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From Platform Crisis to Pedagogical Renaissance: MJDES and the New Digital Divide

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The inaugural volume of the *Multidisciplinary Journal of Distance Education Studies* (MJDES), published in 2022, provided an essential and timely assessment of the global pivot to Emergency Remote Teaching (ERT). It grounded the discourse in the empirical realities of Ghanaian and African Open and Distance e-Learning (ODeL) institutions, documenting the immediate challenges of quality perception (Bawa et al., 2022), institutional transition (Sedofia et al., 2022), and the logistical hurdles posed by school closures (Osae-Kwapong, 2022). Our first volume assessed the shockwave and the necessity of adaptation.

Volume 2, No. 1 (2024), however, marks a crucial and necessary shift. We move beyond simply reacting to the immediate platform crisis and confront the pedagogical renaissance demanded by two profound, interlinked forces that define the current era: the widespread rise of Generative Artificial Intelligence (Gen AI) and the persistent infrastructural inequity that threatens to exacerbate a new digital divide. The research presented in this volume confirms that the challenges faced by ODeL are no longer merely about getting content online; rather, they are about transforming the nature of teaching, learning and assessment itself under the pressures of technological disruption. The central editorial argument for this volume is that the path to sustainable, high-quality ODeL in the Global South requires a disciplined focus on ethical assessment reform and equitable digital competency development that spans the entire educational pipeline, from basic schools to post-graduate programmes.

The Assessment Imperative: A Pivot from Proctoring to Pedagogy

The most immediate and critical tension highlighted in this volume stems from the crisis of assessment integrity in the age of intelligent tools. As Large Language Models (LLMs) offer students powerful, instant co-authorship capabilities, traditional standardised take-home assignments are rapidly becoming functionally unreliable. Meanwhile, the institutional response to this global pressure often defaults to enhanced surveillance, a reaction this volume scrutinises.

The paper by Nigerian scholars on Stakeholders' Perception on Remote Proctored Exam in Higher Educational Institutions provides a timely, empirical examination of this defensive approach. While remote proctoring aims to secure academic integrity, the study reveals the inherent friction and ethical concerns that arise when invasive surveillance tools intersect with the fundamental principles of open, flexible learning that ODeL is founded upon. These technology-intensive solutions are often expensive, demanding significant institutional capital; they are invasive, raising serious student privacy concerns; and they are potentially biased against distance learners who may have poor, unstable connectivity or limited personal space conducive to uninterrupted testing. Critically, these measures address the *symptom* (the potential for cheating) without curing the root *disease* (the continued reliance on outdated assessment design).

This observation leads directly to the pedagogical imperative that ODeL faculty must embrace. As Mudau and Van Wyk (2022) argued from a South African context in Volume 1, highlighting that the future lies in authentic assessment and AI simply accelerates the urgency of this transition. In this regard, the assessment must be designed to leverage, rather than resist, AI:

1. Shift from Reproduction to Critical Synthesis: Assessments must pivot to tasks that require localised context, high-level, human-centric synthesis, and personal reflection that current AI models cannot authentically replicate. This means creating assignments focused on analysis, critique, ethical reasoning, and application within the learner’s specific cultural or professional environment.
2. Redefining Academic Honesty as Intelligent Agency: Instead of simply prohibiting AI use, assessment should be designed to require its use. Tasks should demand students to *critique* an AI-generated response, *edit* a piece of code or argument written by an LLM, or use AI as a tool to rapidly prototype a solution and then reflect rigorously on the specific processes, prompts, and tools they employed. This moves the student from being a passive consumer of knowledge to an active manager of intelligence, a skill far more relevant to the 21st-century workplace than ever before.

The ultimate goal, fueled by this journal’s commitment to evidence-based practice, is to demonstrate that pedagogical innovation is a far more robust, equitable, and educationally valuable defense against academic dishonesty than mere surveillance technology.

Bridging the Competency Gap

The second major contribution of Volume 2 is its emphasis on the breadth and depth of digital competency across the entire educational pipeline. Understanding ODeL student success requires looking back to the foundational skills acquired in earlier schooling. To this end, the study by Adu-Marfo and Asamoah. "Teaching

with Digital Technology in Basic Schools in Ghana: Identities, Challenges and Implications in a Digital Era," offers a vital bottom-up perspective. Their findings reveal that the digital identity of students in basic schools is often misunderstood by their teachers. Consequently, teachers perceive students as "digital natives" based on superficial factors like birth era and usage frequency, ignoring the deeper digital literacy skills required for critical evaluation, academic research and responsible technology use. This perception gap creates a cascading competence challenge that directly impacts the readiness of university distance learners in diverse ways including:

1. **Basic School Limitations:** Teachers struggle profoundly with limited resources, lack of training, and reluctance to change, hindering the development of foundational digital literacy and critical thinking in young learners. The recommended paradigm shift from traditional methods to innovative modes is often thwarted by systemic inertia.
2. **The Inherited ODeL Challenge:** Distance learning centres subsequently inherit a student body that may be adept at social media but lacks the academic [functional] digital literacy required to navigate a complex LMS effectively (Odame, 2022), engage in robust online collaboration (Sedofia et al., 2022), or use AI tools ethically and productively (Kareem, 2025). The quality of ODeL (Bawa et al., 2022) cannot be isolated from the quality of the incoming student's foundational digital preparedness.

This volume stresses that ODeL institutions must develop more rigorous and context-specific digital readiness assessments for incoming students and, crucially, integrate remedial digital literacy training into core curriculum offerings. The digital revolution is not achieved by installing hardware. Instead, it is achieved by systematically building human capacity.

Equitable Infrastructure and Policy Deployment of AI

The challenge of access, a constant thread throughout ODeL history, is exponentially magnified by the introduction of AI. This is by virtue of the fact that AI, with its vast computational and data requirements, threatens to widen the existing digital divide between high-resource and low-resource institutions, particularly across Africa. For instance, the paper on the Potential of AI-Driven Virtual Learning Environments (VLEs) in African Higher Education Institutions provides the necessary aspirational counterpoint. It argues convincingly that AI offers a mechanism to personalise learning at scale and address the sheer volume of students required by mass education. AI-powered chatbots, adaptive tutoring systems, and personalised feedback loops could drastically improve outcomes for students who currently receive minimal one-on-one time with faculty.

However, realising this potential requires a confrontation with the painful realities documented in Online Learning in Distance Education: The Plight of Distance Learners in Ghana. This study established that no amount of advanced AI can overcome the challenge of unreliable power, high data costs or poor connectivity. The *plight* of the distance learner, facing logistical hurdles that often impede the learning process, must be the primary filter through which AI solutions are evaluated. Therefore, the equitable deployment of AI mandates a new focus for ODeL research:

- **Sustainability Research:** We need rigorous studies that evaluate the cost-benefit, energy consumption, and return on investment of AI systems. Priority must be given to developing and adopting lightweight, bandwidth-conscious AI tools that can function effectively in low-connectivity environments.
- **Ethical Governance:** AI adoption is a policy challenge before it is a technical one. To sidestep this, institutions must develop clear, transparent governance models regarding student data privacy, algorithm accountability and intellectual property in a co-created environment. This is hinged on the basis that AI is not a neutral tool, so its integration must be guided by African ODeL values of equity, access and social development.

The Multidisciplinary Mandate of MJDES

The successful navigation of the post-ERT, AI-driven era demands a commitment to interdisciplinary inquiry, the very foundation of MJDES. This volume demonstrates a necessary integration across three academic pillars:

1. **The Pedagogical Pillar (The 'What' and 'How'):** Led by identity challenges and implications and the studies on proctoring, this pillar demands that we reimagine assessment and commit to fostering critical digital competence, ensuring that technology serves learning outcomes, not the reverse.
2. **The Technological Pillar (The 'Tool' and 'Scale'):** Driven by the VLE and online learning plight studies, this pillar focuses on the equitable, sustainable, and infrastructural requirements for effective digital delivery, insisting that solutions must fit the context, not the fantasy.
3. **The Policy Pillar (The 'Mandate' and 'Ethics'):** Informed by the systemic challenges observed across both basic and higher education, this pillar requires governmental and institutional leadership to establish long-term funding, continuous professional development and ethical policy frameworks that guarantee AI enhances educational access rather than restricting it.

In conclusion, Volume 2, No. 1 (2024) of the *Multidisciplinary Journal of Distance Education Studies* serves as a critical call to action. It invites us to move beyond managing the residual fallout of the pandemic and the defensive posture of proctoring. Hence, we must seize the revolutionary potential of AI, not as a shortcut, but as a powerful lever for pedagogical transformation and radical personalisation. This is hinged on our mission to provide the empirical ground for policy and practice to evolve, ensuring that distance education continues to champion equity and access by developing the competent, critically thinking digital citizens who will define the next era of ODeL in Africa and across the globe.

References

Akindele, A. T., Adeoye, O. O., Arulogun, O. T., Osunniyi, J. S., Akanbi, R. Y., & Oluwatobi, M. F. (2024). Stakeholder's perception on remote proctored exam in higher educational institutions: Insights from LAUTECH open and distance learning centre. *Multidisciplinary Journal of Distance Education Studies*, *2*(1). 1-16.

Arkaifie, S. J., & Shaban, S. H. (2024). Online learning in distance education: The plight of distance learners in Ghana. *Multidisciplinary Journal of Distance Education Studies*, *2*(1), 17-40.

Bawa, J., Odame, E. D., Odame, J., & Adingo, S. A. (2022). Learners' perception of the quality of distance education in Ghana. *Multidisciplinary Journal of Distance Education Studies*, *1*(1), 1-18.

Kareem, A.A. (2025). Students' preference for Kahoot as a tool for formative assessment in sex education and marital guidance. Multidisciplinary Journal of Distance Education Studies, 2(1), 41-68.

