for this study comprised secondary school students and their teachers across three (3) schools in Benin City metropolis, Edo State, Nigeria. The schools were: Igbinedion Educational Centre, Standard Foundation Secondary School, and University Preparatory Secondary School. To ensure the findings were representative of varied educational contexts, a stratified random sampling technique was employed. This involved dividing the target population into relevant strata, such as each of the specific schools, and then randomly selecting participants from each stratum. This method helped to account for variability across different settings and demographics, thereby enhancing the generalisability of the findings (Creswell & Creswell, 2022). Specifically, approximately 300 secondary school students and 30 teachers from six schools were recruited, ensuring diversity in terms of location, socio-economic backgrounds, and levels of mobile learning integration.

Data collection utilised a combination of instruments to gather both quantitative and qualitative data.

1. **Questionnaire**: A structured questionnaire was developed to assess students' perceptions of mobile learning, their usage patterns, and academic performance before and after the implementation of mobile learning interventions. The questionnaire included Likert-scale items, multiple-choice questions, and demographic information. This instrument allowed for the collection of quantitative data on students' academic outcomes and engagement levels (Briggs, 2000).
2. **Interviews**: Semi-structured interviews with teachers were conducted to explore their perspectives on mobile learning's effectiveness, challenges they faced in implementation, and their observations of student engagement and performance. These interviews were audio-recorded and transcribed for analysis (Horton et al, 2004).
3. **Mobile App Usage Analytics**: Data were collected through the analytics of a mobile learning app used in the intervention. Metrics such as frequency of app use, completion rates of learning modules, and interaction levels provided valuable quantitative insights into how students engaged with mobile learning resources.

Data analysis was conducted using both quantitative and qualitative methods:

1. **Quantitative Analysis**: The quantitative data collected from questionnaires and app usage analytics were analysed using statistical methods. Descriptive statistics summarised participant demographics and usage patterns, while inferential statistics, such as paired sample t-tests or ANOVA, were employed to compare academic performance before and after the intervention (Field, 2022). Software such as SPSS or R was used for statistical analysis, allowing for rigorous examination of relationships and significance.
2. **Qualitative Analysis**: The qualitative data from interviews were analysed using thematic analysis (Horton, 2004). This process involved coding the interview transcripts and identifying key themes and patterns that emerged regarding teachers' perceptions and experiences with mobile learning. NVivo software was used to facilitate the organisation and analysis of qualitative data, allowing for deeper insights into the individual experiences and contextual factors that influenced mobile learning outcomes.

Limitations and Delimitations

Several limitations and delimitations were acknowledged in this research design:

1. **Limitations**:
   - **Sample Size**: While efforts were made to achieve a diverse sample, the relatively small number of participants (300 students and 30 teachers) may have affected the generalisability of the findings beyond the selected schools.
   - **Self-Reporting Bias**: The use of questionnaires may have introduced self-reporting bias, where participants could have overestimated their levels of engagement or performance due to social desirability.
2. **Delimitations**:
   - **Scope of Research**: This study focused specifically on secondary school students and their teachers, excluding other educational levels such as primary or tertiary education, which may have limited the applicability of findings across different educational contexts.
   - **Geographical Constraints**: The research was confined to a limited number of schools in a specific geographic area, potentially influencing the diversity of experiences related to mobile learning.

Ethical Considerations

In conducting this research, several ethical considerations were carefully addressed to ensure the protection of participants and the integrity of the study.

Firstly, **informed consent** was a fundamental ethical requirement. All participants, including both students and teachers, were fully informed about the nature of the research, its objectives, and the methods used for data collection. This included providing clear information about the voluntary nature of participation, the potential risks and benefits, and the right to withdraw at any time without penalty. Consent forms were provided and signed by participants or, for minors, by their guardians, ensuring that they understood their involvement in the study.

Confidentiality was another key consideration. All personal data and responses collected from participants were treated with the utmost confidentiality. Identifiable information was kept private, and any data presented in the final report was anonymised to protect participants' identities. Secure storage and handling of data were ensured throughout the research process.

