

UTILIZATION OF DIGITAL TOOLS IN TEACHING AND LEARNING OF BIOLOGY IN SENIOR SECONDARY SCHOOLS IN ABUJA MUNICIPAL AREA COUNCIL, FEDERAL CAPITAL TERRITORY, ABUJA

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Abstract

The study investigated the utilization of digital tools in teaching and learning of Biology in senior secondary schools in Abuja Municipal Area Council, Federal Capital Territory. Two research objectives and two research questions guided the study. The study adopted descriptive survey research design. The target population was all the 54 Biology teachers in all the 18 public senior secondary schools in Abuja Municipal Area Council (AMAC). The entire population constituted the sample for the study, adopting census sampling technique. Thirteen (13) items self-structured questionnaire titled: "Utilization of Digital Tools in Teaching and Learning of Biology Questionnaire (UDTTLBQ)" was used to generate data for the study. Test-retest method of reliability was used to obtain the internal consistency. The reliability index was obtained through Cornbrash's alpha (0.98). Out of the 54 questionnaires administered, 51 were returned valid, representing 94% success rate. Data collected was analysed using descriptive statistics, in the form of frequency tables and graphs. The results revealed that Google search engine and Wikipedia are major digital tools that Biology teachers utilize to facilitate the teaching and learning of Biology. Majority of Biology teachers are particularly unaware of Padlet, Socrative and Notability digital tools. Also, high cost of internet subscription and slow internet speed are major constraints to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council. It was recommended among others that Biology teachers should go for professional courses, workshops and training on ICT particularly on how to use digital tools such as Padlet, Socrative and Notability to facilitate the teaching and learning of Biology and Biology teachers should constantly update their knowledge on new trends in digital tools that can make their teaching interesting and understandable for students.

Keyword: Utilization, digital tools, biology, teaching and learning

Introduction

Biology is a branch of science and prerequisite subject for many fields of study like medicine, forestry, agriculture, biotechnology and nursing. The word 'Biology' comes from Greek words; Bios meaning

life, and logy (logia) which means study. According to Osuafor and Chukwuemeka (2023), Biology is basic science subject that deals with the study of living things, it attempts to understand the teeming diversity of life on earth, a diversity of life we are all

part of. Apart from studying life, Biology studies structure, function, growth, origin, evolutions distributions, interrelationships, problems such as diseases, and adaptation of things and proposes solutions where possible. Biology as a science course involves the use of process skills and different approaches to bring about meaningful learning in the learners.

According to Owolarafe, Abdulraheem and Bolaji (2024), Biology represents a distinctive branch within the realm of natural science, dedicated to delving into the intricacies of natural phenomena and occurrences. The Nigerian secondary school Biology curriculum partially mirrors these facets of the discipline. It adopts a conceptual approach, covering topics such as the essence of life, fundamental ecological principles, nutritional processes in plants and animals, conservation of matter and energy, as well as concepts pertaining to variation, variability, evolution, and genetics (WAEC, 2023). The study of Biology in senior secondary school can equip students with useful concepts, principles and theories that will enable them face the challenges before and after graduation.

Biology curriculum aims to equip students with proficient laboratory and field skills in Biology, impart meaningful and applicable knowledge, foster the ability to apply scientific insights to everyday life, cultivate a sound scientific demeanor, and instill an awareness of the interconnectedness between Biology and other scientific disciplines (WAEC Curriculum, 2023). Biology, as a scientific discipline, encompasses intricate interconnections among unfamiliar and abstract concepts alongside specialized terminologies, rendering it challenging both to comprehend and teach. Hadiprayitno and Kusmiyati (2019) opined that many students encounter difficulties in grasping certain biological principles, often resorting to rote memorization rather than genuine understanding.

To make the teaching and learning of Biology more practical and meaningful for students in the contemporary educational landscape, Biology teachers must embrace innovative, technology-driven, and student-centric pedagogical strategies. The national policy on ICT in education according to Owolarafe, Abdulraheem and Bolaji (2024), underscores the government's commitment to furnishing adequate information technology resources to enhance educational practices. The age in which teachers go into class with a lesson plan designed by them and policymakers is gradually fading away. Dancsa, Štampel'ová, Takáč and Annuš (2023) expressed that technology has become everyday life, including the process of education. Today, online technology is a relevant activity and there has been a significant shift towards digital scientific research. Biology teachers are encouraged to use digital tools for educational purposes. This is because a new era of education has started where teaching and learning is blended digitally.

