

ASSESSMENT OF THE INTEGRATION OF MOBILE TECHNOLOGIES IN LEVERAGING THE TEACHING OF BIOLOGY EDUCATION IN COLLEGE OF EDUCATION GINDIRI, PLATEAU STATE, NIGERIA .

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Abstract

This work assesses the integration of mobile technologies as an innovative teaching strategy in leveraging biology education. A case study of NCE three Students College of education Gindiri. The study determines the extent of the use of mobile technologies learning strategies among biology teachers in biology instruction in College of Education Gindiri, identify possible challenges encountered in the use of mobile learning strategies for classroom instructions by teachers in the study area and to suggest way forward for such possible challenges. Twenty statements were raised on teacher's extent of the usage of mobile technologies and the challenges encountered in the use of this method of teaching biology. The sample for the study comprises of all NCE III students in the study area. Respondents were requested to respond on a five Likert scale: Never, Rarely, sometime. Often and always. The scores ranges from one to five marks for each of the responses in ascending order. The test instrument was validated by two experts in the field. The study discusses the meaning, benefits challenges in the uses of this method. Highlighting its potentials to revolutionized biology teaching, thereby improving the student's outcome. The information gathered were analysed using frequencies and simple percentages and the result presented in a tabular form. The paper itemized some recommendations as follows: innovativeness in biology teaching should be a priority of our policy makers, government, administrators and teachers, government should provide the enabling environment and the resources required to foster innovative teaching, proper monitoring, evaluation and sustainability of such strategies should be ensured by government school administrator and teachers, provide low-tech alternatives and ensure equitable access to mobile –technology use, invest in short-practice-focused professional development for teachers emphasizing classroom routines assessment use among others. In conclusion these recommendations if truly implemented will go a long way in promoting the use of mobile technology in leveraging biology education there by improving the system.

Key Points: Assessment, integration, mobile technologies, leveraging, Biology Education.

Background of the study.

Education is an indispensable tool for the development of any nation and the teachers are the implementers of the educational programs. At all facet of the educational systems, the role of the teacher is to translate the theory into practical. In the quest for obtaining meaningful and effective way of learning, many researches had been conducted to this regard. Biology is one of the core subject among the science subject that needs to be taught in such a way to elicit students understanding,

owing to the generality of its importance in providing foundational knowledge about the interrelationship between components of the natural environment.

Biology connotes the study of life, however to Dutfield (2022) it is the study of the biotic and the abiotic components of the functional ecosystem and focusses more on knowledge application. In another word, Millar (2020), refers to it as the teaching and learning of scientific concepts and principles using divers methodologies in both formal and informal setting with the aim of fostering scientific literacy, critical thinking and problem-solving skills among learners as a course it is central to many science courses like: medicines, pharmacy, biochemistry, biotechnology, nursing, genetic engineering, agriculture, microbiology and many others. That is why the National Policy on Education (NPE, 2014) has the goal of education to include : to contribute to national development through high –level relevant manpower training , develop and inculcate proper values for the survival of the individual land society ,develop the intellectual capacity of individuals to understand and appreciate the local and external environment ,acquire both physical and intellectual skills for self- reliance, promote and cement National unity ,promote National and International understanding and interaction and finally promoting and encouraging scholarship and community service. Hence persons who occupied key positions as doctors, pharmacist, biochemist, microbiologist, zoologist, botanist, agronomist, ecologist and all other related professions have had experiences in biology in one way or the other.

The aforementioned had made biology a pivotal part of Science, Technology, Engineering and Mathematics Education. Furthermore, biology is a very relevant subject as it plays important role in the exploration of complex life processes, structures, functions origins, evolution and the distributions of living organisms (Chucku and Arokugu, 2019). Hence the knowledge of biology is paramount for national development and global competitiveness in almost all facet of human endeavour, hence the need for assessing the integration modern innovative ways of teaching like the mobile-technologies. In biology education.

Concepts definition,

The concept of assessment in the light of this research work refers to determining the usability of mobile technology tools in biology teaching and learning. It involves using these tools to gather evidence of engagement, availability of mobile devices and conceptual understanding.

The word integration means weaving mobile tools into the biology curriculum, pedagogy, and learning environment. For example, students use mobile cameras for field work like for taking pictures of leaves, soil organisms or other structures. In another word, it entails embedding mobile technologies into biology leveraging in the context of this research work, entail steps of applying assessment data to refine the usability of mobile technologies in the teaching of biology.