Adu-Marfo, A. O. & Asamoah, M. K. (2025). Teaching with Digital Technology in Basic Schools in Ghana: identities, challenges and implications in a digital era. *Multidisciplinary Journal of Distance Education Studies*, *2*(5)105-128.

Mudau, P. K., & Van Wyk, M. M. (2022). E-portfolio alternative assessment strategy enhancing higher-order thinking skills in an open distance learning environment. *Multidisciplinary Journal of Distance Education Studies*, *1*(1), 19-43.

Odame, J. (2022). Graduate students' knowledge level of the Learning Management System in the University of Ghana College of Humanities. *Multidisciplinary Journal of Distance Education Studies*, *1*(1), 44-59.

Osae-Kwapong, J. (2022). Coping with school closures during COVID-19 in Ghana– 10 key observations. *Multidisciplinary Journal of Distance Education Studies*, *1*(1), 60-81.

Sedofia, J., Yeboah, R., & Commey-Mintah, P. (2022). From in-person to virtual to blended learning: Exploring university students' experiences. *Multidisciplinary Journal of Distance Education Studies*, *1*(1), 82-105.

Shaban, S. H., Aryeh-Adjei, A. A., & Anaman, A. A. (2024). Potential of AI-driven virtual learning environments in African higher education institutions. *Multidisciplinary Journal of Distance Education Studies*, *2*(1), 69-104.

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STAKEHOLDER'S PERCEPTION ON REMOTE PROCTORED EXAMINATION IN HIGHER EDUCATIONAL INSTITUTIONS: INSIGHTS FROM LAUTECH OPEN AND DISTANCE LEARNING CENTRE

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ABSTRACT

Every stakeholder involved in digital assessment has preferences directly related to how they view the advantages and potential risks of doing so. While digital assessment has many advantages, its versatility and flexibility make it look susceptible to exploitation and misconduct, mainly when utilised by stakeholders who lack integrity, which could affect the acceptance and adoption of this technology. This study aims to investigate the key elements influencing the adoption and implementation of online proctored assessments by the educational stakeholders within the chosen university. A survey tool was used to collect data by stratified random sampling from stakeholders, including students and academic staff. Focusing on remotely proctored examinations, the survey questions were developed using the Innovation Diffusion Theory (IDT) and Unified Theory of Acceptance and Use of Technology (UTAUT2) model constructs to ascertain stakeholders' preferences for adopting remote digital assessment. A quantitative analysis methodology was used to test our present theoretical model and determine the causality between variables of the constructs employed. The result of the analysis showed that "Performance Expectancy" (0.27), "Social Influence" (0.177), and "Personal Innovativeness" (0.161) have the highest positive standardised coefficients, indicating that they have the strongest positive relationship with "Behavioural Intention" to adopt remote proctored examination. This study's findings will likely make it easier to pinpoint areas of particular relevance that may be used to spur all parties' interest and accelerate the implementation of remotely proctored examinations in higher education institutions (HEI).

Keywords: Remote proctored examination, unified theory of acceptance and use of technology, innovation diffusion theory, technology acceptance.

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INTRODUCTION

Assessment plays a crucial role in the learning process, it gives tangible proof of what is learned, gauges student progress, and indicates a grasp of the subject content (Popham, 2003). For centuries, pen-to-paper has been the most employed mode of assessment delivery to evaluate learners and measure educational achievements in all forms of education, from elementary to tertiary. However, the past three decades have witnessed a sporadic yet progressive transition in the modalities and structures of assessments (Hunsu, 2015; Guimarães et al., 2018; Jia et al., 2022; Elosua et al., 2023). The arrival and introduction of computers in the early 90s and their generational evolution over time, introducing new features and capabilities, have led to the development and usage of what is now popularly referred to as "digital assessment" (Boitshwarelo et al., 2017; Tran et al., 2021). As technology develops, new and creative digital assessment approaches are being created to evaluate learners utilising various digital tools such as multimedia, gamification, collaborative tasks, personalised feedback, and real-world application to support a more engaging and effective educational experience (Ndibalema, 2021). In addition to the technological advancements, studies have linked a rise in student enrolment in educational institutions as another factor contributing to the transition from paper-based assessments to digital ones. This shift is due to the rising resources needed for grading and providing feedback to a larger number of learners in different courses (Jonsdottir et al., 2017). Research has shown that digital technologies may assist in revolutionising education, as it tends to be a more student-centred and technology-mediated method of learning (Alessio et al., 2017; Boldyrevskii et al., 2022; Keane et al., 2022; Mari State University et al., 2022). It offers potentially advantageous qualities such as affordances and provides more individualised, flexible, and palatable experiences to the learners (Keane et al., 2022). The increasing reliance on RPE in the post-COVID-19 educational landscape has raised concerns among faculty and academic administrators regarding the validity and security of the assessment process. While RPE offers advantages such as flexibility and convenience, there are lingering uncertainties about the impact on academic staff experiences, student experiences and broader educational objectives. Additionally, technical challenges, including internet connectivity issues and power availability, particularly in developing nations, pose potential threats to the reliability of assessment results. This study aims to explore the perceptions of educators and students through the lens of the proposed combination of IDT and UTAUT2 model, aiming to understand the factors influencing the acceptance and use of RPE and their implications for academic integrity, student experiences, and broader educational objectives.

Literature Review

In Nigeria, before the COVID-19 outbreak, higher education institutions had only limited adoption of digital assessments, with the majority of institutions only using the most basic version, a computer-based test (CBT) with multiple-choice questions. When the pandemic hit, the move to digital or online education became necessary due to the movement lockdown enforced by numerous governments worldwide (Shao, 2020). Within the shortest time, there was a proliferation of digital tools and technology platforms, leading to significant changes in the organisation of the educational sector, including learning methodologies, teaching, and administrative strategies, and assessment methodology (EY India, 2021). Digital assessments gained popularity due to their ability to address the aforementioned lockdown constraints as well as the benefits they provide such as remote administration, personalisation of learning resources, automation of learning processes, and instant feedback to all stakeholders (Alruwais et al., 2018). As a result, within minimal time, educational institutions began utilising robust

forms of online assessments such as simulation-based assessments and proctored exams to evaluate educational outcomes and assess students' knowledge and skills. Proctored assessments became a crucial technology for evaluating students during and after the pandemic, resulting in a "new normal" that transformed the educational experience for future generations (Kharbat & Abu-Daabes, 2021).

RPE refers to an online assessment in which a student participates in an exam from a remote location. To prevent cheating, this mode of exam is usually invigilated either by a human via a webcam, microphone, and other digital tools (Cherry et al., 2021) or through the use of an artificial intelligence (AI) powered agent that monitors examinee activities (Paredes et al., 2021). Of both modes of proctoring, AI-based RPE is preferred as it eliminates the need for a human supervisor, amid personnel shortages and it accommodates flexible schedules (Paredes et al., 2021). Some of the features introduced in RPE software to ensure exam integrity and prevent cheating include screen and webcam monitoring. Students' PCs with webcams and microphones are turned on to record and monitor their activities and verify their identities using face recognition both before and during live exams. Other features such as screen recording, browser lock, posture, and head angle monitoring are some of the other features of RPE (Nigam et al., 2021; Paredes et al., 2021; Raman et al., 2021).

Studies have investigated the validity and reliability of remotely proctored examinations in comparison to traditional, or face-to-face examinations, and some of the findings suggest that RPE can provide similar levels of security and validity as much as traditional proctored examination (Weiner & Hurtz, 2017; Cherry et al., 2021). However, concerns have also been raised about the technical issues that could arise, such as the availability and affordability of adequate internet connectivity problems, and poor power availability, especially in developing nations, which can negatively impact the validity of the examination results if participants face such challenges (Ishtiaq et al., 2022). Marais (2022) attempted to holistically understand how academics perceive academic integrity in RPE, he reported bias and critiques of proctoring approaches as many academics complained about the enormous workload placed on them, particularly in human-proctored RPE. The question of who is in charge of cross-checking participants' identities, flagging students who are allegedly cheating, reviewing recorded media of students' screens, and putting together cases to be presented to the disciplinary committee are some of the concerns raised (Marais, 2022). From the viewpoint of the students, some stakeholders felt RPE is a form of power play that gives academicians and the institution control over students, in that several RPE features can likely make students nervous throughout the test process. The issues of privacy and human rights infringement were also reported (Langenfeld, 2020; Khalil et al., 2022; Scassa, 2022).

Post-COVID-19 research has found that faculty and academic administrators are becoming hesitant to continue adopting RPE due to concerns about the validity and security of the assessment process (Akaaboune et al., 2022; Paredes et al., 2021). While adopting these technologies is necessary during the COVID-19 pandemic period, researchers believe it is vital to pause and think about the broader effects of implementing such technological "solutions" and examine how technology and assessment processes intersect with the broader objectives of education (Fawns & Schaepkens, 2022). Students, on the other hand, have mixed opinions, with some commending the flexibility, convenience, and positive exam experience availed by RPE (Paredes et al., 2021; Lee & Fanguy, 2022), while others feel that RPE is invasive and uncomfortable (Alessio et al., 2017; Kharbat & Abu-Daabes, 2021; Vasiliki et al., 2021). The effects of RPE on student outcomes, including

performance, motivation, and engagement, have also been studied. Some of these studies have found that RPE has a favourable effect on student motivation and engagement (Alessio et al., 2017; Cherry et al., 2021; Boldyrevskii et al., 2022), Others, however, have found no discernible difference between a remote and a conventional proctored exam (Vasiliki et al., 2021).

