

Modelling the Integration of Generative AI in African Higher Education Institutions Through Mobile Learning

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Abstract: Although the application of artificial intelligence (AI), specifically generative AI (GenAI) may be revolutionizing all industries, particularly the education industry, its integration in developing countries might not be without other challenges. In addition to mixed reactions by stakeholders due to fears of promoting bad practices such as plagiarism, other challenges such as non-affordability, non-availability, and inadequate access to supporting hardware technology cannot be put aside. This study is part of a broader study which leverages on the availability, accessibility, affordability, and the usability of mobile devices to explore the integration of Gen AI in Higher Education institutions in Africa, especially Nigeria. The first component of the study ascertains the perceptions of stakeholders and the factors that can affect their acceptance to integrate GenAI in facilitating pedagogical practices in African HEIs. A mixed methods research approach, which combines the quantitative and qualitative approaches is adopted in order to triangulate the results. Quantitative data was analyzed using arithmetic means, and regression analysis, while qualitative data was analyzed using content analysis. Results indicate mixed reactions especially with respect to social influence and mobile learning conditions.

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I. INTRODUCTION

All over the world, Higher Education Institutions (HEIs) are in constant search for new/better ways of addressing challenges that seem to hinder the attainment of their mandates. The purpose is to facilitate pedagogical practices. Over the years, most of the HEIs have relied on technology to address/overcome prevailing challenges (Arvind & Atul, 2024).

The integration of technology often come with some changes/adjustments in the manner in which things were hitherto done. However, it is common knowledge that change does not come without reactions or challenges (AlAli & Wardat, 2024). Some of the reactions that come with change can be positive (embracing the change), while others are negative (resisting the change) (Naidu & Sevnarayan, 2023). A number of factors can be responsible for the nature of reactions that accompany a change, specifically technological change. Some of the factors can include availability, affordability, and perhaps the ease of use of the technology (Chaka & Govender, 2017).

Today, the technology that seems to be trending is Artificial intelligence (AI). Artificial Intelligence is simply a

technology that creates machines, which mimic human intelligence (Martinez, 2018; Jackson, Ekong, & George, 2024). While humans have the capacity to reason on their own and then take decisions based on their reasoning, AI devices simply take decisions by learning from data. For this reason, the application of AI has become ubiquitous. Its application cuts across many disciplines including automobiles, medicine, agriculture, commerce, transportation, education, etc. (Chen, 2022; Sukubu & Atteng, 2023).

Although many may think that AI is entirely a new technology, research (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019) has shown that AI is as old as the advent computing itself. This is because the computer is an artificially intelligent device. The application of AI has only been escalated significantly in recent times. Thus, like many other industries, AI has been viewed to have the capacity to revolutionize the field of education (Chan & Colloton, 2024).

Jackson, Ekong and George (2024) observe that the emergence of Generative AI has moved the application of AI to a new level by reshaping or altering the manner in which people conduct their affairs generally. Generative AI uses other technologies such as machine learning algorithms to

create new content from exiting content in order to mimic human behaviour and accomplish complex tasks (Jackson, Ekong, & George, 2024). A number of tools are available to facilitate the application of Generative AI. Some of the tools include Large Language Models (LLMs), Machine Trnslators (MTs), Digital Writing Assistants (DWAs), Automated Paraphrasing Tools (APTs), and Chat Generative Pre-trained Transformers (ChatGPT) (Naidu & Sevnarayan, 2023). In addition to these software tools are hardware devices that are needed to access the software tools.

While it is true that the application of AI, specifically GenAI may be revolutionizing all industries, particularly the education industry (Maphoto, et al., 2024), its integration in developing countries might not be without other challenges. In addition to mixed reactions by stakeholders due to fears of promoting bad practices such as plagiarism (Naidu & Sevnarayan, 2023), other challenges such as non-affordability, non-availability, and inadequate access to supporting hardware technology cannot be put aside.

On the other hand, mobile devices are becoming more affordable and accessible by the day (Chaka & Govender, 2017). By implication, the use of mobile devices has become everyone's trademark. As a matter of fact, the growing concern today is how to make proper use of mobile devices rather than how to afford or access them. Therefore, the use of mobile devices has the ability to promote the integration of GenAI HEIs while at the same time address the challenge of non-affordability, non-availability and non-accessibility of associated technology. Mobile learning promotes individualized/personalized/learner centred learning. These characteristics are also common with GenAI. For this reason, this study explores the possibility of integrating GenAI in African HEIs through mobile learning.

