Secondary School Teachers' Proficiency in Integrating Technology within their Subject-Matter Contexts in Nigeria

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Abstract

This study focusses on assessing the proficiency of secondary school teachers in integrating technology to improve teaching within the context of their subject matter in upper basic schools in Gwagwalada Area Council, FCT Abuja. The total population of the study consisted of all secondary school teachers in junior secondary schools in Gwagwalada Area Council, Abuja. Simple random sampling was used to select 45 teachers who took part in the study. A questionnaire was used as an instrument to gather data for the study. Cronbach's alpha was used to determine the reliability of the research instrument, with a reliability coefficient index of 0.77, which was considered suitable for the study. Data retrieved from the questionnaire were analysed using frequency counts, percentages, mean, and standard deviation. The findings revealed that a small portion of the teachers acknowledged the use of technology as part of their teaching strategies. This distribution underscores the prevalent reliance on traditional teaching approaches within the surveyed population, thus weakening their ability to integrate technology to enhance teaching in the context of their subject matter. The study concluded that secondary school teachers demonstrate a general reluctance to embrace specific technologies, such as interactive whiteboards and educational apps. This revealed a tendency among secondary school teachers to diverge from integrating these specified technologies to enhance teaching within the context of their subject matter. Therefore, the study recommends that professional development initiatives specifically address the perceived barriers and provide targeted training to enhance teachers' proficiency with interactive whiteboards, educational apps, and multimedia presentations.

Keywords: Technology Integration, Teacher Proficiency, Educational Technology, Professional Development, Subject Matter Context.

Introduction

Education is undergoing a transformative change globally, with technology integration playing a pivotal role in shaping the learning environment. Therefore, understanding the technological proficiency of secondary school teachers is crucial in this context. Secondary school

stands as a cornerstone of education, shaping the intellectual and civic development of students through a multidisciplinary approach that includes all subjects (National Council for Secondary School, 2017). At the heart of this educational environment are secondary school teachers, entrusted with translating the expansive scope of secondary school into engaging and meaningful learning experiences. Given the pervasive influence of technology in modern society and its potential to enhance learning, teachers must be equipped to leverage these tools effectively. This includes not only basic technical skills but also the pedagogical knowledge to integrate technology meaningfully into their lessons to improve student understanding and engagement. Therefore, assessing secondary school teachers' technological proficiency involves an in-depth evaluation of their instructional practices, content knowledge, and overall effectiveness in using technological tools to deliver the curriculum. This assessment examines various aspects of their teaching methodologies, including lesson planning, classroom management, and the integration of various instructional and technological strategies to engage students. Additionally, it evaluates teachers' understanding of the subject matter, ensuring that they can effectively impart knowledge to students with diverse learning needs and foster an inclusive and effective learning environment.

Technology extends learning beyond the classroom, enabling collaborative projects and discussions that contribute to a broader and more enriched understanding of secondary school topics (Cuban, Kirkpatrick, & Peck, 2021). The interactive and collaborative nature of these technological tools, including learning management systems (LMS) with discussion boards, collaborative writing platforms, and interactive simulations, is consistent with the principles of effective secondary school education. These tools promote active learning, student engagement, and the development of 21st-century skills such as communication, collaboration, and critical thinking, all of which are crucial for success in higher education. Several types of technology play pivotal roles in education as they encompass interactive programs designed for educational purposes, offers a dynamic avenue for students to engage with diverse and different concepts through multimedia presentations, educational games, and simulations (Becker, 2020). These technological tools enhance content delivery and create an interactive learning environment.