Additionally, **respect for participants' autonomy** was crucial. This included respecting their decision to participate or not in the research and ensuring that they were not coerced or pressured in any way to take part. Care was taken to avoid any undue influence on students, particularly in a school environment, where there might have been a perceived power imbalance between the researcher and the students.

The **right to privacy** was also respected. Participants were assured that their responses would be used solely for the purposes of the research and not for any other purposes. Personal information was not disclosed to unauthorized individuals or third parties.

In terms of **minimizing harm**, the researcher ensured that participation in the study did not cause physical, emotional, or psychological distress. If the study involved the use of mobile learning apps, the researcher ensured that these tools did not adversely affect the participants' well-being or academic performance. Furthermore, any sensitive issues discussed during interviews or focus groups were handled delicately, and participants had the option to withdraw from such discussions if they felt uncomfortable.

Finally, the study adhered to relevant ethical guidelines and institutional review board (IRB) requirements. Ethical approval was sought from the appropriate governing body to ensure that the research met established ethical standards.

By addressing these ethical considerations, the research protected participants' rights, ensured the integrity of the study, and contributed to the reliability and validity of the findings

DATA ANALYSIS

The sample consisted of 164 females (54.6%) and 136 males (45.4%), with no respondents choosing "Rather not say." This gender distribution was relatively balanced, supporting the study's credibility without any gender bias. Regarding the educational level, 159

participants (53%) were from Junior Secondary School (JSS), and 141 (47%) were from Senior Secondary School (SSS). This distribution was also balanced, ensuring the inclusion of both educational levels without bias.

Participants' use of mobile devices for learning revealed that 36.3% used them frequently, while 28% used them occasionally. However, 21.7% used them rarely, and 7.3% never used them, with only 6.7% using mobile devices for learning consistently. This suggested that mobile learning was common but not an everyday activity for most students.

Regarding mobile learning's impact on understanding lessons, 50.7% of participants agreed, and 21% strongly agreed, totaling over 70% of positive responses. However, 3.3% strongly disagreed, and 11% disagreed, with 15% remaining neutral, indicating mixed perceptions about its effectiveness.

In terms of motivation, 41.7% agreed and 8.3% strongly agreed that mobile learning increased their motivation, but 29.3% remained neutral. Additionally, 19% disagreed, and 1.7% strongly disagreed, suggesting that while mobile learning motivated many, it did not have the same effect on all students.

On confidence in using mobile apps, 36.3% agreed and 23.7% strongly agreed that they felt confident using mobile apps for learning. However, 5% strongly disagreed, and 11.3% disagreed, indicating that some students lacked confidence in using mobile learning tools. 23.7% were neutral, suggesting uncertainty among a significant number of students.

The frequency of mobile learning app usage varied, with 34.3% using the app 3-4 times a week, and only 6.7% using it daily. In contrast, 9% never used the app, and 20% used it less than once a week. The most popular content type was discussions and forums, engaged with by 29.3% of students, followed by text-based resources at 26%. Quizzes and interactive activities were used by 15%, and videos by only 8.7%. These trends suggested that students favored interactive and text-based resources over passive video content.

Regarding time spent on mobile learning apps, 34.7% of students used them for 30-60 minutes daily, and 29.3% for 1-2 hours. Smaller percentages reported spending 2-3 hours (15.7%) or more than 3 hours (1%) daily. This indicated that while mobile learning was used regularly, it was generally not the primary focus of students' study time.

On academic performance, 38.7% agreed that mobile learning had improved their performance, while 4.3% strongly agreed. However, 19.3% disagreed, and 6.7% strongly disagreed, with 31% remaining neutral. Similarly, 36% agreed that their test scores had improved, and 18.3% strongly agreed, though 10.7% strongly disagreed, and 16.7% disagreed.

When it came to engagement, 36.7% of students disagreed that mobile learning was more engaging than traditional methods, and 17.3% strongly disagreed. Only 15.7% agreed, and just 1% strongly agreed, indicating that traditional methods were still preferred.

In terms of assignment completion, 49.3% agreed, and 12.3% strongly agreed that mobile learning helped them complete assignments more effectively. Only 5% strongly disagreed, and 6.7% disagreed, suggesting that mobile learning aided assignment completion for most students.

