AJSTME, Volume. 11, Issue 4. 396-401, November, 2025. https://www.ajstme.com.ng
ISSN: 2251-0141 (Print), 2971-6233 (Online)

Utilization of Large Language Models for Learning Among Undergraduate Biology Education Students in the University of Nigeria, Nsukka

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Abstract

The study sought to determine the utilization of large language for Learning Among Undergraduate Biology Education Students in the University of Nigeria, Nsukka. The study was guided by three research questions. The study adopted descriptive survey design. The population of the study included 759 Education Biology students in the Department for the 2024/2025 academic session. A sample of 262 students was used for the study. The sample was determined using Taro Yamane formula for sample size determination and selected using simple random sampling technique. The instrument for data collection was a researcher-developed questionnaire titled "utilization of large language models questionnaire." The instrument was validated by three experts in Department of Science Education and trial-tested on 20 Chemistry Biology students in same Department. A reliability index of 0.81 using Cronbach Alpha. Collected data was analysed using Mean and Standard deviation. Findings revealed that: undergraduate Biology Education students utilize large language models to a low extent. ChatGPT and Gemini is utilized to a high extent whereas Bard, Llama, Copilot, Grok, DeepSeek, Mistral, Command R, and Claude.ai are utilized to a low extent. The study recommended that: University management should provide stable and affordable internet access across campus to remove access barriers and support regular use of large language models for learning.

Keywords: Large Language Models, Utilization, Biology, Undergraduate, Learning

Introduction

Higher education is increasingly shaped by digital technologies that support flexible and independent learning. In recent years, artificial intelligence tools, especially large language models, have become widely available to university students for academic purposes such as explaining concepts, summarising learning materials and supporting assignment preparation (Kasneci et al., 2023; Baidoo Anu & Ansah, 2023; Dwivedi et al., 2023). Large language models are computer-based systems trained on large volumes of text to generate human like responses to user prompts (Zhai, 2022; Huang et al., 2023). Their ability to provide instant feedback and personalised explanations makes them attractive to students who seek academic support outside formal classroom teaching (Sallam, 2023). As a result, many undergraduates now integrate these tools into their everyday study practices, often without structured guidance from lecturers (Kasneci et al., 2023).

Biology education students are trained to become professional teachers and are expected to develop strong academic competence and effective learning skills. Their training involves reading scientific texts, interpreting information, preparing lesson plans and producing academic work. These tasks require sustained engagement with content and independent learning ability. Large language models may support these processes by helping students clarify difficult ideas, organise content and practise academic writing (Baidoo Anu & Ansah, 2023; Dwivedi et al., 2023). They may also assist in generating examples for teaching and revising course content (Huang et al., 2023). However, the educational value of these tools depends on how students use them for learning and the extent to which such use promotes understanding rather than dependence (Sallam, 2023).

Studies on large language models in education have focused mainly on perceptions, ethical issues

and possible instructional applications (Zhai, 2022; Kasneci et al., 2023; Dwivedi et al., 2023). These studies provide useful insights into potential benefits and risks, but they offer limited evidence on students' actual learning practices with these tools. In the Nigerian context, research on artificial intelligence in higher education is still developing and is largely concerned with awareness and attitudes to digital technologies (Akinwale & Adekunle, 2023; Okonkwo & Ade-Ibijola, 2024). There is little empirical evidence on how students in teacher education programmes use large language models for learning. This is more pronounced in subject specific areas such as Biology education, where learning involves both conceptual understanding and pedagogical preparation.

The absence of clear evidence on students' utilisation of large language models raises important educational concerns. When students rely on these tools without guidance, they may develop learning habits that reduce independent reasoning and academic integrity (Sallam, 2023; Kasneci et al., 2023). Conversely, when properly used, large language models may support self directed learning and improve access to academic support (Baidoo Anu & Ansah, 2023; Huang et al., 2023). Understanding how Biology education students use these tools is therefore essential for determining whether their utilisation supports the goals of teacher education, which emphasise deep learning, reflective practice and professional competence (Dwivedi et al., 2023).