Digital resources and on-line platforms form another crucial aspect of technology integration. These resources, including e-books, articles, and educational websites, along with online platforms such as learning management systems facilitate resource sharing and collaborative learning experiences (Chukwuemeka et al., 2015; Chukwuemeka et al., 2021). The

interconnectedness provided by collaborative platforms such as Google Workspace for Education, Microsoft Teams, and learning management systems (LMS) like Canvas or Moodle contributes to a more collaborative and accessible learning environment in secondary school. For instance, interactive whiteboards and displays, often integrated within these platforms, enable teachers to create dynamic and engaging lessons that foster student interaction and participation. Through the incorporation of multimedia content and real-time interaction, they enhance the visual representation of secondary school concepts, fostering engagement and participation among students (Bebell & Kay, 2020). This dynamic visualisation contributes to a more immersive learning experience. For example, digital presentation tools, such as PowerPoint and Prezi, offer teachers the ability to design visually appealing and interactive presentations. By leveraging educational technology tools, educators can create multimedia-rich lessons that capture students' attention and facilitate a deeper understanding of concepts. The visual engagement provided by these tools enhances the overall effectiveness of content delivery.

Aregbesola et al. (2024) stated that teachers' proficiency in integrating technology into teaching in secondary schools is crucial to effective teaching in the 21st century. This is because technology has infiltrated every aspect of human endeavour, creating a pressing need for secondary school teachers to seamlessly integrate technology into their pedagogical practices and subject matter. Teachers' proficiency in integrating technology to enhance teaching within the context of their subject matter involves evaluating their ability to integrate technology not only as a standalone tool, but also as a dynamic component intertwined with pedagogy and content knowledge. Teachers must demonstrate proficiency in selecting, implementing and adapting technology to facilitate a deeper understanding of secondary school concepts, making subjects more accessible and engaging for students. To create technologically proficient students in this age of digital citizenship, teachers must improve their own technological mastery. Educators who integrate technological tools into their instruction need to be experts in doing so.

This emphasis on effective technology integration aligns with constructivist learning theories, which emphasize authentic experiences and real-world application. According to Jean Piaget in the mid-20th century, learning in authentic contexts and engaging in real-world tasks is another key aspect of constructivism. The theory advocates for meaningful, contextually rich learning experiences that align with the complexities of the real world. Building on this idea, Ojelade et al. (2022) emphasized that education, from primary to secondary school and potentially

extending to tertiary institutions, must be comprehensive and build up students for future endeavors. Therefore, constructivism places a strong emphasis on reflection and metacognition, encouraging students to think about their thinking processes. In the context of the study of teachers' proficiency in integrating technology to improve teaching within the context of their subject matter, constructivism provides a theoretical foundation to understand how educators actively engage with and integrate technology into their teaching practices. The study aligns with constructivist principles as it explores not only the knowledge aspects, but also the beliefs about self-efficacy of teachers in the use of technology.

It is crucial to recognise the pivotal role teachers play in educational sustainability, and, therefore, their ability to adapt to rapidly evolving technologies applicable to learning environments (Ortega & Fuentes, 2015). They further emphasises that supporting teachers is essential to overcome the challenges of technology integration. The integration in education has a multidimensional structure that comprises various components and indicators. Teachers' proficiency in integrating technology to enhance teaching may be hindered by several factors, including limited internet access, time constraints, teachers' lack of basic technological skills, teacher attitudes towards technology integration, school culture, and teachers' need for professional development regarding technology integration (Chukwuemeka & Iscioglu, 2017; Ilisko & Ignatjeva, 2014). Unfortunately, teachers in public secondary schools are often unprepared to capitalise on the developmental potential offered by incorporating technology into their lessons. They may still adhere to traditional teaching methods that can disengage students and diminish their interest in learning.

Currently, a significant challenge is the proficiency in technology integration faced by educators in teaching, where many struggle seamlessly to incorporate technology into their teaching practices. According to Zahid et al., (2023) today's world poses so many people who were born and raised with computers at their fingertips. It is therefore crucial that teachers maintain and improve their skills in order to provide students with the best possible education. Furthermore, global advances require a swift shift in pedagogical philosophies and methods, necessitating a reworking or reconstruction of current teacher education programmes and structure (Chukwuemeka et al., 2021). When educators can stay up-to-date with the latest developments in their fields, they are better able to expand their own pedagogical expertise, subject knowledge, and use of technological tools. Furthermore, the gaps in policy and professional development within

the educational system can be identified as obstacles to effective integration of technology into secondary school education (Chukwuemeka and Iscioglu, 2017). Inadequate policies and limited professional development initiatives in this regard can hinder educators' capacity to leverage technology effectively in their instructional practices (Davis et al., 2018).