Concepts of mobile- technologies

Mobile technology refers to portable and wireless technologies that enable communication, computation, data access, and services on the move. It typically involves devices (smartphones, tablets, wearable's, laptops), connectivity (cellular networks, Wi-Fi, Bluetooth, among others), and supporting software (apps, cloud services) (IBM- Online). Mobile learning technologies are contemporary ways to teach biology effectively emphasizing their role in improving student's engagement, understanding and digital literacy. To Lee and Thompson (2023), this type of learning harnesses the use of technologies such as the educational apps, virtual labs and online

platforms using smartphones, tablets and related portable devices which provide adequate medium for interactive opportunities among learners. These tools are functional in revolutionizing biological researches, diagnostics, environmental monitoring and education. Their combination of high-quality optics /sensor, computational power, connectivity and portability makes them increasingly useful in every area of the educational systems

Uses of mobile- technologies in biology classroom instructions.

Mobile technologies are very relevant in biology teaching and learning as they provide concrete, research-supported opportunities to enrich biology instruction ranging from field data collection to immersive augmented reality visualization, but realizing their promise depends on careful pedagogical design, teacher support, and attention to equity and infrastructure, (Ciloglu & Ustun, 2023). They also stressed the fact that mobile –technologies in biology instruction show consistent increases in student motivation and positive attitudes toward biology topics when integrated purposefully. Mobile technologies allow biology students to visualize complex structures and systems such as organelles, anatomy, and ecological models hence improving students’ performance and engagement (Khan, et al 2025). It equally creates an interactive platform for students to share their views even over the social media. In this regard, Lu, et al (2021) maintained that mobile Technology-Based Cooperative learning model integrating devices like iPads and apps such as Live Board and Google Drive enables students to create and share live content while instructors provide real-time feedback. Mobile technologies offer adequate opportunities and support for flexible and well as personalized learning experiences, allowing students to engage with biology content at their own pace and according to their individual learning styles (Martin & Ertzberger, 2023). Mobile –technologies therefore are of enormous benefits hence the need to inculcate same in teaching and learning particularly biology.

Statement of the Problems

Despite the relevance of biology to the individual and the society in determining economy growth, and despite the afford employed by biology teachers in trying different pedagogy, the achievement of students in biology still remain a matter of concern and some of the reasons were reported by Adiboye and Omatoye (2023) that the teaching of biology sometimes poses a lot of challenge to biology teachers due to the abstract nature of some aspects as genetics. To them, this was presented by the West African Examination Council and the National Examination Council Chief Examiners Report (2016, 2017 2018 and 2021) that the under-achievement of students in public biology examination was due to inadequate understanding of some genetic concepts, nervous system and physiological feature, hence the used of phrases like :unsatisfactory, downward trends, decline in pass rate, poor expression , in ability to compare biological processes appropriately and poor performances in questions requiring application by examiners.

Furthermore, students under achievement are also traceable to the used of traditional method of teaching adhered to by most science teachers as stressed by Josiah and Shedow (2020) that the last decades portrays passive and less involvement of students leading to teacher centeredness in the teaching and the learning process, making it boring and uninteresting as students are less or not motivated at all to

learned. Available literatures also revealed that student's underperformance and achievement is as a result of inadequate infrastructural facilities, inadequate qualified staff, overcrowded classroom, poor funding of education, poor curriculum innovation and implantation and the like (Eze & Nwachucku, 2021, Olatunde-Aiyedu, Obinna & Chukwu, 2022, Adebayo and Ogunleye 2023, and UNESCO, 2023,). This state of under-achievement among biology students had prompted the researcher in assessing the frequency of teacher's integration of mobile technologies in the teaching and learning of biology.

Aim/objectives

In view of the above, the aims and objectives of this study is to assess teachers' integration of mobile technologies in learning biology, a case of College of Education Gindiri. Therefore, the study specifically sought to:

- Determine the extent of the use of mobile-technologies among biology teachers in the teaching and learning process in biology.
- Identify possible challenges encountered in the use of mobile-technologies by teachers in teaching and learning process in biology.

Research questions

To what extent do biology teachers integrate mobile- technologies in biology teaching and learning?

What are the likely challenges encountered by biology teachers in integrating mobile-technologies in biology teaching and learning?

Methodology.

The study was a case study, and the population for the study were biology students of the College of Education Gindiri. The sample size for the study constitutes all biology NCEIII students, comprising of 93 Students. The instruments for the collection of data were forty statements divided into Sections A and B. The first section constitutes 20 statements on the frequencies of biology teacher's integration of mobile technologies in classroom instruction. While the second section has 20 statements on the challenges encountered by both teachers and students in using mobile technologies for biology teaching and learning. The validity of the text items was established by two experts in biology. The questionnaire was administered to the students with the help of research assistants and all 93 items were returned.