The University of Nigeria, Nsukka, is a major centre for teacher education in Nigeria and produces a large number of Biology education graduates each year. Despite the growing availability of large language models among students, there is no clear empirical evidence on how Biology education students in the University of Nigeria, Nsukka utilise these tools for learning. It is not clearly known the extent of their use, the learning purposes for which they use them, the frequency of use or the challenges they encounter (Akinwale & Adekunle, 2023; Okonkwo & Ade-Ibijola, 2024). This lack of institution based and discipline specific evidence limits informed decision making on the role of artificial intelligence tools in teacher education.

Furthermore, most existing studies do not distinguish between general university students and students in teacher education programmes, whose learning demands and professional expectations differ (Kasneci et al., 2023; Dwivedi et al., 2023). Biology education students are future teachers who will influence how technology is used in secondary school classrooms. Their present learning practices with large language models may shape their future instructional practices. This makes it necessary to examine their utilisation of these tools within their training context. The limited availability of such studies therefore represents a clear gap in both literature and educational practice. It is against this background that this study investigates the utilization of large language models for learning among undergraduate Biology education students in the University of Nigeria, Nsukka.

Research Questions

The following questions were posed to guide the study.

1. To what extent do undergraduate Biology Education students utilize large language models?
2. What factors influence the utilization of large language models among undergraduate Biology Education students?
3. What strategies can be adopted to improve the utilization of large language models among undergraduate Biology Education students?

Methods

The study adopted descriptive survey design. The study was carried out in the University of Nigeria, Nsukka, specifically in the Department of Science Education. The population of the study is 759 Biology Education students in the Department in the 2024/2025 academic session. A sample size of 262 was determined using Taro Yamane sample size determination formula and selected through simple random sampling technique. The instrument for data collection is a researcher-developed questionnaire titled "utilization of large language models questionnaire". The instrument is organized into three clusters A, B and C. Cluster A consists of 10 items designed to elicit data on the extent of utilizations of large language models among undergraduate Biology Education students. Cluster B consists on 10 items designed to elicit data on factors that influence students' utilization of large language models among undergraduate Biology Education students. Cluster C also consists of 10 items designed to elicit data on strategies to improve utilization of large language models among undergraduate Biology Education students. All items on the instrument were structured on four-point response options of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD). The instrument was validated by three experts in the department of science education and trial-tested on trial-tested on 20 Chemistry Biology students in same

Department. A reliability index of 0.81 using Cronbach Alpha. Collected data was analysed using Mean and Standard deviation.

Results

The findings of the study is organized in tables below in line with the research questions that guided the study.

Table 1: Mean and standard deviation of the extent of utilizations of large language models among undergraduate Biology Education students.

S/N	Large Language Models	Mean	SD	Decision
1.	ChatGPT	3.90	0.30	HE
2.	Bard	1.45	0.67	LE
3.	Llama	1.25	0.54	LE
4.	Gemini	3.15	0.48	HE
5.	Copilot	1.45	0.67	LE
6.	Grok	2.10	0.54	LE
7.	DeepSeek	1.25	0.43	LE
8.	Mistral	1.25	0.54	LE
9.	Command R	1.30	0.78	LE
10.	Claude.ai	1.30	0.78	LE
Cluster Mean		**1.84**	**0.57**	**LE**

Result on table 1 shows that undergraduate Biology Education students utilize large language models to a low extent. ChatGPT and Gemini is utilized to a high extent whereas Bard, Llama, Copilot, Grok, DeepSeek, Mistral, Command R, and Claude.ai are utilized to a low extent.