➤ *Statement of the Problem*

As Higher Education Institutions continue to search for better ways of handling pedagogical practices, Generative AI has been considered as an option (Sukubu & Atteng, 2023). However, stakeholders in Higher Educations Institutions seem to be divided with regards the integration of Gen AI (Naidu & Sevnarayan, 2023). While some view GenAI as a leverage (Arvind & Atul, 2024), others see it as coming with other challenges, for example non-affordability, non-availability and inadequate access to supporting devices (AlAli & Wardat, 2024). Additionally, the reactions of stakeholders can depend on their context (Chaka & Govender, 2017). Thus this study poses the question:

- *How do stakeholders in African Higher Education institutions perceive the integration of GenAI to facilitate pedagogical practices and what factors are likely to influence the acceptability of the technology?*

➤ *Research Questions*

To understand clearly and to address the problem in focus, the main question/problem has been broken into two sub-questions as stated below:

- What are the perceptions of stakeholders in African HEIs towards the integration of GenAI to facilitate pedagogical practices?
- To what extent do Performance Expectancy, Effort Expectancy, Social Influence, and Mobile Learning Conditions Affect the Intention of Stakeholders in African HEIs to accept the integration of Gen AI in pedagogical practices?

➤ *Objectives of the Study*

The research questions were aimed at achieving the following objectives:

- To ascertain the perceptions of stakeholders towards the integration of GenAI in facilitating pedagogical practices in African HEIs.
- To ascertain the factors that can likely affect the intention of stakeholders to integrate GenAI in facilitating pedagogical practices in African HEIs.

➤ *Scope and Limitations of the Study*

The study is conducted in one Nigerian University for a start. The institution has been selected on the basis that it is a specialized institution for molding education professionals.

The major limitation is the inability of the study to go beyond this institution due to financial considerations.

II. METHODOLOGY

Methodology deals with the manner in which a research endeavour was carried out (Creswell, 2014). It involves the research design and research strategy adopted; the study area and population used in the study; methods of data collection; and the methods of data analysis. The various components of the methodology as applied in the study are further discussed below:

➤ *Study Location*

The study was conducted in Nigeria, specifically in the Federal University of Education, Pankshin, Plateau State. The institution was selected on the basis that it is specialized institution for molding education professionals. The Population of the study is about 5350 consisting of 4,553 students and 797 lecturers.

➤ *Research Approach*

In order to address the research questions adequately, the study adopted a mixed methods research approach. This approach combines the quantitative and qualitative approaches in order to triangulate the results. This way, results from the two approaches complement each other, making the findings richer (Creswell, 2014).

➤ *Methods of Data Collection*

In line with the research strategy that was adopted, two forms of data – quantitative and qualitative data were collected for the study. A questionnaire was used as the data collection instrument. The questionnaire consists of four sections. Section 'A' deals with personal information of the respondents, section 'B' deals with access and use of AI

applications on mobile devices, section ‘C’ handles quantitative data collection using a five point rated scale, while section ‘D’ contains open-ended questions, which handle qualitative data collection. The research instrument was validated by subjecting it to the scrutiny of a statistician. The questionnaires were distributed physically to participants using convenience method. About 97% return rate was recorded.

➤ Methods of Data Analysis

Quantitative data was analyzed using descriptive statistics (means) and regression analysis, while qualitative data was analyzed using content analysis.

➤ Theoretical Framework

The Unified Theory of Acceptance and Use of technology (UTAUT) is adapted to underpin the study. UTAUT, which was developed by Venkatesh *et al.*, (2003) is used to study and explain the behaviour of people towards the acceptance and use of an Information System. The theory posits that three main independent variables (Performance Expectancy, Effort Expectancy, and Social Influence) directly influence individuals’ intention towards the acceptance and use of a new system, while the fourth (facilitating conditions) influences the use behaviour. The theory further states that other factors (gender, age, experience, and voluntariness of use) moderate the impact of the four independent variables.