According to Haleem, Javaid, Qadri, and Suman (2022), digital technologies emerged as the saviour of education at this critical time. The use of computers and other devices together with digital tools allows students to play a more productive role and be at the centre of the learning process. The teacher plays a leading role in this process and can validate learning effectiveness. With the myriads of digital resources available, learners can download the information they need or upload their content. Digital tools are technologies that can be deployed to facilitate effective teaching and learning of Biology in secondary schools. According to Crawford (2020), digital tools are software applications and online resources designed to facilitate tasks, activities, and processes through electronic devices such as computers, tablets, and smartphones. These tools encompass a wide range of functionalities including

communication, collaboration, education, productivity, and data management.

The common goals of teachers everywhere are to make lesson presentation vital and interesting to their students. These goals can be reached most effectively through the effective utilization of digital tools and other devices used for the transmission of concepts and other ideas deemed important. Akinwumi and Falemu (2020) posited that practical activities in Biology provide opportunities for students to actually do science as opposed to learning about science but meaningful learning of science requires the use of multisensory approaches where appropriate facilities are selected and used. This is necessary because in this kind of learning, students make use of more than one sense modality in learning. The ability of teachers to integrate and use digital tools for educational purposes is essential for enhancing teaching and learning of Biology.

Previous researches have reported a relationship between teachers' level of digital competence and their use of digital tools in schools (Dancsa, Štempel'ová, Takáč & Annuš, 2023; Alordiah et al, 2023). Digital tools such as blogs, wikis, the Google classroom, Google search engine, YouTube audio and video files and WhatsApp instant messaging have been the subject of numerous studies that have sought to identify the potential of these digital tools when used by teachers (AbdelSalam & Madji, 2021; Owolarafe, Abdulraheem & Bolaji, 2024). These digital tools extend the classic limitations of space and time in traditional education and that they increase student satisfaction with learning, improve academic achievement and facilitate comprehension of the subject matter studied.

Mucundanyi and Woodley (2021) asserted that free digital tools can support learning activities and improve student learning experiences in schools, colleges, and universities. Apart from Wikipedia where teachers sourced research materials, Google

Classroom is a valuable tool to create courses, invite students to join courses, add content, communicate with students, and create assignments and quizzes. Mucundanyi and Woodley (2021) stressed that Google Classroom also shows grades and due dates of assignments. It is possible to reuse existing materials, adjust the calendar, and customize the front page. Google Classroom is becoming more popular and comes in two versions, Google Classroom for teachers and G-Suite for Education with advanced features recommended to schools.

G-Suite for Education includes Google Classroom with other features such as Gmail, Calendar, Google Docs, Sheets, Forms, Slides, and Hangouts. More than 90 million teachers and students are using G Suite, while the number of teachers and students for Google Classroom is above 40 million (Mucundanyi & Woodley, 2021). Also, digital tools such as Google Earth and Google Maps have proved especially useful to teach subjects such as Earth Science in secondary education, while YouTube is one of the digital tools available to post and share Biology resources. YouTube provides students and Biology teachers with an opportunity to learn from the videos by pausing, playing, and replaying. Using a variety of Biology learning resources such as audio and video, motivates and engages students to learn.

According Dancsa et al (2023), Padlet is a virtual bulletin board tool that allows Biology teachers to share information, resources, and activities with their students. With Padlet, teachers can create a collaborative learning environment where students can share ideas and resources. Teachers can add multimedia elements, such as images, videos, and documents, to their Padlets to make them more engaging and informative. It also provides a real-time collaboration feature so students can collaborate on their assignments and projects. Also, Animoto is a digital tool that allows Biology teacher and students to create high-quality videos in a short time and from

any mobile device, inspiring students and helping improve academic lessons in Biology. The Animoto interface is friendly and practical, allowing teachers to create audio-visual lesson contents that adapt to educational needs of the students (Abah, 2019; Aina, & Opeyemi, 2020).

Socrative is one digital tool that can be utilized to facilitate the teaching and learning of Biology. According to Dancsa, Štempeľová, Takáč, and Annuš (2023), Socrative is a platform that enables teachers to create quizzes and assessments that students can take using their devices. With Socrative, Biology teachers can monitor student progress and receive instant feedback. It also provides real-time data, so Biology teachers can adapt their lessons and assessments to meet students' needs. Biology teachers can also collaborate with their peers to share and access quizzes created by other teachers. Socrative is easy to use and allows teachers and educators to engage their students and assess their knowledge.