Table 2: Mean and standard deviation of the factors that influence students' utilization of large language models among undergraduate Biology Education students

S/N	Item Statement	Mean	SD	Decision
11.	Lack of stable internet connection	3.45	0.74	Agree
12.	Lack of digital skills to operate LLM tools	3.69	0.65	Agree
13.	Perception that LLMs are not useful or relevant	3.50	0.59	Agree
14.	Inadequate training or orientation on how to use LLMs	3.55	0.60	Agree
15.	High cost of accessing premium features	3.85	0.48	Agree
16.	Lack of awareness or understanding of LLMs	3.69	0.57	Agree
17.	Fear of academic dishonesty or being penalized for using LLMs	3.50	0.67	Agree
18.	Limited awareness of the full range of LLM applications	3.65	0.85	Agree
19.	Concern about overdependence on AI tools	3.80	0.51	Agree
20.	Lack of personal devices (smartphone/laptop) for using LLMs	3.65	0.85	Agree
Cluster Mean		**3.63**	**0.65**	**Agree**

Result on table 2 shows that the factors that influence students' utilization of large language models among undergraduate Biology Education students include: Lack of stable internet connection, Lack of digital skills to operate LLM tools, Perception that LLMs are not useful or relevant, Inadequate training or orientation on how to use LLMs, High cost of accessing premium features, Lack of awareness or understanding of LLMs, among others.

Table 3: Mean and standard deviation of the strategies to improve utilization of large language models among undergraduate Biology Education students

S/N	Item Statement	Mean	SD	Decision
21.	Providing stable and affordable internet access for students and staff	3.45	0.86	Agree
22.	Training users to improve digital skills needed to operate LLM tools	3.40	1.07	Agree
23.	Raising awareness on the usefulness and relevance of LLMs in education	3.45	1.07	Agree
24.	Organizing regular workshops and orientation sessions on how to use LLMs	3.80	0.40	Agree
25.	Reducing or subsidizing the cost of accessing premium LLM features	3.40	0.97	Agree
26.	Promoting awareness campaigns on the concept and benefits of LLMs	3.40	0.74	Agree
27.	Clarifying academic policies to allow responsible use of LLMs	3.65	0.48	Agree
28.	Educating students on the broad range of applications LLMs can offer	3.50	0.50	Agree
29.	Encouraging a balanced use of LLMs to avoid overdependence	3.50	0.92	Agree
30.	Providing personal digital devices (laptops or tablets) to students	3.32	1.17	Agree
Cluster Mean		**3.49**	**0.82**	**Agree**

Result on table 3 show that the strategies to improve utilization of large language models among undergraduate Biology Education students include: Providing stable and affordable internet access for students and staff; Training users to improve digital skills needed to operate LLM tools; Raising awareness on the usefulness and relevance of LLMs in education; Organizing regular workshops and orientation sessions on how to use LLMs, among others.

Discussion of the Findings

The study showed that ChatGPT and Gemini were utilised to a high extent, while Bard, Llama, Copilot, Grok, DeepSeek, Mistral, Command R and Claude.ai were utilised to a low extent by undergraduate Biology Education students. This indicates that students rely mainly on popular and widely accessible large language models that are familiar and easy to use, while making limited use of less visible alternatives. The high utilisation of ChatGPT and Gemini reflects their ease of access, user friendly interfaces and frequent exposure through peers, classroom discussions and online platforms. In contrast, the low utilisation of other models suggests limited awareness, restricted access, technical requirements and weaker integration into students' academic routines, which collectively shape students' choices of large language models.

Studies that align with this result include Okoro and Obi (2024), who found that Nigerian undergraduates used ChatGPT more frequently than other large language models due to its accessibility and wide online presence. Similarly, Udeh and Alade (2023) reported that students preferred mainstream models like ChatGPT and Gemini because they were easier to navigate and more reliable for academic tasks. A related study by Hassan and Barde (2023) showed low utilisation of emerging or specialised models such as Llama and Mistral among university students, linking this to low awareness and limited institutional exposure. In contrast, Nnaji and Olowu (2022) found more balanced utilisation across several models in their study, suggesting that exposure and training opportunities can influence usage patterns. These variations emphasise the role of accessibility, awareness and platform familiarity in shaping how students choose and utilise large language models.