Theoretical Framework

In the absence of coercion, the adoption of complex, new technologies such as RPE is always slow, uncertain, and sometimes risky (Cho & McCardle, 2009). Most of the time, these technologies are implemented with an expectation that is weighed against the cost, which might not necessarily be monetary (Heidenreich & Talke, 2021). The degree of ignorance, reluctance to change, worry about making the wrong decision, technological inadequacy, and other strange factors can also have an odd impact on how people accept new technologies. The literature on technology adoption has proposed several models to explain user behaviour in adopting and using information technology and one of the most employed models is the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003), which employs human psychology and sociology characteristics to explain a user's intent to accept a technology and subsequent usage behaviour. The UTAUT model was initially composed of four constructs: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition. Later, however, (Venkatesh et al., 2012) identified important new constructs and relationships that were incorporated into UTAUT, modifying it to fit a consumer use context model. This model was named UTAUT2 (Venkatesh et al., 2012).

UTAUT2 is typically adequate and employed in many technology adoption estimation kinds of research; however, it was found insufficient due to the peculiarities of RPE and its features. To establish a more complete measurement of new technology acceptance, Dwivedi et al. (2019) suggested including some of the constructs from the IDT (Zhang et al., 2008) in the UTAUT2 model (Venkatesh et al., 2012). The IDT was proposed by Rogers & Cartano (1962) to evaluate how new ideas and technologies spread within a social system over time. In an attempt to explore earnestly the full spectrum of variables that drive RPE acceptability in higher education institutions and present a more complete picture of the factors that might influence this technology adoption, this research hybridised constructs from both UTAUT2 and IDT as the proposed technology acceptance model.

In this study, the latent variables related to technology acceptance behaviour were derived from established research on IDT and UTAUT2. The adaptation of these measures allowed for a systematic approach to examining the technology acceptance behaviour of the participants. Figure 1 shows the framework of the variables used in this research. It comprised eight exogenous constructs which are Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Image (IM), Hedonic Motivation (HM), Price Value (PV), Personal Innovation (PI), Facilitating Conditions (FC), and one endogenous construct i.e., Behavioural Intentions (BI). The explanation of the proposed model construct is presented in Table 1.

Table 1: Proposed model constructs

Constructs	Explanation
PE	PE is characterised by an individual's confidence that utilising new technology will enhance their performance to attain job-related benefits. In this investigation, PE pertains to the academic staff and learners' conviction that utilising an RPE will aid them in accomplishing their goals with greater effectiveness and efficiency.

EE	EE is defined as the belief that an individual's interaction with the information system will be uncomplicated and trouble-free.
SI	SI refers to external influences, such as peer or supervisory pressure, encouragement from the faculty, and so on, that affect stakeholders' perceptions of system use.
IM	IM refers to how new technology, in this case, RPE, is perceived by stakeholders in terms of its characteristics, benefits, and potential drawbacks.
HM	HM is described as the fun or pleasure resulting from using a particular technology, and it is predicted to have a direct influence on technology acceptance and use.
PV	PV refers to an individual's cognitive trade-off between the perceived benefits of using a system and the amount spent.
PI	Personal innovativeness is a stable personality trait that makes individuals desire to try out new technological advancements.
FC	FC refers to the extent to which an individual believes that organisational support and infrastructure are available to support the system's use.
BI	BI refers to the behavioural readiness to accept, Use or adopt a particular technology.

Source: (Venkatesh et al., 2012; Zhang et al., 2008)

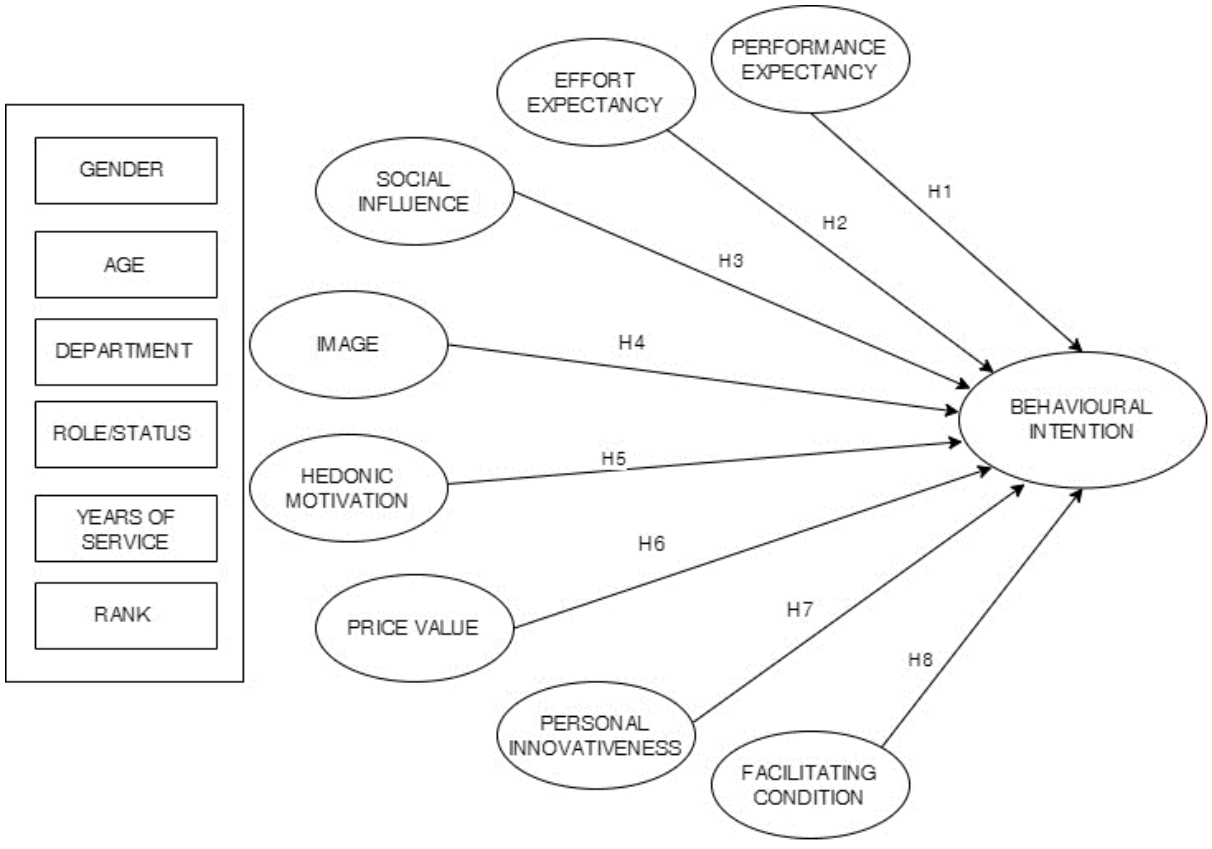

Figure 1: The proposed research model

Hypothesis

A hypothesis is seen as a study solution to a problem that is still a speculation since it has to be proven. This study proposes various hypotheses to explain what factors affect the utilisation of remotely proctored exams in higher education institutions based on the proposed model (See Table 2).

Table 2: Hypothesis

H1	Performance expectancy positively affects the behavioural intention to use RPE.
H2	Effort expectancy positively affects the behavioural intention to use remote RPE
H3	Social Influence positively affects the behavioural intention to use RPE
H4	Image positively affects the behavioural intention to use RPE
H5	Hedonic motivation positively affects the behavioural intention to use RPE
H6	Price Value positively affects the behavioural intention to use RPE
H7	Personal innovation positively affects the behavioural intention to use RPE.
H8	Facilitating conditions positively affect the behavioural intention to use RPE.

Methodology

Empirical data was collected through a self-administered questionnaire distributed via Google Forms. The participants consisted of academic staff and learners of the Ladoke Akintola University of Technology Open and Distance Learning Centre (LODLC) in Nigeria, who were selected as they represent primary stakeholders in this research context. LODLC was selected due to its dual-mode lecture delivery and extensive experience with RPE, offering a rich context to explore stakeholders' perspectives on RPE implementation. Participants were selected using a stratified random sampling method to share their experiences and opinions on RPE through closed-ended questionnaires. The calculated sample size for the survey was 365 using Cochran's formula. However, only 197 participants responded. The collected data were analysed using descriptive analysis, while inferential statistics such as correlation and multiple regression analysis were employed to analyse the formulated hypothesis. All analyses were done at a 95% confidence level. Ethical considerations in questionnaire administration were upheld by ensuring voluntary participation, confidentiality of responses, and obtaining informed consent from participants.

Data Analysis

A demographic study was conducted to learn more about the characteristics of the participants. Then, descriptive statistics were generated for the sample. Multivariate regression analysis was employed to examine the proposed hypotheses. This study used the correlation matrix analysis and multivariate regression analysis approach to examine the interrelationships among the variables and how multiple independent variables collectively influence a single dependent variable. It provides a more comprehensive view of the combined effects of different factors, allowing for a deeper understanding of the relationships in the data. This enhanced analysis improves the precision and accuracy of statistical modelling and the insights derived from it. IBM SPSS version 26 was used for data analysis.

Result

This section presents the result of the analysis of the data collected from the respondents.

Reliability test

Reliability tests were run on the gathered data to ensure measurement stability and consistency and to provide users with confidence in the dataset's dependability.

Table 2: Reliability test

Factors	Cronbach's Alpha
Performance Expectancy	0.929
Effort Expectancy	0.925
Social Influence	0.831
Facilitating Condition	0.148
Hedonic Motivation	0.871
Price Value	0.741
Image	0.893
Personal Innovation	0.679
Behavioural Intention	0.722

Source: Authors Computation (2024)

The findings of the reliability study show that the variables under consideration exhibit various degrees of internal consistency. Performance Expectancy (0.929), Effort Expectancy (0.925), Social Influence (0.831), Hedonic Motivation (0.871), and Image (0.893) are high-reliability variables with values that are near to 1. Moderate reliability factors are Behavioural Intention (0.722) and Price Value (0.741). Although Personal Innovation (0.679) has a value below the generally agreed lower limit of 0.70 for Cronbach's alpha, it is still considered acceptable by Taber (2018) and Hair et al. (2006), who stated that Cronbach's alpha value of 0.679 falls within the range of acceptable value. Therefore, Personal innovativeness is acceptable in this study. Cronbach's alpha value for the Facilitating Conditions factor is 0.148, well below the generally accepted lower limit of 0.70.