Esohe, Ukpakara and Onyemaechi (2024) however posited that many teachers are not equipped with the necessary skills to incorporate digital tools into their teaching practices, leading to underutilization of available digital resources at their disposal. Also, there is limited data on the specific impact of various digital tools (e.g., blogs, Google search engine, Google classroom, Socrative, Padlet, YouTube audio and video files, and educational software) on students' understanding and retention of Biology concepts. Addressing these challenges is critical to leveraging technology's potential to improve student engagement, comprehension, and overall academic performance in Biology. It is against this backdrop that this paper investigated the utilization of digital tools in teaching and learning of Biology in secondary schools in Abuja Municipal Area Council, Federal Capital Territory.

Statement of the Problem

Biology education in Nigeria faces numerous challenges that impede the delivery of effective and comprehensive learning experiences. Traditional teaching methods dominate classrooms, often relying on rote memorization rather than fostering critical thinking and problem-solving skills. The researcher

observed that technology that could have been integrated into the teaching and learning of Biology is faced with barriers related to Internet connectivity, infrastructure, affordability of devices and data, electricity and digital literacy. Perhaps, insufficient understanding of how digital tools can be aligned with national educational standards and assessment methods in Abuja Municipal Area Council is a problem that necessitated the current study on utilization of digital tools in teaching and learning of Biology in secondary schools in Abuja Municipal Area Council.

Objectives of the Study

The specific objectives of the study were to:

1. Ascertain the digital tools utilized by teachers for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council, Federal Capital Territory?
2. Find out constraints to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council, Federal Capital Territory.

Research Questions

The following research questions were raised to guide the study:

1. What are the digital tools utilized by teachers for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council, Federal Capital Territory?
2. What are the constraints to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council, Federal Capital Territory?

Research Methods

This study is a descriptive research design of the survey type. The target population was all the 54 Biology teachers in all the 18 public senior secondary schools in Abuja Municipal Area Council (AMAC) of the Federal Capital Territory (FCT), Abuja. The population was considered manageable and therefore, census sampling technique was used to adopt the entire population for the study. Census is a quantitative research method, in which all the members of the population are enumerated. The size of this population for Biology teachers is insignificant

and so, all the biology teachers constitute sample for the study. Thirteen (13) items self-structured questionnaire titled: “Utilization of Digital Tools in Teaching and Learning of Biology Questionnaire (UDTTLBQ) was used to generate data for the study. Content validity was used. Test-retest method of reliability was used to obtain the internal consistency. The reliability index was obtained through Cornbrash’s alpha (0.98). Out of the 54 questionnaires administered, 51 were returned valid, representing 94% success rate. The analyses of data were carried

out based on the specific objectives and research questions of the study. Data collected was imputed into the SPSS (25) software package where descriptive statistics, in the form of frequency tables and graphs were generated. Discussions of findings were done immediately after each data analysis.

Results

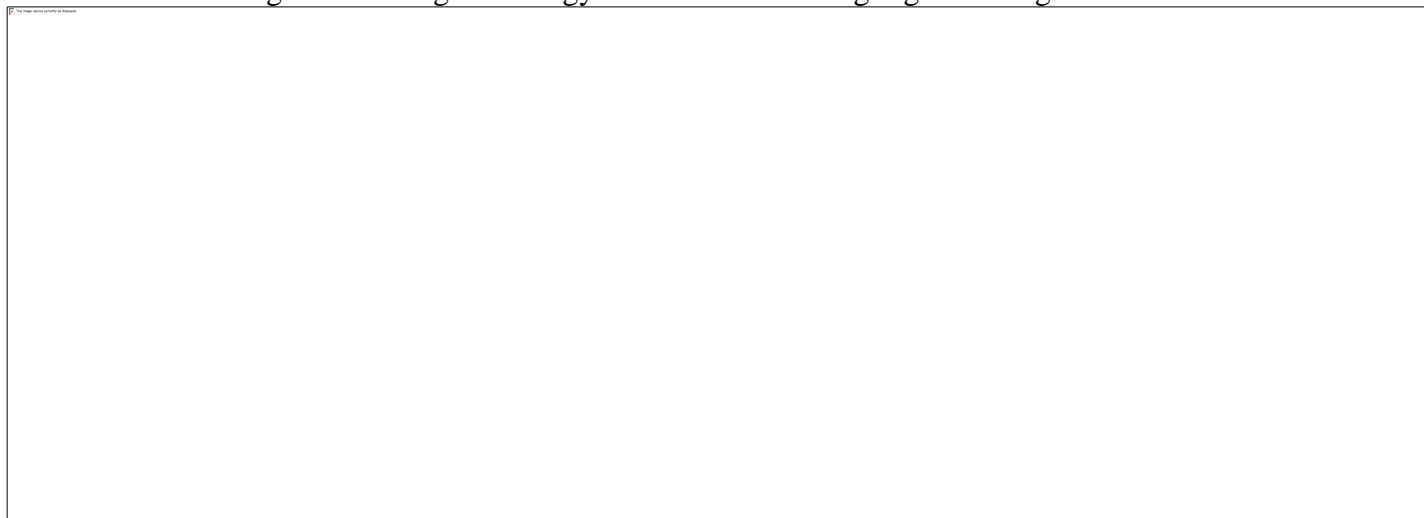
Research Question One: What are the digital tools utilized by teachers for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council, Federal Capital Territory?