➤ Application of UTAUT in the Study

In order to address the research questions that have been put forward in this study and thereby attaining the objectives of the study, a modified version of UTAUT is used. Unlike the original UTAUT, the study tests the effects of all four variables (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions) on the intention of stakeholders to used AI on mobile devices to facilitate teaching or learning. Additionally, since the study deals with mobile learning, the variable “Facilitating Conditions” has been modified to “Mobile Learning Conditions” in line with Chaka and Govender (2017). Figure 1 depicts the version of UTAUT that is used in the study.

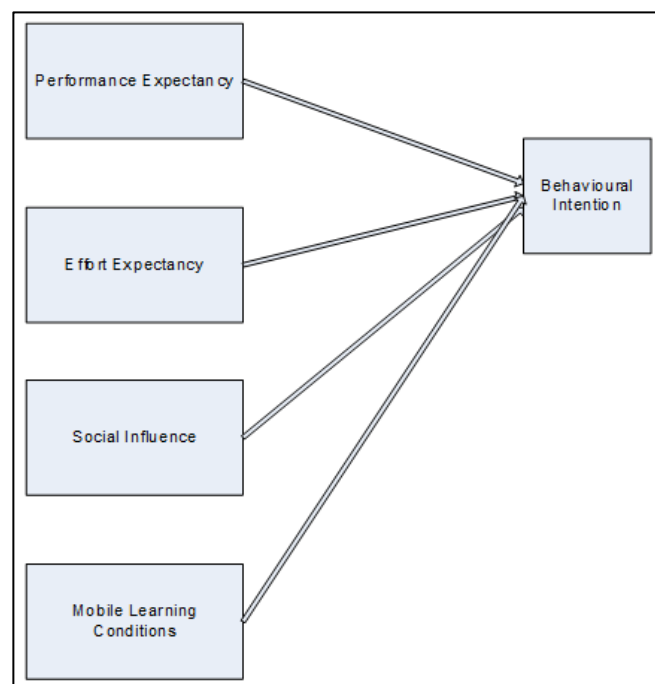


Fig 1 Adapted UTAUT Framework

III. RESULTS

As already highlighted, the study addresses two main research questions. Both questions are addressed from the quantitative and supported by the qualitative perspectives. Data was analyzed and results are presented in line with the two research questions.

➤ Research Question 1:

What are the perceptions of stakeholders in African HEIs towards the integration of Gen AI to facilitate pedagogical practices?

In addressing the first research question the study ascertains whether stakeholders perceive that generative AI on mobile devices is useful in facilitating pedagogical practices, easy to use, influence by others and whether the mobile learning conditions are favourable.

From the quantitative approach, results are as indicated in table 1.

Table 1 Perceptions of Stakeholders from Quantitative Approach

S/N	Acceptance of Gen AI in Pedagogical practice	Mean	Std. Dev	Remark
1	Performance Expectancy	3.66	1.42	Accepted
2	Effort Expectancy	3.50	1.41	Accepted
3	Social Influence	3.11	1.37	Accepted
4	Mobile Learning Conditions	3.10	1.46	Accepted
5	Behavioural Intention	3.17	1.45	Accepted

As indicated by the mean values ($\bar{x} \geq 2.5$), stakeholders (lecturers and students) perceive topmost that the use of AI tools on mobile devices are useful in facilitating pedagogical practices and that it is easy to use. Stakeholders further perceive that important others are happy with their use of AI

tools on mobile devices in the midst of favourable mobile learning conditions.

Results from the qualitative approach are indicated in table 2.

Table 2 Perceptions of Stakeholders and Likely Influential Factors from Qualitative Angle