The study also found that students' utilisation of large language models among Biology Education students is influenced by lack of stable internet connection, limited digital skills, perception that large language models are not useful or relevant, inadequate training or orientation, high cost of premium features and poor awareness or understanding of these tools. This shows that students' utilisation of large language models is shaped mainly by practical and structural constraints rather than interest alone. It indicates a gap between awareness and actual utilisation, as students may know about large language models but are unable to use them effectively when supporting conditions are

weak. These barriers reduce opportunities for meaningful use of large language models for learning and point to the need for improved digital infrastructure, better guidance and more supportive learning environments to enhance students' utilisation.

Studies that support this result include Kasneci et al. (2023), who reported that poor internet access and limited digital competence reduced students' effective use of large language models in higher education. Similarly, Baidoo Anu and Ansah (2023) found that students were less likely to use large language models when they lacked training or did not perceive them as relevant to academic tasks. Dwivedi et al. (2023) also showed that high costs associated with advanced features discouraged regular use of large language model tools. In contrast, Zhai (2022) found higher levels of utilisation in learning environments where students had reliable internet access and institutional support for digital learning, indicating that supportive conditions play a major role. These differences show that infrastructure, skills and perceptions strongly influence students' adoption of large language models.

The study showed that strategies for improving utilisation of large language models among undergraduate Biology Education students include providing stable and affordable internet access, training students to improve digital skills, raising awareness of the usefulness and relevance of large language models and organising regular workshops and orientation sessions. This indicates that improved utilisation depends on addressing both infrastructural and educational gaps. It suggests that students are more likely to use large language models when digital support systems are available and when they understand how these tools can support learning. Stable internet access enables consistent engagement with online platforms, digital skills training builds confidence in using the tools, awareness programmes correct misconceptions and workshops provide guided practice. Together, these strategies create a supportive environment that encourages regular and meaningful utilisation of large language models for academic work.

Studies that align with this result include Okonkwo and Ade Ibijola (2024), who reported that stable internet access significantly improved students' adoption of artificial intelligence based learning tools, including large language models. Kasneci et al. (2023) also observed that structured digital skills training enhanced students' ability to use large language models for academic work. Baidoo Anu and Ansah (2023) further showed that awareness and sensitisation programmes helped students recognise the academic value of large language models, which increased their utilisation. In contrast, Dwivedi et al. (2023) found low utilisation in institutions where formal guidance and support structures were lacking, suggesting that organised learning opportunities are important for adoption. These variations highlight the importance of infrastructure, skills development and continuous institutional engagement in improving utilisation of large language models.

Conclusion

The use of large language models for learning among undergraduate Biology Education students remains limited and uneven, with reliance concentrated on a few familiar platforms. This pattern indicates that utilisation is constrained more by environmental and competence related conditions than by lack of interest. The result suggests that students are not yet positioned to benefit fully from large language models because essential supports for effective use are weak or absent. Improving utilisation therefore depends on strengthening digital infrastructure, building students' operational competence and providing structured academic guidance on appropriate use. When these conditions are improved, large language models are more likely to become meaningful learning tools rather than peripheral or occasional resources within Biology teacher education programmes.

Recommendations

The following recommendations are made for the study:

1. University management should provide stable and affordable internet access across campus to remove access barriers and support regular use of large language models for learning.
2. The Faculty of Education should organise regular training programmes to improve students' digital skills needed to operate and apply large language models for academic tasks.
3. Lecturers should integrate guided use of large language models into coursework and learning activities to help students understand how these tools can support academic work.
4. Awareness programmes should be conducted to educate students on the usefulness and relevance of large language models for learning and to correct negative perceptions about their value.

5. The university should explore institutional access or partnerships with large language model providers to reduce the cost burden of premium features for students.

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