Respondents responded to the questionnaire items on a five Likert scale of: Always, Often, Sometimes, Rarely and Never. The scale was weight 5, 4, 3, 2 and 1. For decision on the items, the mean index was found to be 2.94 for items in Table 1 and 3, 10 for items in Table 2 respectively. Any mean below 2.94 and 3.10 in the first and the second table are considered rejected while means at 2, 94 and 3.10 and above were accepted. The data collected were analysed using mean and standard deviation and result presented in table.

Research question one

To what extent do biology teachers integrate mobile- technologies in biology teaching and learning?

Table 1

Frequency of the integration of mobile-technologies by biology teachers in college of education Gindiri Plateau State.

Statements	mean	SD	Decision
1 My biology teacher uses mobile devices to show videos Related to biology topics	3.31	1.42	accepted
2 My teacher uses mobile apps to explain biology concepts in class	2.98	1.23	accepted
3 My teacher uses a phone or tablets to access biology diagrams or Illustrations	2.94	1.31	accepted
4 Our teacher encourages us to use mobile phone to look up biology Information	3.27	3.10	accepted
5 My teacher shares online biology resources using mobile devices.	2.96	1.17	accepted
6 We do Biology quizzes or tests through mobile apps or platforms	2.58	1.39	rejected
7 The teacher uses mobile phones to take attendance or monitor class Participation	3.47	1.03	accepted
8 Mobile technology is use during biology practical activities or experiments	2.97	1.44	accepted
9 The teacher uses mobile devices to give feedback on our biology. assignment	3.13	1.37	accepted
10 We are allowed to use our mobile phone to participate in biology class discussion.	13	1.34	accepted
11 Our teacher uses mobile devices to display models/ simulations of biology structures	3.09	1.39	accepted
12 The teacher uses mobile devices during field trips for data collection or notes taking.	3.11	1.21	accepted
13 Our teachers use mobile technology to connect with students/teachers on-line	3.21	1.24	accepted
14 The teacher sends biology learning materials through mobile apps like WhatsApp.	3.20	1.28	accepted
15 We are asked to submit biology homework through mobile devices.	2.83	1.38	rejected
16 The teacher project images or slides from a mobile device during biology lesson	2.29	1.37	rejected
17 We play educational biology games using mobile apps in class.	2.94	1.38	accepted
18 My teacher uses mobile tools to help explain difficult biology terms	2.46	1.31	rejected
19 My teacher uploads biology notes on platform so we can access through our phones	2.46	1.34	rejected
20 My teachers used of mobile technologies is regular and adequate	3.21	1.27	accepted.

Researcher's Field Work (2025).

The result in table one showed that all the statements on teachers' integration of mobile-technology in the teaching and learning of biology were all accepted with the exception of statements numbers, 6 15, 16, 18 and 19 which were rejected by the respondents indicating that biology teachers' integration of mobile-technologies in teaching and learning is good and encouraging hence majority of the statements were positively responded to by respondents.

Research question 2

What are the likely challenges encountered by biology teachers in integrating mobile-technologies in biology teaching and learning?

Table2

Challenges of the integration of mobile-technologies by Biology Teachers in College of Education Gindiri, Plateau State

Statements	mean	SD	Remarks
1. I don't have a mobile device to use for biology learning	3.00	1.55	rejected
2. Poor internet connection makes it hard to use mobile technology in biology class.	3.17	1.58	accepted
3. I don't have enough mobile data to access online biology materials.	3.00	1.45	rejected
4. I get distracted by social media or other apps when using my phone for biology	2.93	1.51	rejected
5. The schools does not allow the use of mobile phone during classes.	3.55	1.57	accepted
6. Not all students in my class can afford smartphones for learning.	3.11	1.58	accepted
7. Some biology apps or videos use too much data or memory.	3.27	1.44	accepted
8. The mobile screen is too small to study complex biology diagrams.	2.94	1.67	rejected
9. Teachers rarely explain how to use technology for biology learning	2.79	1.66	rejected
10. I don't know which mobile apps are best are best for learning biology.	2.79	1.60	rejected
11. Mobile apps some time crash or don't work properly during class.	2.95	1.55	rejected
12. I find it difficult to focus on biology topics when using mobile technologies	2.94	1.51	rejected
13. The mobile apps use in the class are not easy to understand.	2.74	1.47	rejected
14. The teacher doesn't often ask for our feedback in using mobile devices for lessons	3.10	1.37	accepted
15. I am afraid of damaging or losing my phone if I bring it to school	3.04	1.53	rejected
16. Power cuts or low battery affects my ability to use mobile devices.	3.31	1.18	accepted
17. Some biology apps have many ads that interrupt learning	2.97	1.46	rejected.
18. I don't feel confident using my phone for biology learning	2.72	1.55	rejected
19. I prefer textbooks over mobile devices for learning biology,	3.42	1.46	accepted
20. Poor guidance and support affects my use of mobile technologies.	3.40	1.50	accepted