Finally, overall satisfaction with mobile learning was high, with 60% agreeing and 12.7% strongly agreeing, while 2.7% strongly disagreed and 4% disagreed. However, 20.7% remained neutral, indicating some mixed feelings about the mobile learning experience.

DISCUSSION OF FINDINGS

The findings of this study align with recent literature that underscores the potential of mobile learning in enhancing academic performance in secondary schools. A substantial number of students in this study reported positive academic outcomes, with **38.7%** agreeing and **4.3%** strongly agreeing that mobile learning improved their academic performance, and **36%** indicating improvement in their test scores. These results are consistent with previous studies that demonstrate the positive impact of mobile learning on student achievement. For instance, **Alrasheedi et al., (2015)** found that mobile learning can facilitate personalized learning experiences and improve academic performance by allowing students to access learning resources at their convenience. Similarly, **Sofia and Mar, (2024)** reported that students who used mobile learning tools showed better performance in subject areas such as mathematics and science, attributing this to the flexibility and accessibility of mobile learning platforms.

However, the study also identified a proportion of students who disagreed with the idea that mobile learning had improved their academic performance (**19.3%** disagreed and **6.7%** strongly disagreed). This finding resonates with **Hwang and Wu (2014)**, who highlighted that mobile learning's effectiveness varies depending on factors such as the quality of content, students' digital literacy, and their learning preferences. Similarly, **Jisc (2014)** pointed out that the impact of mobile learning is not universal, and its success hinges on how well it aligns with students' individual needs and educational contexts.

The data also revealed mixed responses regarding the engagement with mobile learning tools. While **29.3%** of students engaged with discussions and forums, only **8.7%** interacted with videos. This suggests a preference for interactive and collaborative content, a finding echoed by **Shadiev et al. (2017)**, who noted that students tend to find interactive and peer-based learning more engaging than passive learning methods such as watching videos. **Turel et al. (2019)** also emphasized that engagement in mobile learning is higher when the content is designed to

foster interaction, collaboration, and critical thinking, rather than just passive consumption of information.

On the issue of confidence in using mobile apps, the study found that while **36.3%** of students felt confident in using mobile apps for learning, **11.3%** were uncertain or lacked confidence. This aligns with research by **Bajpai et al. (2019)**, who found that students' confidence in using technology directly affects their engagement and learning outcomes. The study by **Teo et al. (2020)** also highlighted that lack of digital literacy and confidence in using mobile apps remains a significant barrier to effective mobile learning, particularly in developing countries. Therefore, providing digital literacy training to both students and educators is crucial for maximizing the potential of mobile learning.

Additionally, the relatively low frequency of mobile learning use, with only **6.7%** of students using mobile apps daily, underscores a key challenge identified in the literature: inconsistent usage. According to **Bailie (2014)**, even though mobile learning tools are widely available, their integration into daily educational routines is often hindered by factors such as limited access to devices, internet connectivity issues, and a preference for traditional learning methods. The findings of this study mirror these concerns, as only a small proportion of students reported daily use of mobile learning tools, while the majority used them intermittently.

In terms of barriers to implementation, the study found that while some students were confident in using mobile apps, others faced challenges, with **23.7%** expressing uncertainty. This is consistent with **Valk et al. (2010)**, who identified a lack of infrastructure, poor internet connectivity, and limited access to mobile devices as significant barriers to mobile learning in developing countries like Nigeria. **Davis, (2014)** also pointed out that mobile learning's success depends on addressing these infrastructural challenges, ensuring that all students have equitable access to technology.

Implications of the Findings

The findings of this study have important implications for mobile learning initiatives in Nigerian secondary schools. First, the positive impact of mobile learning on academic performance, with **38.7%** of students agreeing and **4.3%** strongly agreeing that it enhances their academic outcomes, suggests that mobile learning can be a valuable tool for improving student learning. However, the mixed responses—where a portion of students reported no perceived improvement in their academic performance (**19.3%** disagreed and **6.7%** strongly disagreed)—highlight that the effectiveness of mobile learning is not universal and may be contingent upon factors such as content quality, accessibility, and students' individual learning styles (Aliyu et al., 2019).