Table 1: Digital tools utilized by Biology teachers for teaching and learning of Biology in secondary schools

	Variables	Frequency	Percent
Valid	Google search engine	21	41.2
	Google classroom	3	5.9
	Socrative	2	3.9
	Padlet	3	5.9
	YouTube	9	17.6
	Wiki	11	21.6
	Notability	2	3.9
	Total	51	100.0

Source: SPSS version, 25

Table 1 revealed that large percentage of the biology teachers, 21 (41.2%) use Google search engine to facilitate the teaching and learning of Biology, 11 (21.6%) use Wiki and 9 (17.6%) of the biology teachers use YouTube. 3 (5.9%) of the biology teachers use Google classroom and another 3 (5.9%) use Padlet digital tool, 2 (3.9%) use Socrative digital tool and another 2 (3.9%) use Notability. The findings implied that majority of the biology teachers in secondary schools in Abuja Municipal Area Council utilize Google search engine as digital tool to facilitate the teaching and learning of Biology. This was further highlighted in figure 1 below:



An overview of figure 1 showed that a large percentage of Biology teachers (41.2%) in secondary schools in Abuja Municipal Area Council utilize Google search engine as major digital tool to facilitate the teaching and learning of Biology.

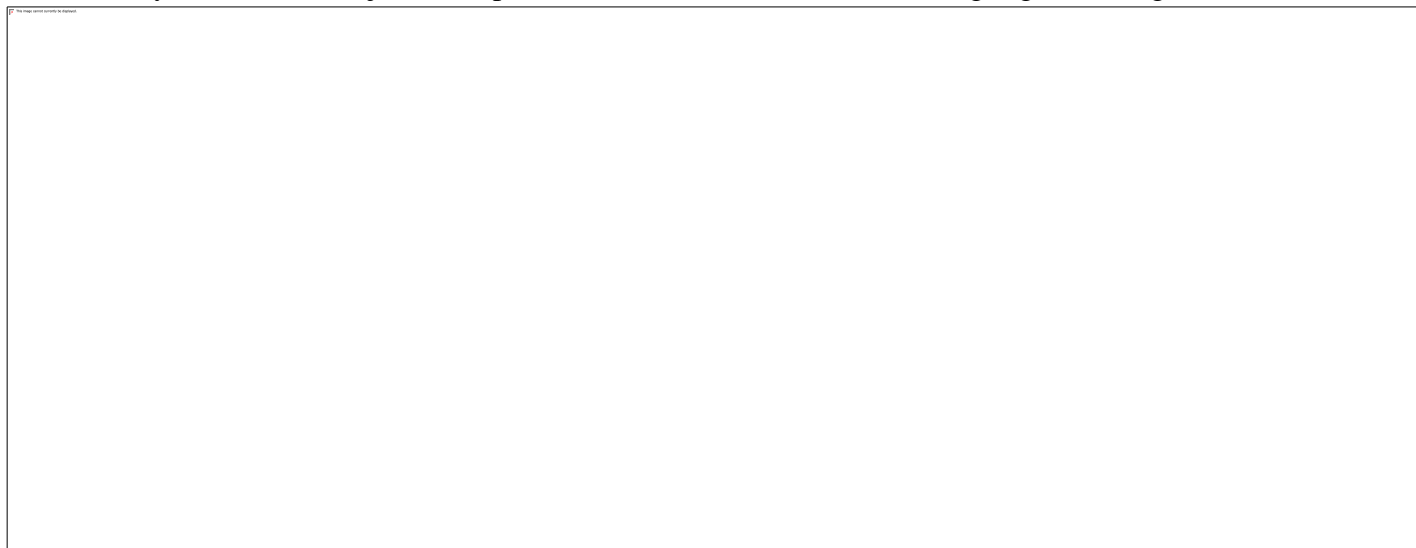
Research Question Two: What are the constraints to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council, Federal Capital Territory?