Consequently, it will not be considered in our analysis. The overall reliability for all the instruments is 0.87. This means high internal consistency exists for all the models' instruments.

Descriptive Data

As indicated in Table 3, the total number of participants in this study was 197; 59.4% of the participants were male, and 40.6% were female. The largest age group was found to be in the 26 to 30 range, representing 19.8% of the respondents. The participants had diverse academic backgrounds, with the largest group being in the field of computer science/IT/technology (27.9%). 36.5% of the participants had prior experience with RPE, while 63.5% had not. 67.0% of participants are students and 33.0% are staff. The largest group among academic ranks is assistant lecturers/lecturer II (11.2%) followed by senior lecturers (8.1%). These findings indicated that the majority of the stakeholders in the selected higher institutions are fairly represented.

Table 3: Demography

		Frequency	Percentage
Gender	Male	117	59.4
	Female	80	40.6
Age	15 to 19	6	3.0
	20 to 25	34	17.3

	26 to 30	39	19.8
	31 to 35	27	13.7
	36 to 40	31	15.7
	41 to 45	16	8.1
	46 to 50	15	7.6
	Above 50	29	14.7
Area of Specialisation	Agriculture	12	6.1
	Environmental Sciences	3	1.5
	Arts	3	1.5
	Humanities and Social Sciences	12	6.1
	Computer Sc./IT/Technology	55	27.9
	Education	26	13.2
	Engineering	8	4.1
	Accounting Management and Commerce	23	11.7
	Natural Sciences	7	3.6
	Health Sciences	38	19.3
	Applied Sciences	10	5.1
Have you done or involve in an RPE?	Yes	72	36.5
	No	125	63.5
Status	Student	132	67.0
	Staff	65	33.0
Rank	Student	132	67.0
	Assistant Lecturer/Lecturer II	22	11.2
	Lecturer I	10	5.1
	Senior Lecturer	16	8.1
	Professor	10	5.1
	Others	7	3.6

Source: Authors Computation (2024)

Correlation Analysis

Table 4 presents the pairwise correlations among the factors considered. Based on the values in the matrix, The correlation coefficients range from 0.497 to 0.838, such that the highest correlation coefficient is between PE-EE and SI-HM (0.838, 0.772 and 0.801). PV is also strongly correlated with HM and IM. BI is strongly correlated with PV, and PI is strongly correlated with SI and BI. Indicating a strong positive association between these variables. This indicates that all correlations between the dependent and independent variables were both strong and moderate, and they all had positive linear associations that were significant at 0.01 ($p<0.01$).

Table 4: Correlation matrix

	PE	EE	SI	HM	PV	BI	PI	IM
PE	1							
EE	.838**	1						
SI	.772**	.701**	1					
HM	.801**	.739**	.774**	1				
PV	.761**	.746**	.761**	.788**	1			

BI	.756**	.696**	.744**	.741**	.735**	1		
PI	.497**	.506**	.587**	.530**	.546**	.600**	1	
IM	.638**	.673**	.630**	.695**	.700**	.661**	.622**	1

**. Correlation is significant at the 0.01 level (2-tailed).
Source: Authors Computation (2024)

Multiple Regressions of BI against PE, EE, HM, PV, PI and IM
Table 5 shows the regression model summary. The R Square (R^2) value is 0.692, which means that a 69.2% change in Behavioural intention is due to changes in the PE, EE, HM, PV, PI, and IM. A significant correlation (p= 0.000) was found between the dependent variable (BI) and the independent variables (PE, EE, HM, PV, PI, and IM) in the ANOVA summary.

Table 5: Regression model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.832a	0.692	0.680	0.77629

a. Predictors: (Constant), Image, Personal Innovativeness, Performance Expectancy, Social Influence, Price Value, Hedonic Motivation, Effort Expectancy
Source: Authors Computation (2024)

Table 6 shows the result of multiple regression for the model analysis. Eight (8) independent variables were used to predict the behavioural intention to use RPE. It was observed that four of the independent variables were significant in predicting behavioural intention to use RPE. According to the results, PE (0.27) and SI (0.177) have the highest positive standardised coefficients, indicating that they have the strongest positive relationship with "Behavioural Intention." The "PI" (0.161) also has a positive relationship with the dependent variable, with a p-value of less than 0.05, indicating that it is statistically significant. EE (0.008), HM (0.125), PV (0.142), and IM (0.086) have much weaker or no significant relationship with the dependent variable.

Table 6: Regression model

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.355	0.166		2.141	0.034
	PE	0.113	0.038	0.270	3.015	0.003
	EE	0.003	0.034	0.008	0.100	0.921
	SI	0.083	0.035	0.177	2.355	0.020
	HM	0.105	0.068	0.125	1.541	0.125
	PV	0.124	0.067	0.142	1.844	0.067
	PI	0.137	0.047	0.161	2.94	0.004

IM	0.053	0.040	0.086	4 1.310	0.192

a. Dependent Variable: Behavioural Intention
Source: Authors Computation (2024)

Discussion

Using the proposed technology acceptance model as a theoretical lens, the main goal of this study is to investigate how educators and students view the RPE in the selected institution of study. PE was the most powerful predictor of BI on stakeholders' perception of the adoption of RPE. This was following the findings of previous research (Alwahaishi & Snasel, 2013; Chao, 2019; Dwivedi, Rana, et al., 2019). This means that the stakeholders believed that the RPE technology helps in saving time and effort, as well as providing a secure, reliable, and efficient exam experience. This is in support of H1 that PE positively affects BI.

The result of SI (the influence of others, such as peers or colleagues, on the individual's decision to adopt the technology) on BI was significant, indicating its significant effect on stakeholders' acceptance of RPE, which is in support of H3. This result agrees with the finding of VanDerSchaaf et al. (2023) who reported that SI stands out as a critical influence on behavioural intention to adopt the software for accessing university services. This is in contrast to the report of Gunasinghe et al. (2019) who stated that social influence and personal innovativeness in information technology were not significant predictors of e-Learning. This difference could be a result of interpersonal relationships among the considered stakeholders.

PI, or the individual's willingness to try new things, also has a positive and statistically significant relationship with the intention to use RPE, H7 (Chao, 2019). On the other hand, the results suggest that other factors such as EE, IM, HM, and PV have weaker or no significant relationship with the adoption of RPE, therefore, H2, H4, H5 and H6 were rejected. This could be a result of perceived risks such as uncertainties and potential negative perception of adopting RPE which may cause the stakeholders to be hesitant in embracing the technology even if it promises improved performance (Choe et al., 2021; Ali et al., 2022).

This indicates that while PE, SI, and PI are significant factors in the adoption of RPE, other factors have less of an effect or may not be as significant. Nevertheless, the remaining 31.8% of unexplained variance could be further investigated by increasing the latent or observed variables in the construct.

The findings suggest that academic staff and learners of LODLC perceptions of RPE are largely dependent on PE, SI and PI In predicting technology acceptance, this study contributes to the theory of RPE adoption from the perspective of the academic staff and learners. Therefore, LODLC should create a social norm that supports the adoption of RPE by promoting and encouraging its use among academic staff and learners. Likewise, influencing opinion leaders and experts in shaping their perception and adoption of RPE cannot be underestimated. LODLC can leverage their reputation and expertise to influence the opinions of opinion leaders and experts in the field by partnering with leading organisations and promoting the use of RPE.

Conclusion and Implications

This study provides insight into the adoption of RPE in the selected higher education institution by integrating UTAUT2 and IDT construct to establish a relationship with the BI of stakeholders. The study examined some hypotheses and discovered that PE (the belief that the technology can accurately assess knowledge and skills), SI (the influence of others on adoption), and PI (the willingness to try new things) are the most important factors in the adoption of RPE among stakeholders. EE, HM, PV, and IM were found to have weaker or no significant relationship with adoption. In other to improve stakeholders' acceptance of RPE, LODLC should dedicate more effort to increasing PE, SI, and PI and partner with leading organisations in RPE to influence the opinions of opinion leaders and experts. Policymakers in the institution should incorporate the identified factors that have a significant effect on the BI of the stakeholders into RPE guidelines to improve the perception of RPE adoption. Training programs and awareness campaigns on RPE should address concerns related to PE, and SI, and foster a culture of innovation. Continuous evaluation and adaptation of RPE approaches are essential to align with evolving technology and educational practices.

Limitation of the Study

Due to the limited time and scope, the study encountered certain limitations. The study employed a quantitative survey methodology, capturing data at a single point in time and the perception of the considered stakeholders could change over time due to new information and experience, therefore, future studies could employ a longitudinal design to obtain more accurate findings. Likewise, the study has focused entirely on a single institution, Ladoke Akintola University of Technology Open and Distance Learning Centre (LODLC) and the study's findings may primarily reflect the unique characteristics, policies, and technological infrastructure of LODLC, limiting the generalisation of findings to other institutions or educational settings.

Declaration of Interest Statement

There is no conflict of interest in this research work.