Researcher's Field Work (2025)

Table 2 revealed that statements numbers: 2, 5, 6, 7, 14 19 and 20 are identified by the respondents as sources of challenge for their biology teachers in integrating mobile technologies in biology teaching and learning. The remaining statements were not considered as challenges by the respondents as the statements were rejected.

Discussion of the findings

The result of the finding showed that the integration of mobile-technologies in the teaching and learning of biology is an ongoing process particularly among biology

teachers in the study area, as indicated by the responses of the respondents. 15 items out of 20 were accepted representing 75%, while only 5 items representing 25% were rejected. The integration of mobile technologies by biology teachers aligned with the work of Williams and Patel (2024) in discussing the need for pedagogical approaches that utilise mobile technologies to their fullest potential, emphasising the importance of aligning technological tools with teaching methodologies. Nevertheless, the processes of the integration are not without challenges as some few were pointed by the respondents.

Based on the findings therefore, the challenges encountered by teachers in integrating mobile-technologies in the study area are minimal as 13 items representing 65% were considered not a challenge for biology teachers in this respect. Only 7 items representing 35% were identified by the respondents as constituting a challenge. The challenges identified in numbers 2, 5, 6, 7, 14, 19 and 20 are: Poor internet connection for the use of mobile-technologies, stoppage of the use of mobile device during lesson by school authority, inability of some students to afford smartphone, too much of data and memory usage by some biology apps or videos, inability of teachers to provide feedback for students when mobile devices are used, the preference of text books by some students over mobile technologies, However, a few students noted challenges such as occasional technical issues and a preference for traditional learning methods in certain topics, and the lack of guidance and support by biology teachers to students when using mobile-technologies.

The view of the respondents on the lack of guidance and support seems to agree with study of needs assessment in Indonesian high schools that showed students were only "somewhat familiar" with augmented reality and required more exposure to use it effectively (Ramadhani et al, 2024). Their position tally with the findings of (Opoku-Asare & Ankomah, 2024) on pre-service biology teachers, that while they had technological knowledge, applying it effectively in classroom contexts remained inconsistent there by posing some challenge in its application.

Furthermore, the use of mobile-technologies can be affected by issues that are technical in nature as well as classroom management practices by the teacher for example, battery life, power failure, app compatibility and other external distractions are problems likely to emanate to pose challenges in the use of mobile technologies. Educational apps vary considerably in pedagogical quality, soundness and alignment with learning outcomes and assessment remaining uneven. For example, different phone models have different camera and sensor qualities there by affecting the consistency of instructional outcome. Still, in another submission by Khan and Lee (2023) they maintained that teachers faced initial difficulties in integrating technology with existing curricula and required ongoing professional development. More so, acceptability, usability, student's competence .and extra cost of other peripherals can also be a big challenge among others.

Conclusion.

The integration of mobile technologies—in classroom settings enhance student engagement, improve conceptual understanding, and support the development of science process skills and offers exciting opportunities for enhancing digital literacy. This study shades lights on the extent of the used of mobile –technologies in learning practices in biology education and the challenges encountered by teachers in the process and recommend ways on how mobile learning technologies can be

effectively utilized to enhance digital literacy in biology education. It as well provide valuable insights for educators, curriculum designers, and policymakers when redesigning curriculum and pedagogical strategies.

Recommendations

- Future researches should be geared towards considering the broader context of teaching such as the socio-cultural environmental factors under which learning occur, this would provide a platform for more comprehensive understanding in the integration of mobile technologies
- Innovativeness in biology teaching should be a priority of our policy makers, government, administrators and teachers
- Proper monitoring, evaluation and sustainability of such strategies should be ensured by government school administrator and teachers
- **Different pedagogical approaches can be embrace as** utilizing a mix of qualitative and quantitative methods can offer deeper insights into the complexities of teaching and learning processes.
- Engaging educators, students, and other stakeholders in research process can lead to more relevant and applicable of findings.
- Provide low-tech alternatives and ensure equitable access to mobile –technology use.
- Invest in short, practice-focused professional development for teachers emphasizing classroom routines assessment use.

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