The absence of a systematic and comprehensive assessment tailored to assess secondary school teachers' technological proficiency, content knowledge, and self-efficacy poses a significant challenge. Ndayebom & Aregbesola (2023) submitted that most research covering teachers alike in Nigeria is not verse with the use of technology, which presents a challenge to education within the country. Another concern among teachers in the proficiency of technology is their creativity, which is valuable and involves generating original concepts for teaching. In a diverse educational setting such as the Gwagwalada Area Council, understanding and addressing potential disparities in technological resources and skills becomes essential for equitable learning experiences in secondary school. The roles and responsibilities of teachers are changing as a direct result of the effect and influence of technology on student learning. Teachers now have the tools to adapt their lessons to the learning styles of students who grew up in the age of technology. Therefore, the objective of this study was to assess the proficiency in integrating technology to improve teaching within the context of their subject matter.

Research Questions

The following research questions were formulated to guide the study:

- What is the frequency and percentage of secondary school teachers using technology to enhance their teaching in the context of their subject matter?
- How proficient are secondary school teachers in integrating technology to improve their teaching within the context of their subject matter?

Methodology

The researchers first consulted with the school authorities to ask permission to carry out the study. They were asked to meet with the Vice-Principal Administration in each of the eight schools, who then introduced them to the teachers. The researchers informed the teachers about the study and asked for their help in completing the questionnaires. The characteristics are shown in Tables 1, and 2.

This study used a descriptive survey methodology, using a questionnaire to gather information from teachers. The total population of junior secondary school teachers in Gwagwalada Area Council during the study period was estimated to be 75. Using the Krejcie and Morgan table (Krejcie & Morgan, 1970) with this population size, a sample size of 65 was determined. Simple random sampling was used to select 65 elementary school teachers from the eight schools. This sample size was deemed sufficient to provide a representative sample of the teacher population. However, due to study focus only 45 teachers who worked at the junior secondary schools in the gwagwalada area council that school year ultimately participated in the study. Therefore, because of the sample size the generalizability of the findings will be only specific to the junior secondary school teachers in the area council. This limitation is acknowledged and considered during the results interpretation.

To gather data and information from teachers within the selected secondary schools, the researchers used a structured questionnaire based on a four-point Likert scale. The questionnaire was systematically organised according to the research questions and consisted of two sections: Section A contained questions about the teachers' biodata, and Section B included questions designed to address the research questions, with five items each. To ascertain the reliability of the research instrument, Cronbach's alpha was used, resulting in a reliability coefficient index of 0.77. Data retrieved from questionnaires were analyzed using frequency counts, percentages, mean, and standard deviation. The decision rule for the questionnaire was set at 2.50.

Results

Table 1: Distribution of respondents by Gender

Gender	Frequency	Percentage (%)
Male	23	51%
Female	22	49%
Total	45	100%

Source: Field survey, (2023).

Table 1 illustrates the gender distribution of respondents in the study, which includes a total sample size of 45 teachers. The data reveal a nearly balanced representation between male and female participants, with 51% (23 respondents) being male and 49% (22 respondents) being female. This equilibrium in gender distribution suggests a moderate size study, and the percentages provide a clear perspective on the proportional representation of each gender within the sample.

Table 2: Distribution of respondents by Age

Age	Frequency	Percentage (%)
Under 25	7	16%
26-34	18	40%
35-44	12	27%
45-54	6	13%
55 and above	2	4%
Total	45	100%

Source: Field survey, (2023).