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Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

Akaaboune, O., Blix, L. H., Carrington, L. G., & Henderson, C. D. (2022). Accountability in Distance Learning: The Effect of Remote Proctoring on Performance in Online Accounting Courses. *Journal of Emerging Technologies in Accounting*, *19*(1), 121–131. https://doi.org/10.2308/JETA-2020-040

Alessio, H. M., Malay, N. J., Maurer, K., Bailer, A. J., & Rubin, B. (2017). Examining the Effect of Proctoring on Online Test Scores. *Online Learning*, *21*(1). https://doi.org/10.24059/olj.v21i1.885

Ali, A., Qaiser, R., & Baig, W. (2022). Examination of Customers Intention to Adopt Digital Banking Services: Moderating Role of Perceived Risk in Banking Sector of Pakistan during COVID-19. *Journal of Social Sciences Review*, *2*(4), 27–34. https://doi.org/10.54183/jssr.v2i4.50

Alruwais, N., Wills, G., & Wald, M. (2018). Advantages and challenges of using e-assessment. *International Journal of Information and Education Technology*, *8*(1), 34–37.

Alwahaishi, S., & Snasel, V. (2013). Consumers' Acceptance and Use of Information and Communications Technology: A UTAUT and Flow Based Theoretical Model. *Journal of Technology Management & Innovation*, *8*(2), 61–73. https://doi.org/10.4067/s0718-27242013000200005

Boitshwarelo, B., Reedy, A. K., & Billany, T. (2017). Envisioning the use of online tests in assessing twenty-first-century learning: A literature review. *Research and Practice in Technology Enhanced Learning*, *12*(1), 1–16.

Boldyrevskii, P., Vinnik, V., Zalessky, M., Grigoryan, M., & Pravodelova, E. (2022). Evaluation of the effectiveness of the use of digital educational technologies in the educational process of a university. *Human Resource Management within the Framework of Realisation of National Development Goals and Strategic Objectives*, *1*. https://doi.org/10.56199/dpcsebm.pegw5399

Chao, C.-M. (2019). Factors Determining the Behavioral Intention to Use Mobile Learning: An Application and Extension of the UTAUT Model. *Frontiers in Psychology*, *10*, 1–14. https://doi.org/10.3389/fpsyg.2019.01652

Cherry, G., O'Leary, M., Naumenko, O., Kuan, L.-A., & Waters, L. (2021). Do outcomes from high-stakes examinations taken in test centres and via live remote proctoring differ? *Computers and Education Open*, *2*, 1–9. https://doi.org/10.1016/j.caeo.2021.100061

Cho, S.-H., & McCardle, K. F. (2009). The Adoption of Multiple Dependent Technologies. *Operations Research*, *57*(1), 157–169. https://doi.org/10.1287/opre.1080.0534

Choe, J. Y. (Jacey), Kim, J. J., & Hwang, J. (2021). Perceived risks from drone food delivery services before and after COVID-19. *International Journal of Contemporary Hospitality Management*, *33*(4), 1276–1296. https://doi.org/10.1108/IJCHM-08-2020-0839

Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2019). Re-examining the Unified Theory of Acceptance and Use of Technology (UTAUT): Towards a Revised Theoretical Model. *Information Systems Frontiers*, *21*(3), 719–734. https://doi.org/10.1007/s10796-017-9774-y

Dwivedi, Y. K., Williams, M. D., Lal, B., & Williams, M. J. (2019). Revisiting the unified theory of acceptance and use of technology: A literature review and research agenda. *Journal of Business Research*, *98*, 217–234.

Elosua, P., Aguado, D., Fonseca-Pedrero, E., Abad, F. J., & Santamaría, P. (2023). New Trends in Digital Technology-Based Psychological and Educational Assessment. *Psicothema*, *35.1*, 50–57. https://doi.org/10.7334/psicothema2022.241

EY India. (2021). *Vision 2040: A prescience to the future of higher education in India* (p. 1). https://www.ey.com/en_in/tmt/vision-2040-a-prescience-to-the-future-of-higher-education-in-india

Fawns, T., & Schaepkens, S. (2022). A matter of trust: Online proctored exams and the integration of technologies of assessment in medical education. *Teaching and Learning in Medicine*, *34*(4), 444–453.

Guimarães, B., Ribeiro, J., Cruz, B., Ferreira, A., Alves, H., Cruz-Correia, R., Madeira, M. D., & Ferreira, M. A. (2018). Performance equivalency between computer-based and traditional pen-and-paper assessment: A case study in clinical anatomy. *Anatomical Sciences Education*, *11*(2), 124–136. https://doi.org/10.1002/ase.1720

Gunasinghe, A., Hamid, J. A., Khatibi, A., & Azam, S. M. F. (2019). The adequacy of UTAUT-3 in interpreting academician's adoption to e-Learning in higher education environments. *Interactive Technology and Smart Education*, *17*(1), 86–106. https://doi.org/10.1108/ITSE-05-2019-0020

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). *Multivariate data analysis Prentice Hall Pearson Education* (6th ed.). Pearson Prentice Hall.

Heidenreich, S., & Talke, K. (2021). Consequences of mandated usage of innovations in organisations: Developing an innovation decision model of symbolic and forced adoption. *Academy of Marketing Science Review*, *10*(3–4), 279–298. https://doi.org/10.1007/s13162-020-00164-x

Hunsu, N. J. (2015). Issues in transitioning from the traditional blue-book to computer-based writing assessment. *Computers and Composition*, *35*, 41–51. https://doi.org/10.1016/j.compcom.2015.01.006

Ishtiaq, K., Ali, A., Alourani, A., Kumar, T., Shahbaz, M., & Raja, M. (2022). An Investigation of the Educational Challenges during COVID-19: A Case Study of Saudi Students' Experience. *European Journal of Educational Research*, *11*(1), 353–363.

Jia, Q., Cao, Y., & Gehringer, E. (2022). Starting from "Zero": An Incremental Zero-shot Learning Approach for Assessing Peer Feedback Comments. In E. Kochmar, J. Burstein, A. Horbach, R. Laarmann-Quante, N. Madnani, A. Tack, V. Yaneva, Z. Yuan, & T. Zesch (Eds.), *Proceedings of the 17th Workshop on Innovative Use of NLP for Building Educational Applications (BEA 2022)* (pp. 46–50). Association for Computational Linguistics. https://doi.org/10.18653/v1/2022.bea-1.8

Jonsdottir, A. H., Bjornsdottir, A., & Stefansson, G. (2017). Difference in Learning Among Students Doing Pen-and-Paper Homework Compared to Web-Based Homework in an Introductory Statistics Course. *Journal of Statistics Education*, *25*(1), 12–20. https://doi.org/10.1080/10691898.2017.1291289

Keane, T., Linden, T., Hernandez-Martinez, P., & Molnar, A. (2022). University Students' Experiences and Reflections of Technology in Their Transition to Online Learning during the Global Pandemic. *Education Sciences*, *12*(7), 453. https://doi.org/10.3390/educsci12070453

Khalil, M., Prinsloo, P., & Slade, S. (2022). In the nexus of integrity and surveillance: Proctoring (re) considered. *Journal of Computer Assisted Learning*, *38*(6), 1589–1602.

Kharbat, F. F., & Abu-Daabes, A. S. (2021). E-proctored exams during the COVID-19 pandemic: A close understanding. *Education and Information Technologies*, *26*(6), 6589–6605.

Langenfeld, T. (2020). Internet-based proctored assessment: Security and fairness issues. *Educational Measurement: Issues and Practice*, *39*(3), 24–27.

Lee, K., & Fanguy, M. (2022). Online exam proctoring technologies: Educational innovation or deterioration? *British Journal of Educational Technology*, *53*(3), 475–490. https://doi.org/10.1111/bjet.13182

Marais, I. E. (2022). Institutionalisation of academic integrity: Experiences at a distance education university in South Africa during COVID-19. *Critical Studies in Teaching and Learning*, *10*(2), 57–79. https://doi.org/DOI: 10.14426/cristal. v10i2.585

Mari State University, Fedorova, S. N., Golikova, N. D., & Mari State University. (2022). Digital competence of the educational process parties. *Vektor Nauki Tol'yattinskogo Gosudarstvennogo Universiteta. Seriya Pedagogika i Psihologiya*, *2*, 36–42. https://doi.org/10.18323/2221-5662-2022-2-36-42

Ndibalema, P. (2021). Online Assessment in the Era of Digital Natives in Higher Education Institutions. *International Journal of Technology in Education*, *4*(3), 443–463. https://doi.org/10.46328/ijte.89

Nigam, A., Pasricha, R., Singh, T., & Churi, P. (2021). A systematic review on ai-based proctoring systems: Past, present and future. *Education and Information Technologies*, *26*(5), 6421–6445.

Paredes, S. G., de Jesús Jasso Peña, F., & de La Fuente Alcazar, J. M. (2021). Remote proctored exams: Integrity assurance in online education? *Distance Education*, *42*(2), 200–218. https://doi.org/10.1080/01587919.2021.1910495

Popham, W. J. (2003). *Test Better, Teach Better: The Instructional Role of Assessment*. ASCD.

Raman, R., B, S., G, V., Vachharajani, H., & Nedungadi, P. (2021). Adoption of online proctored examinations by university students during COVID-19: Innovation diffusion study. *Education and Information Technologies*, *26*(6), 7339–7358. https://doi.org/10.1007/s10639-021-10581-5

Rogers, E. M., & Cartano, D. G. (1962). Methods of measuring opinion leadership. *Public Opinion Quarterly*, 435–441.

Scassa, T. (2022). The surveillant university: Remote proctoring, AI, and human rights. *Can. J. Comp. & Contemp. L.*, *8*, 271.