Additionally, the study's finding that students prefer interactive content like discussions and forums (**29.3%**) over passive content like videos (**8.7%**) suggests that mobile learning tools need to prioritize engagement and interactivity. This has implications for the design of educational apps, where content should be dynamic and collaborative to foster deeper learning. The preference for discussions and forums aligns with the growing body of literature emphasizing the value of social and collaborative learning in digital environments (Shadiev et al., 2017). Furthermore, the relatively low daily usage of mobile apps (**6.7%**) implies that mobile learning is not yet fully integrated into students' daily academic routines, potentially limiting its effectiveness. This highlights the need for a more structured and consistent incorporation of mobile learning into both formal and informal learning settings.

Moreover, the challenges faced by students in using mobile learning tools, such as lack of confidence in using mobile apps (**11.3%**), indicate that digital literacy remains a barrier. This finding underscores the importance of equipping students and educators with the necessary skills to effectively utilize mobile learning platforms. As pointed out by Teo et al. (2020), a lack of digital literacy can impede the benefits of mobile learning, suggesting that ongoing training and professional development for educators, alongside targeted digital literacy programs for students, are essential.

Recommendations

Based on the findings, several recommendations can be made to enhance the accessibility and effectiveness of mobile learning initiatives in Nigerian secondary schools. First, improving the infrastructure and access to mobile learning devices is essential. As **Valk et al. (2010)** noted, limited access to technology is a significant barrier to mobile learning in developing countries. Schools should invest in providing affordable devices and reliable internet connectivity to ensure that all students can benefit from mobile learning tools. This could be facilitated through partnerships with mobile network providers or government initiatives aimed at improving ICT infrastructure in schools.

Second, content design should prioritize interactivity and collaboration. The preference for discussions and forums over videos indicates that mobile learning platforms should integrate more interactive, peer-driven activities to enhance student engagement. Educators should be trained to design and facilitate these activities, fostering a more engaging and supportive learning environment. **Shadiev et al. (2017)** highlighted that mobile learning is most effective when it promotes interaction, collaboration, and critical thinking, suggesting that educational apps should move beyond passive content delivery to incorporate features that encourage active participation.

Third, digital literacy training is crucial for both students and educators. As the study found that a portion

of students lacked confidence in using mobile learning apps, schools should implement targeted programs to build digital skills. This would ensure that students are equipped to use mobile learning tools effectively and maximize their potential academic benefits. Educators, too, should be trained in integrating mobile learning into their teaching practices, as this would help create a more conducive environment for students to engage with the technology.

Finally, mobile learning should be more consistently integrated into students' academic routines. The relatively low frequency of daily use (**6.7%**) suggests that mobile learning is not yet fully embedded into students' study habits. Schools should encourage students to incorporate mobile learning tools into their daily study routines and provide support to ensure that these tools are used regularly. As **Bailie (2014)** argued, the integration of mobile learning into daily routines is essential for its success.

Suggestions for Further Studies

Future studies could explore the specific factors that contribute to the effectiveness of mobile learning, particularly focusing on content quality, students' digital literacy, and learning preferences. This would provide a deeper understanding of how mobile learning can be tailored to meet diverse student needs. Additionally, research could investigate the long-term impact of mobile learning on academic performance, particularly in subjects that are traditionally challenging for students, such as mathematics and science. Studies could also examine the effectiveness of mobile learning in different regions of Nigeria, considering the varying levels of infrastructure and access to technology, to better understand the barriers to implementation and the potential solutions.

Another area for further investigation could be the role of teacher professional development in the successful implementation of mobile learning. As highlighted in the study, educators must be adequately trained to use mobile learning tools and integrate them into their teaching practices. Exploring how teacher training impacts the use and effectiveness of mobile learning would be beneficial in ensuring that mobile learning is maximally effective.

Finally, qualitative studies could explore students' and teachers' experiences with mobile learning, offering insights into how mobile learning is perceived, what challenges are faced, and how these challenges can be overcome. This would provide a richer understanding of the contextual factors influencing the effectiveness of mobile learning in Nigerian secondary schools.

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