Table 2 presents the distribution of the respondents by age in a study with a total sample size of 45 individuals. Age categories are delineated as follows: Under 25 (16%), 26-34 (40%), 35-44 (27%), 45-54 (13%), and 55 and above (4%). In particular, the largest proportion of respondents falls within the 26-34 age range, comprising 40% of the total sample. In contrast, the 55 and above category represents the smallest segment at 4%. This breakdown offers a concise overview of the age distribution among participants, allowing researchers to consider possible age-related influences on the study's outcomes.

Answering Research Questions

Research Question 1: What is the frequency and percentage of secondary school teachers using technology in their teaching practices?

Table 3: Frequency and percentages of secondary school teachers using technology to enhance their teaching within the context of their subject matter

Use of Technology	Frequency	Percentage (%)
Yes	11	24%
No	34	76%
Total	45	100%

Source: Field survey, (2023).

Table 3 presents insights into their self-evaluation to the adoption of technology in teaching based on responses from 45 teachers. The data reveal that a significant majority, representing 76% of the respondents, reported not incorporating technology in their teaching practices. On the contrary, a smaller portion, comprising 24% of the participants, acknowledged the use of technology as part of their teaching methods. This distribution underscores the prevalent reliance on traditional teaching approaches within the surveyed population. The findings suggest potential variations in the integration of technology in educational practices between the participants.

Research Question Two: How proficient are secondary school teachers in integrating technology to improve their teaching within the context of their subject matter?

Table 4: Proficiency of secondary school teachers in integrating technology to enhance their teaching within the context of their subject matter.

Item Statement	SA	A	D	SD	Mean	Decision
I use to integrate interactive whiteboards into my secondary school instruction.	4	10	23	8	2.38	Disagreed
I use educational apps to supplement my teaching in secondary school.	3	9	28	5	2.44	Disagreed
I incorporate online simulations and virtual field trips into my secondary school lessons.	5	9	20	11	2.44	Disagreed
I normally explore the use of multimedia presentations (videos, images) for a more engaging secondary school classroom.	3	11	28	3	2.41	Disagreed
I use to integrate collaborative online platforms for group projects in secondary school.	11	5	18	10	2.34	Disagreed
Sectional Mean					2.40	Disagreed

Table 4 provides information on the types of technology that secondary school teachers integrate into their instructional practices, as well as their overall attitude toward these technologies. The table encompasses various items related to different technologies and approaches, each accompanied by responses in terms of strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). The first item focusses on the integration of interactive whiteboards into secondary school instruction. The majority of teachers disagreed with this proposition, as evidenced by 10 respondents in the 'agree' category, 4 respondents in 'strongly agree,' 23 in 'disagree,' and 8 in 'strongly disagree.' The mean score of 2.38 further reveals the prevailing disagreement among teachers about the incorporation of interactive whiteboards. Similarly, the second item explores the use of educational apps to supplement teaching in secondary school. With 28 respondents in the 'disagree' category, 5 respondents in the 'strongly disagree' category, and a mean score of 2.44, there is a clear trend of disagreement among teachers regarding the use of educational apps in secondary school instruction.

The third item delves into the intention to incorporate online simulations and virtual field trips into secondary school lessons. The responses indicate a distribution, with 5 in 'strongly agree,' 9 in 'agree,' 20 in 'disagree,' and 11 in 'strongly disagree,' resulting in a mean score of 2.44. This suggests a lack of consensus among teachers on the adoption of online simulations and virtual field trips in their instructional practices. The fourth item shows the attitudes towards exploring

multimedia presentations, including videos and images, for a more engaging secondary school classroom. The majority, with 28 in ‘disagree’ and a mean score of 2.49, again show a tendency to disagree with the incorporation of multimedia presentations in their teaching methods. The fifth item explores teachers' openness to integrating collaborative online platforms for group projects in secondary school. The responses are as follows: 11 in 'strongly agree,' 5 in 'agree,' 18 in 'disagree,' and 10 in 'strongly disagree,' resulting in a mean score of 2.34. This suggests a general disagreement among teachers about the potential benefits of collaborative online platforms for group projects in secondary school. Finally, the sectional mean for all items equals 2.40, indicating an overall tendency toward disagreement among teachers regarding the integration of the specified technologies. However, it is worth noting that there is variation in their proficiency, with some technologies generating more consensus than others.