Shao, P. (2020). *Impact of city and residential unit lockdowns on prevention and control of COVID-19*. https://doi.org/10.1101/2020.03.13.20035253

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tran, T. P., Sidhu, L., & Tran, D. (2021). A Framework for Navigating and Enhancing the Use of Digital Assessment. *2021 5th International Conference on E-Society, E-Education and E-Technology*, 1–6. https://doi.org/10.1145/3485768.3485803

VanDerSchaaf, H. P., Daim, T. U., & Basoglu, N. A. (2023). Factors Influencing Student Information Technology Adoption. *IEEE Transactions on Engineering Management*, *70*(2), 631–643. https://doi.org/10.1109/TEM.2021.3053966

Vasiliki, A., Sanne, P., Jan, E., Johan, W., & Birgitte, S. (2021). Remote versus on-site proctored exam: Comparing student results in a cross-sectional study. *BMC Medical Education*, *21*(624). https://doi.org/10.1186/s12909-021-03068-x

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly*, *27*(3), 425–478. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly*, *36*(1), 157–178.

Weiner, J. A., & Hurtz, G. M. (2017). A comparative study of online remote proctored versus onsite proctored high-stakes exams. *Journal of Applied Testing Technology*, *18*(1), 13–20.

Zhang, N., Guo, X., & Chen, G. (2008). IDT-TAM integrated model for IT adoption. *Tsinghua Science and Technology*, *13*(3), 306–311. https://doi.org/10.1016/S1007-0214(08)70049-X

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STUDENTS' PREFERENCE FOR KAHOOT AS A TOOL FOR FORMATIVE ASSESSMENT IN SEX EDUCATION AND MARITAL GUIDANCE

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Abstract

Over the years, the assessment of students' learning progress was done using the traditional method of written or oral tests, quizzes, classroom revisions among others. With the affordance of educational technologies, game-based learning like Kahoot and various other platforms has made periodic assessment of students' learning engaging and exciting. Consequently, this study investigated the preference of undergraduate students for learning games with respect to Kahoot as a tool for formative assessment in sex education and marital guidance. The study primarily employed a qualitative approach using thematic analysis. Secondarily, a descriptive survey design was used to collect and analyze quantitative data. The sample of the study consist all 76 students who registered for the course in second semester 2021/2022 academic session in the Department of Educational Foundations, University of Lagos. An online questionnaire via google forms with open-ended questions was used to elicit responses from the respondents with respect to preference and challenges they experience with the adoption of gaming as a tool for formative assessment. The students' academic performance was also measured using the end of semester grades. The demographic data of respondents was analysed using frequency counts. Research question 1 and 2 was analysed using simple percentages and cross tabulation respectively, while thematic analysis was used to analyse research question 3 and 4. The hypothesis was analysed using Mann-Whitney U test. The findings revealed that a preponderance of students (89.19%) prefer learning games as a tool for formative assessment for the reason that it makes

learning exciting and encourages group engagement in class. Non-preference for gaming by the remainder few was due to the choice for individualized assessment and technical hitches (internet). The study recommends the adoption of learning games in other courses and the improvement of internet services in institutions of higher learning by network providers to foster students' learning experience.

Keywords: Academic Performance, Formative assessment, Kahoot, Learning games, Students Preference

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Introduction

The goal of counselling education is to train individuals to be professionally skilled in relevant psychological principles and practices to assist clients in addressing varied life challenges. This is achieved by exposing trainees to different courses ranging from counselling theories, group dynamics, behaviour modification, abnormal psychology, psychological testing and evaluation, sex education and marital counselling guidance among others. One of the courses taught; Sex Education and Marital Guidance exposes would be counsellors to the methodology of delivering sex education at all levels of education and the provision of assistance to individuals, would be couples and couples to manage their marital challenges. In the University of Lagos, the course is 2-unit offered at the third year as EDF 322. The learning progress of students in the course like other courses offered in the department is continuously assessed by means of oral tests, quizzes, and/or other means as decided by the course lecturer and department. The course like other courses offered in the department would have a maximum score of 100 percent, of which 30 or 40 percent is continuous assessment and the remaining 60 or 70 percent is assigned to the end of the course examination (Department of Educational Foundations, 2021).

With the appointment of the first female and 13th Vice-Chancellor by the Governing Council of the University of Lagos on Friday, October 7, 2022; Professor Folasade

Tolulope Ogunsola, FAS, there was a birth of a new agenda for the University to be a FUTURE READY academic institution. This FUTURE READY agenda represents an acronym of a comprehensive and pragmatic mission to achieve the vision of the University which is to "be a top-class institution for the pursuit of excellence in knowledge through learning and research, as well as in character and service to humanity." The first "U" and "T" in the acronym represents "unlocking human potential" and "technology driven university" which is to be achieved by a multifaceted approach with emphasis on a purposeful investment in staffs and a fully digitalized campus (University of Lagos, n.d.). Consequently, several trainings were organized and still ongoing for faculty members to facilitate learning through innovative teaching experiences and the digitalization of pedagogical delivery.

On 17th and 18th April 2023, a two-day training tagged CARPE DIEM workshop for PEBLE (Partnership for Enhanced and Blended Learning) was organized for some faculty members in the University of Lagos. The PEBLE-WA (West Africa) is a follow-on project from PEBL-EA (East Africa) funded by the Australian Government's Department of Foreign Affairs and Trade, having the Association of Commonwealth Universities (ACU) as the lead partner on the project. The project had Ghana Tertiary Education Commission, Staff and Educational Development Association (SEDA), National Universities Commission (NUC), National Open University of Nigeria (NOUN), and Commonwealth of Learning (CoL) as technical Partners. The project also involved 12 partner universities in West Africa among which the University of Lagos, University of Ibadan, Kwame Nkrumah University of Science and Technology, Kumasi Technical University were partners. The aim of the training was to develop in faculties skills and enhance the practice of using technology in the designing and delivery of course content for blended and online teaching through a CARPE DIEM approach (a team /seize the moment approach to learning). With emphasis on promoting active learning among learners, demos and hands on activities were done during the workshop.

One of the tools used to engage faculty members during the training session was Kahoot!. It is one of the most commonly used game-based learning platform (Pange, Degteva & Nikiforidou, 2022). It is used to facilitate learning through games in the

classroom or distance learning, at all educational levels and in all subject areas on any device provided it is internet enabled. It uses artificial intelligence (AI) to make students' learning experience interesting with the following A.I features; AI-assisted creator to enhance the efficiency with respect to time it takes to make Kahoots, story text enhancer to make it easy to create story content, text-to-speech conversion for users to have the Kahoot questions and answers read aloud in human-like speech and other features

It's usage also extends beyond the academic environment as it is also used at homes and places of work for fun and learning. It has a significant function of promoting active learning, creativity and team work which is in sync with the CARPE DIEM approach. Players receive points based on accuracy and speed, adding a competitive element to the learning process. This structure boosts student engagement and motivation in addition to reinforcing learning via competition. It was therefore integrated in teaching Sex Education and Marital Guidance to facilitate learning among students and as a means of formative assessment.

Formative assessment is used to monitor or carry out an evaluation of students' learning progress while the lesson is being taught (Okoli, 2014). It provides informative and rewarding feedback to students which serves as a report to the extent of students' response to learning and reinforcement for successful learning respectively (Okoli, 2014). According to Ismail and Mohammad (2017), Kahoot serves as a supplementary tool for conducting formative assessments during feedback sessions. In Wang's (2015) view, the distribution chart that is displayed on the screen after students' response to each question is useful because it helps the teacher get feedback on the class's understanding of a topic, thereby providing an opportunity to clarify areas where students struggle.

Kahoot! (2021) explains how formative assessment can be conducted with students in the physical and virtual space; teachers should encourage and emphasize active participation and interaction for both virtual and physical learners, class discussions should follow answers to each question displayed. Also, the teacher can take advantage of the report section, to identify the number of students that played, the

difficult questions that need to be retaught and to get individualized report on each student's performance, so that they can be further helped with their learning. The report can be shared with significant colleagues in the school on the learning progress of the students (Kahoot!, 2021).

Students as beneficiaries of the teaching-learning process are critical stakeholders when considering an introduction and integration of novel modes of formative assessment using game-based learning; Kahoot!. Their opinions or views about matters that concerns their learning experiences should be prioritized because they are recipients of the teaching experience which reflects in their academic performance. Thus, it is necessary to investigate their preference for a mode of formative assessment that they are not used to for possible continuance or adoption.

Literature Review

Preference and Reason for Preference for Kahoot

Examining students' preference and reasons for preferring Kahoot, is very key in getting feedback for instructional purposes. Kariko and Ayuningtyas (2021) compared preference for kahoot and quiziz for formative assessment. A preponderance of students preferred quizzis for formative assessment. The respondents also preferred that the assessment should not be graded but for fostering learning activity. Even though the primary focus of formative assessment is for feedback and not for grading, it can be deduced from their study that most students prefer Kahoot for formative assessment without the assignment of grades.

Ismail and Mohammad (2017) investigated how 113 undergraduate medical students in a medical school at Malaysia perceived Kahoot as a formative assessment tool. Their study revealed that students perceive Kahoot as fun and useful for formative assessment. The only reservation the student had was that Kahoot does not help to make complex content simple. Makhasane and Olawande (2022) investigated the preference for digital game-based learning among grade R-12 students in South Africa. The researchers were interested in determining the kind and mode of game-based learning that suits the learning needs of learners. To achieve this, the study adopted a descriptive survey research design with a combination of quantitative and

deductive reasoning method. A questionnaire was used to gather data from 194 students selected from four schools comprising two primary schools and two secondary schools. The data was analysed using frequency counts and simple percentage. The findings of the study revealed that most learners love to play games especially one that allows for competition, challenge and curiosity.