Table 2: Constraints to the utilization of digital tools for teaching and learning of Biology in secondary schools

	Variables	Frequency	Percent
Valid	Too much junk information	3	5.9
	High cost of internet subscription	15	29.4
	Power failure	8	15.7
	Network failure	5	9.8
	Slow internet speed	11	21.6
	Lack of digital competency	9	17.6
	Total	51	100.0

Source: SPSS version, 25

Table 2 revealed that a large percentage of the biology teachers 15 (29.4%) were of the view that high cost of internet subscription is a constraint to the utilization of digital tools for teaching and learning of Biology in secondary schools, 11 (21.6%) were of the view that it is slow internet speed and 9 (17.6%) were of the view that constraint comes from Biology teachers' lack of digital competency. While 8 (15.7%) of the biology teachers were of the view that power failure posed as constraint to the use of digital tools, 5 (9.8%) believed that that network failure is the constraint and 3 (5.9%) of the biology teachers were of the view that; there is the problem of too much junk information while using digital tools. From the findings, conclusion can be drawn that high cost of internet subscription is a major constraint to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council. This was further highlighted in figure II below:



An overview of figure II showed that a large percentage of the biology teachers (29.4%) agreed that high cost of internet subscription is a major constraint to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council.

Discussion of Findings

The findings revealed that Google search engine (41.2%) and Wikipedia (21.6%) were major digital tools that Biology teachers utilized to facilitate the teaching and learning of Biology. Majority of the Biology teachers were particularly unaware of Padlet,

Socrative and Notability digital tools in enhancing the teaching and learning of Biology in secondary schools in Abuja Municipal Area Council. The findings corroborated the positions of AbdelSalam and Madji (2021) and Owolarafe, Abdulraheem and Bolaji (2024) who agreed that digital tools such as blogs, wikis, the Google classroom, Google search engine, YouTube audio and video files and WhatsApp instant messaging have been the subject of numerous studies that have sought to identify the potential of these digital tools when used by teachers. Many teachers find it easier to explore Google search engine than other digital tools.

The findings also revealed that high cost of internet subscription (29.4%) and slow internet speed (21.6%) were major constraints to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council. These findings contradicted the position of Esohe, Ukpakara and Onyemaechi (2024) that many teachers are not equipped with the necessary skills to incorporate digital tools into their teaching practices, leading to underutilization of available digital resources at their disposal. It also contradicted the results of the studies by Dancsa, Štempeľová, Takáč and Annuš (2023) and Alordiah et al, (2023) that relationship exist between teachers' level of digital competence and they use of digital tools to facilitate teaching and learning in the school. This means that, even if the cost of internet subscription is made affordable for teachers and internet run at high speed as expected, teachers' digital competence and their use of digital tools are still essential.

Conclusion

Digital tools in education have the potential to significantly enhance the teaching and learning of Biology in Nigeria by making complex scientific concepts more accessible and engaging for students. However, based on the findings of the study, the following conclusions are drawn: Google search

engine and Wikipedia are major digital tools that Biology teachers utilize to facilitate the teaching and learning of Biology as majority of them are unaware of Padlet, Socrative and Notability digital tools. High cost of internet subscription and slow internet speed are major constraints to the utilization of digital tools for teaching and learning of Biology in secondary schools in Abuja Municipal Area Council.

Recommendations

Based on the findings of the study, the following recommendations were suggested:

1. Biology teachers should go for professional courses, workshops and training on ICT particularly on how to use digital tools such as Padlet, Socrative and Notability to facilitate the teaching and learning of Biology in secondary schools.
2. Biology teachers should constantly update their knowledge on new trends in digital tools that can make their teaching interesting and understandable for students.
3. The Federal Government of Nigeria through its relevant regulatory agencies should adopt policies that will influence internet service providers to not only reduce the cost of internet subscription, but also enable infrastructure that will improve network connection.
4. Government at all level should provide free internet wifi connection in every school and public places for the use of every Nigerian citizen

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