Discussion of Findings

This study reveals that a significant majority, which represents 76% of the respondents, reported not incorporating technology into their teaching strategies, which could be the result of lack of in-service training in the teachers’ professional development of teachers. On the contrary, a smaller portion, comprising 24% of the participants, acknowledged the use of technology as part of their teaching strategies. This distribution underscores the prevalent reliance on traditional teaching approaches within the surveyed population. The findings suggest potential variations in the integration of technology into educational practices among participants, providing researchers with valuable insights into the current landscape of technology utilization in teaching. This was corroborated by Ortega & Fuentes, (2015) whose submitted that it is important to realize the importance in educational sustainability; thus, their abilities to adapt themselves to rapidly developing technologies applicable to learning environments are vital than ever. However, teachers’ willingness to integrate technology to enhance teaching may be hindered by a variety of issues such as limited access to the Internet, time constraints, teachers’ lack of basic technological skills and teacher proficiency toward technology integration, school culture, and teachers’ need for professional development in technology integration (Ilisko & Ignatjeva, 2014). In this era, technology is an integral part of education and teachers need to equip themselves with this crucial tool to enhance teaching within the context of their subject matter. According to Zahid et al. (2023), today's world has seen the rise of a generation who were born and raised with computers at their

fingertips. It is crucial that educators maintain and improve their skills to provide students with the best possible education.

Further assessment reveals the proficiency of secondary school teachers in integrating technological tools into instructional practices. The results can be seen in Table 4. These technologies vary from whiteboard, educational apps, on-line simulations and virtual field trips, multimedia presentation, and collaborative online platform, with the sectional mean for all the items equal to 2.40, indicating an overall tendency toward disagreement among teachers regarding the integration of the specified technologies. However, it is worth noting that there is variation in their proficiency, with some technologies generating more consensus than others. The study of Becker (2020) revealed that several types of technology play pivotal roles in education as they include interactive programmes designed for educational purposes and offers a dynamic avenue for students to engage with different concepts through multimedia presentations, educational games, and simulations. Also, Cuban et al., (2021) submitted that technology extends learning beyond the classroom, enabling collaborative projects and discussions that contribute to a broader and more enriched understanding context of their subject matter. This implies that teachers must embrace professional development to become acquainted with diverse technologies that will suit the context of their subject matter periodically.

Conclusion

The study concluded that secondary school teachers generally demonstrate a reluctance to embrace specific technologies, such as interactive whiteboards, educational apps, and online simulations. This revealed the tendency of secondary school teachers to resist the integration of these specific technologies to enhance teaching within the context of their subject matter. However, it is worth noting that there is variation in their proficiency, with some technologies generating more consensus than others. While expressing moderate agreement on the potential use of collaborative on-line platforms. Proficiency levels vary among teachers, with a consensus on positive attitudes toward technology integration but a lack of unanimity regarding navigating educational software. Institutional factors play a pivotal role, as teachers indicate that adequate training, positive institutional support, and ongoing professional development will positively affect their technological proficiency. Although challenges exist, such as time constraints and varied prior personal experiences with technology, the overall picture suggests a dynamic landscape

where institutional support and targeted professional development opportunities play crucial roles in shaping teachers' confidence and proficiency in integrating technology for effective secondary school instruction. These findings contribute to the broader discourse on technology integration in education and underscore the need for customised support structures to empower educators in navigating the evolving technological landscape.

Recommendations

1. Professional development initiatives specifically address perceived barriers and provide targeted training to improve teachers' proficiency with interactive whiteboards, educational apps, and multimedia presentations.
2. Schools should implement ongoing, subject-specific training programmes to address the specific challenges identified, especially focusing on improving teachers' navigation skills with educational software relevant to secondary school.
3. School authorities should provide facilities and equipment that will promote the integration of technology for teachers in secondary schools.

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