In a study conducted by Plump and LaRosa (2017), 88.7% of 139 graduate and undergraduate students presented a positive view in their experience engaging with Kahoot. According to the barchart figure 4 in the study, a preponderance of respondents in their engagement with kahoot, enjoyed playing the game, claimed it is easy to use, made lectures more interactive and helps with the understanding of concepts during lectures. Pinto, Jaftha, Borg, Micallef and Chircop (2022) explored students' profiles, gaming and learning preferences, and expectations of gamification in education. They adopted a descriptive-normative research design. A questionnaire in an online format was used to gather data from the respondents. Simple random sampling technique was used to select a sample of 361 students, although 271 students completed the online survey. A significant portion of students expressed that lectures could be made more enjoyable through gamification, and many were supportive of the idea. Their findings also showed that students believed gamification could increase their engagement and competitiveness in completing tasks. Majority of the students in an international school in northern Malaysia also had a pleasurable experience with Kahoot for the reason that it encourages active participation and learning during language classes (Kaur & Nadarajan, 2020).

Challenges experienced by Students with the use of Kahoot

Despite the preference of kahoot by students, challenges experienced with its use is inevitable. In Sianturi and Hung (2023) systematic review of ten research works conducted in India, Turkey, Spain, Indonesia, the United States and the United Arab Emirates, some challenges with the use of Kahoot were found. According to their review, poor internet connection was the predominant challenge with the use of kahoot among students. This was revealed to impede the completion of quiz by the students. Limited time to attempt the questions and a deficiency in experience and skills in technology use was another challenge discovered. In addition, the review

discovered that some students were distracted. This distraction is caused by the audio effect and the feature of Kahoot application of having the questions projected on the screen and answers displayed on students' devices. Furthermore, Kahoot was also discovered to cause anxiety. Some students were anxious on seeing the scoreboard showing the top scorers and their names absent.

According to Bhuana (2022), lack of internet connection was a drawback experience for students who learn using kahoot. In addition to this, students also perceive the absence of further discussions on questions after playing kahoot, boredom as a result of frequent usage and limited time allocated to answer each questions as challenges experienced with the use of kahoot for learning (Bhuana, 2022). Undependable internet connection was also a major challenge of students with the use of Kahoot (Wang & Tahir, 2020). Other challenges experienced by students found include inadequate time to answer questions, difficulty to read questions and answers on the projected screen, the fear of not winning, inability to alter answers after submission, pressure to give answers and difficulty in meeting up after submitting wrong answers (Wang & Tahir, 2020). Reduced feedback from teachers, internet connection hitches, incompetence in technology usage and restrained access to classroom technology and other resources of the school were identified as drawbacks reported by students with the use of Kahoot (Rosdy & Yunus, 2021).

Kahoot and Academic performance

With respect to academic performance, one of the objectives of this study is to determine if there would be any difference in academic performance of students based on preference, thus students' academic performance of those who prefer and who do not were compared. There seems to be no empirical research in this specific objective, however the effect of Game -based learning has being proven to improve the academic performance of students. In a study conducted by Vargianniti and Karpouzis (2019) the effect of an adapted monopoly game called geopoly was measured on the academic performance of elementary students. To achieve this, a sample of 43 students were divided into groups; the first which is the experimental group who played geopoly but did not attend physical class, while the second group

which is the control group was attended physical class. A pre-test post-test control group design was used. A questionnaire was used to gather pre and post test data from the learners. Based on t-test statistical analysis of the post-test scores of the two groups, the academic performance of students exposed to geopoly have an increased. Thus, it was established that game improved students' academic performance.

Ndirika (2013), posits game-based learning as instrumental to improving the attitude and academic performance of students in science subjects. The author, explained the benefits of the integration of game-based learning in the teaching of science which are; it makes repetitive learning more engaging and helps raise awareness, reinforce knowledge, teach essential skills, and instill values. Games also encourage active participation, boost motivation, attention, and concentration, and immerse students in the material for more effective learning. They foster learning from mistakes, enhance tutoring and skill exploration, and promote a positive attitude toward learning. Additionally, game-based learning improves problem-solving, creativity, and critical thinking, supports cognitive processes, and caters to different learning styles, while also building valuable computer skills.

While game-based learning has been established as being preferred and effective for improving academic performance and engagement, none of the studies above explicitly examined the use of Kahoot for formative assessment, especially in a course like sex education and marital guidance. This study sought the impact of preference for Kahoot on academic performance, which previous studies did not investigate. Also, most studies reviewed were conducted outside the Nigerian context. There is a lack of research exploring how game-based learning, particularly Kahoot, is received among undergraduates in Nigerian classrooms. Hence, it is necessary that this study is undertaken to examine the preference of students for kahoot as a means for formative assessment.

Statement of the Problem

Learning for some students in the University of Lagos have been perceived as a boring exercise and a waste of time. This reflects in their reduced involvement during lectures, engagement with phones during lectures, being absent-minded during lectures and a reduced attendance for lectures to attend to other things that provides pleasure and money. This situation is worsened by a lack of innovative teaching strategies that can effectively engage students and promote meaningful learning experiences

This is a digital age characterized by an engrossment of children and youths alike with digital devices like the mobile phones. They are so preoccupied with the affordances accompanied with the use of mobile devices which sometimes affects their academics negatively. Since they are preoccupied with their mobile devices, it is therefore important that facilitators of course content or subject areas should take advantage of digital pedagogical innovations to facilitate learning in students.

Game-based learning has particularly shown potential in motivating students and improving educational results at the primary and secondary levels. Yet, its application in higher education, especially in a course like Sex Education and Marital Guidance, has not been thoroughly explored. Despite the promising advantages of game-based learning, there is a notable lack of research on its effectiveness in higher education in Nigeria, especially regarding the assessment of student learning progress (formative assessment). This study seeks to fill that gap by examining students' preferences for game-based formative assessment in Sex Education and Marital Guidance.

Research Objectives

The study purposes to:

1. Investigate the preference for game-based learning (Kahoot!) for formative assessment in sex education and marital guidance (EDF 322)
2. Determine the preference for game-based learning (Kahoot!) for formative assessment in other courses.

3. Examine reasons for preference for game-based learning (Kahoot!) for formative assessment among students.
4. Inquire the challenges students experience with the use of game-based learning (Kahoot!) for formative assessment.
5. Investigate significant difference in the academic performance of students who prefer game-based learning (Kahoot!) for formative assessment and those who do not.

Research Hypothesis

1. There is no significant difference in the academic performance of students who prefer game-based learning (Kahoot!) for formative assessment and those who do not.

Methodology

The study primarily employed a qualitative approach using thematic analysis. Secondarily, a descriptive survey design was used to collect and analyze quantitative data. Thematic analysis was used as a qualitative approach to investigate the reasons for preference in an open-ended response format, while descriptive survey research design was used as a quantitative approach to collect and analyze quantitative data.

The study population are all 74 students enrolled in the course (EDF 322; Sex Education and Marital Guidance) during the second semester of the 2021/2022 academic session. The sample for this study consisted all 74 students enrolled in the course (EDF 322; Sex Education and Marital Guidance) during the second semester of the 2021/2022 academic session. A census sampling technique was employed to select the entire population of students who registered for the course. This approach ensured that the opinions and academic performance of every student at the end of the course were included in the data collection, providing comprehensive insights into the preferences for formative assessment using Kahoot. The students comprised 59 females and 15 males, with an average age of 24.67 years.

Kahoot was introduced and used to measure students' learning towards the end of the course and to revise the course content. Ten (10) multiple-choice questions were constructed and used in the Kahoot session to gauge how well the students understood the course. Based on how they were seated, the students were sorted into eight (8) groups with 8 to 11 members in each group. Each group was free to pick its own group name, which encouraged participation and a sense of autonomy. The names of the group were: Goal getters, winners, achievers, elite, titans, pace setters, team exceptional and mind builders. To ensure that every student understood the structure and expectations of the game, the rules governing the game was projected on the screen before the Kahoot! started. The guidelines addressed things like group cooperation, scoring, and how to respond to the questions. At the end of the game, their positions in the game were revealed, their responses or answer to each question were revised and students were allowed to ask questions.

Data were collected using an online questionnaire administered via Google Forms. The questionnaire was designed to capture both demographic information and qualitative responses related to students' experiences with formative assessment using Kahoot. The demographic section included questions such as matriculation number, age, and gender to provide a profile of the participants. The core of the questionnaire consisted of open-ended questions aimed at exploring students' preferences for using Kahoot as a formative assessment tool. Participants were asked to provide reasons for their preferences or non-preference and to describe any challenges faced using this game-based learning mode. Students were able to openly express their ideas in the open-ended style, which helped to foster a better understanding of their viewpoints and experiences.

The demographic data of respondents was analysed using frequency counts and simple percentage. Research question 1 and 2 were analysed using simple percentage and crosstabs respectively to derive a descriptive analysis of the preference for game-based learning (Kahoot!) for formative assessment in EDF 322 and other courses, research question 3 and 4 were analysed using thematic analysis, while Mann-Whitney U test was used to analyse the hypothesis at 0.05 level of

significance. Mann-Whitney U test was considered appropriate because it is used to compare the academic performance (a continuous variable) of two independent groups and its robustness to violations of normality and distributional differences rather than mean differences.