S/N	Item statements	Response
1	In your view, how relevant do you think is the use on AI in relation to your primary responsibilities in this institution	Percent
	Very useful and supportive	61.5
	Very relevant	23.1
	It gives fast information	15.4
2	In which areas do you think that AI has been useful to you in performing your primary responsibilities in the institution	Percent
	Useful for learning and understanding	100.0
3	How do you find the use of AI to support your primary responsibilities in this institution	Percent
	It makes learning process easier	92.3
	Indecisive	7.7
4	In a few words, summarise your feelings and experience in interacting with an AI application on your mobile device for the purpose of teaching or learning	Percent
	Helping in answering questions and making notes	30.8
	Very convenient	61.5
	indifferent	7.7
5	To what extent have you felt encouraged towards the use of AI to support teaching or learning by people that you value	Percent
	Highly encouraged	84.6
	Moderately encouraged	15.4
6	How does the management of your institution or other key officers encourage you to use AI to teach or learn	Percent
	Moderately encouraged by the institution	76.9
	Not being encouraged	23.1
7	How do you rate the resources available to you in supporting the use of AI on your mobile devices to teach or learn	Percent
	Fairly good, need to be improved	52.4
	Inadequate resources especially power supply	24.5
	Data is very expensive	23.1
8	How do you view the use of AI application on your mobile device to teach or learn vis-à-vis other teaching or learning systems	Percent
	Interesting and learners centred but gives room for cheating	83.3
	Very useful and friendly to interact with	16.7
9	What is your intention towards the use of AI application of your mobile device	Percent
	I will use it but with caution	69.2
	I don't encourage it	15.4
	Research and to explore things	15.4
10	How do you plan to adopt the use of AI on your mobile device to support your primary responsibility	Percent
	Regularly to support my primary responsibilities	65.0
	Partially	35.0

From table 2, the first and second questions seek to ascertain the perceived usefulness of the technology. As the table indicates, the themes with the highest percentages are *very useful and supportive* (61.5%) and *useful for learning and understanding* (100%). These suggest that participants feel that the technology is useful to them.

For questions three and four, which ascertain the perceived ease of use of the technology, results indicate that participants feel that the technology *makes learning process easier* (92.3%) and that it is *very convenient* (61.5%).

In terms of social influence, stakeholders believe that they are *highly encouraged* by important others (84.6%) but *moderately encouraged* (76.9%) by the institution's management. On the availability of resources (mobile

learning conditions), stakeholders perceive that facilities are *fairly good but need improvement* (76.9%). However, in response to how stakeholders view the use of AI tools in relation to other pedagogical practices, the leading theme is that the use of AI on mobile devices is *interesting and learners' centred but gives room for cheating* (83.3%).

➤ Research Question 2:

To what extent do model items (Performance Expectancy, Effort Expectancy, Social Influence, and Mobile Learning Conditions) affect the intention of Stakeholders in African HEIs to accept the integration of Gen AI in facilitating pedagogical practices?

The aim of the question is to ascertain if any of the independent variables (Performance Expectancy, Effort Expectancy, Social Influence, and Mobile Learning Conditions) has an influence on the intention of stakeholders

to accept to use GenAI to facilitate pedagogical practices in African HEIs, especially Nigeria. Results from the quantitative approach are indicated in table 3.

Table 3 Regression Analysis of Independent Variables and Behavioural Intention

Model Summary							
Model items	R	R Square	Adjusted R Square	Std. Error Estimate	F	Sig.	Remark
Performance expectancy	.310	.096	.808	.12920	.106	.799	Not sig
Effort Expectancy	.942	.888	.776	.04543	7.946	.217	Not sig
Social Influence	.377	.142	.716	.12588	.165	.754	Not sig
Mobile Learning Conditions	.978	.957	.914	.02812	22.35	.133	Not sig

The table presents the regression analysis between the independent variables and behavioural intentions towards accepting the integration of Gen AI in pedagogical practices. The results indicate that performance expectancy has 96% influence on behavioural intentions of stakeholders in African HEIs towards accepting the integration of Gen AI in pedagogical practices, while effort expectancy has 88.8% influence on behavioural intentions of stakeholders in towards accepting the integration of the technology in facilitating pedagogical practices. The results also indicate that mobile learning conditions has an influence of 95.7% on the behavioural intentions of stakeholders towards accepting the integration of Gen AI in pedagogical practices, while social influence has least influence (14.2%) on behavioural intentions towards accepting the integration of Gen AI in pedagogical practices. However, as can be seen from the table, regression analysis indicates that although all variables have influence on the intention of stakeholders, none of the independent variables has any significant effect on the intention of stakeholders as $p > 0.05$.

IV. DISCUSSION OF FINDINGS

From the results, it becomes clear that stakeholders in Higher Education Institutions in Africa, specifically Nigeria, have mixed perceptions with regard to the integration of AI tools on mobile devices to facilitate pedagogical practices. While the quantitative data reveals mostly that stakeholders perceive that mobile AI tools are useful for teaching or learning, and that teaching and learning with AI tools is much easier. The qualitative data corroborate this position. For example, Table 1 shows the perceptions of stakeholders in terms of the usefulness and the ease of use of the technology. Performance expectancy got the highest mean score of expression (3.66), which is greater than the benchmark of 2.5. This is closely followed by effort expectancy with a mean score of 3.50. Table 2 reveals the most frequent themes such as *very useful and supportive* and *useful for learning and understanding*, which are positive indicators of performance expectancy. Similarly, themes such as *it makes learning process easier*, and *very convenient*, are positive indicators of effort expectancy. These themes agree with the quantitative data with respect to performance and effort expectancy. However, while the quantitative and qualitative data is in agreement in terms of performance expectancy and effort expectancy, the situation is slightly different in the aspects of social influence and mobile learning conditions. Like in the

case of performance expectancy and effort expectancy, the quantitative data reveal the affirmation of stakeholders with respect to social influence and mobile learning conditions. The qualitative data on the other hand reveal mixed reactions. Themes such as *not being encouraged* in terms of social influence and *inadequate resources especially power supply* with respect to mobile learning conditions indicate dissenting voices. In other words, the findings reveal that there may be no absolute encouragement for the integration of AI on mobile devices to facilitate pedagogical practices in HEIs in Africa, specifically Nigeria. These indication may not be unconnected with the feeling that AI makes students lazy and that it encourages examination malpractice. Furthermore, contrary to the quantitative results, stakeholders perceived that all may not be well with the mobile learning conditions. This revelation is seen in the qualitative data through themes such as *inadequate resources such as power supply* and *data is very expensive*. In simple terms, the results imply that stakeholders are positive that despite challenges of inadequate facilities such as power and high cost of data coupled with anxiety and apprehension in the use of the system, teaching or learning using AI applications on mobile devices is helpful and easy to use. No wonder, the reactions of stakeholders on their intention to use AI on mobile devices to facilitate pedagogical practices are equally mixed. While the intention of stakeholders is positive to use the technology based on the mean score of 3.17 from the quantitative approach, the qualitative approach as usual reveal some mixed feelings. For example, themes such *I will use it with caution*, *I don't encourage it*, *regularly to support my responsibilities* and then *partially* indicate mixed feelings of stakeholder's intentions to use the technology. This findings are in line with the literature.

Therefore, in line with the guiding theory, the perceptions of stakeholders align with the four independent variables of UTAUT. The study reveals that the factors that influence the intention stakeholders in Higher Education institutions in Africa, especially Nigeria include performance expectancy, effort expectancy, social influence and then mobile learning conditions. However, the study further reveal that while these factors may truly be affecting the intentions of stakeholders, none of the factors has a significant influence on their intentions. In other words, even if stakeholders choose to accept to use AI tools on their mobile devices to facilitate teaching or learning, it may not significantly be as a

result of any of the factors that have been defined in UTAUT framework.

V. CONCLUSION

Based on the result of the analysis and the discussion that follow, the study concludes that consistent with the literature, stakeholders in Higher Education Institutions in Africa, specifically Nigeria are not in agreement on the use of AI on mobile devices to facilitate pedagogical practices. The majority of stakeholders are positive that using AI applications on mobile devices is useful for teaching or learning and that it is easy to use. Others are skeptical for fear of negative usage and perhaps associated cost. The study further deduced that although the perceptions of stakeholders strongly align with the four independent variables of UTAUT, none of the variables significantly affects the intention of stakeholders to use the technology.

RECOMMENDATIONS

Based on findings and conclusion, the study recommends as follows:

- Mobile learning using AI applications should be used by stakeholders in Higher Education Institutions in Nigeria under strict monitoring and supervision in view of negative tendencies.
- A policy framework for the integration of mobile learning specifically using generative AI application should be put in place to guide usage.
- In view of the erratic nature of power supply, in most African countries especially Nigeria, solar farms should be prioritized for Higher Education Institutions.
- Free Internet services should be provided in Higher Education Institutions to support teaching and learning.

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