Results

Figure 1: Respondent's Distribution by Gender

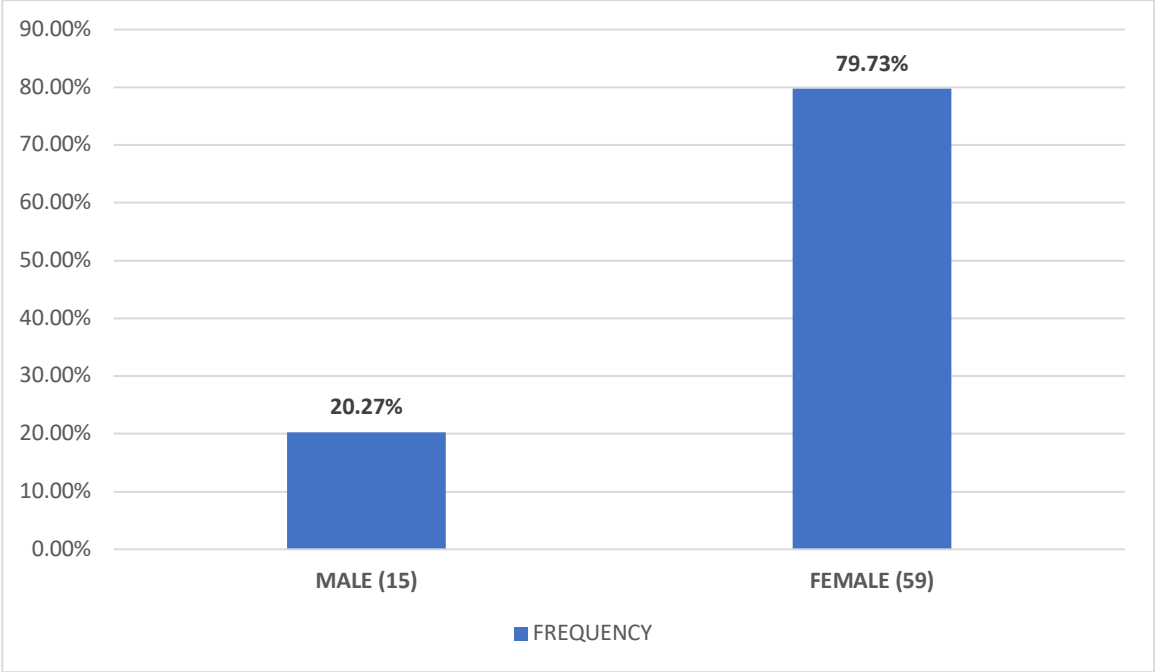

Figure 1 reveals that a preponderance of respondents were females; 59 (79.73%), while the male respondents were 15 (20.27%)

Research Question 1: Do students prefer game-based learning (Kahoot!) for formative assessment in sex education and marital guidance (EDF 322)?

Figure 2: Students' preference for game-based learning (Kahoot!) for formative assessment

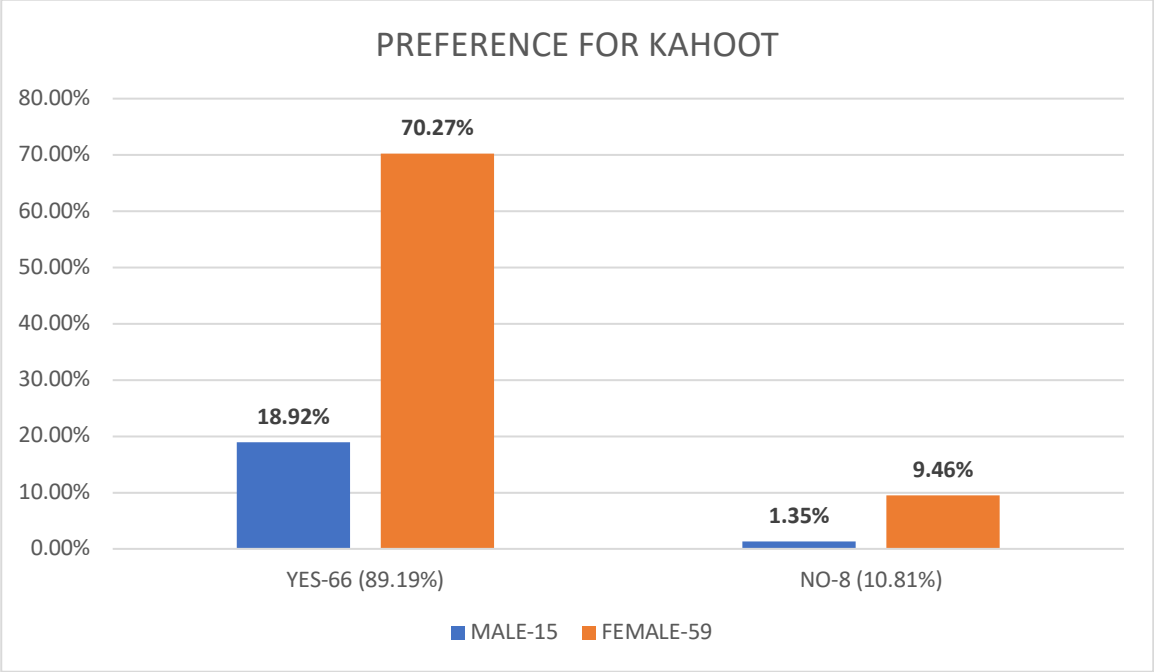

Figure 2 shows that a majority of the students 66 (89.19%), comprising 14 (18.92%) males and 52 (70.27%) females prefer game-based learning (Kahoot!) for formative assessment. 8 (10.81%) students, comprising 1 (1.35%) male and 7 (9.46%) females do not prefer game-based learning (Kahoot!) for formative assessment.

Research Question 2: Would students prefer game-based learning (Kahoot!) for formative assessment in other courses?

Figure 3: Students preference for game-based learning (Kahoot!) for formative assessment in other courses

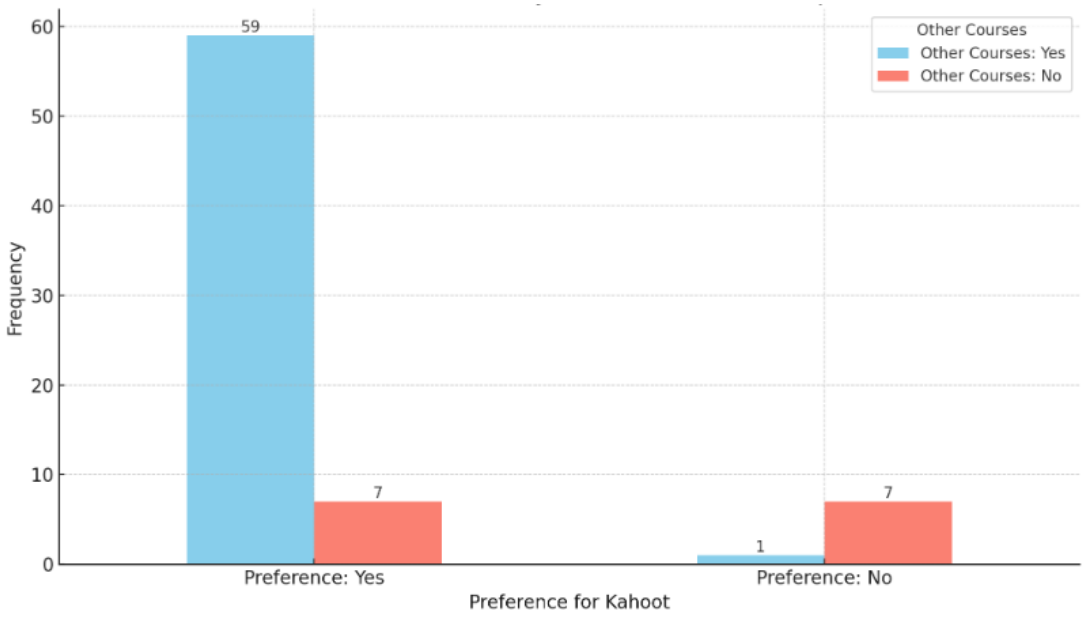

Figure 3 was an output of crosstabulation analysis to explore the relationship between students' preference for using Kahoot in EDF 322 and other courses. 59 (79.73%) students who preferred Kahoot as a formative assessment tool in EDF 322 also prefer it to be used in other courses. 7 (9.46%) students who preferred Kahoot as a formative assessment tool in EDF 322 do not prefer it to be used in other courses. Only 1 (1.35%) student who did not prefer Kahoot as a formative assessment tool in EDF 322 prefer it to be used in other courses. Another 7 (9.46%) students who did not prefer Kahoot as a formative assessment tool in EDF 322 also do not want it used for formative assessment in other courses. This distribution suggests that a strong preference for Kahoot in EDF 322 is associated with its preference in other courses, reinforcing its perceived value as a formative assessment tool among students.

Research Question 3: What are the reasons for preference or non-preference for game-based learning (Kahoot!) for formative assessment among students?

Answer:

To explore the dynamics of students' preference for formative assessment, a thematic analysis of their qualitative comments was performed. This analysis focuses on students' reflections about their preferences for or against using online gaming assessments through Kahoot, based on a set of open-ended responses. A variety of

recurring themes emerged, showcasing how students perceived this tool as both a positive learning experience and, in some cases, a source of frustration due to its technological and logistical limitations. The themes are subsequently presented with accompanying student comments.

- **Reason for Preference:**

Theme 1: Engagement and Enjoyment

A significant number of students expressed that Kahoot made learning enjoyable and exciting. One participant said, *"It's fun. Learning should be fun and exciting,"* while others noted that the interactive nature of Kahoot infused the learning process with enthusiasm. This sense of excitement was coupled with remarks about the tool's ability to reduce classroom stress. For instance, one student mentioned that it *"eases tension,"* while another remarked that it was *"fun and educative, imprinting the course in our minds and hearts."* These responses indicate that Kahoot was valued not just as a formative assessment tool but as a method that lightened the atmosphere, making it easier for students to absorb the material.

In addition to the enjoyment factor, students appreciated the way Kahoot gamified the learning process. Terms like *"engaging," "interactive,"* and *"innovating"* were frequently used. One student summarized this sentiment: *"I prefer it because it is fun, innovating, and it brings out one's energy and curiosity."*

Theme 2: Cognitive and Learning Benefits

Many students emphasized the cognitive benefits of using Kahoot, particularly in fostering quick thinking and problem-solving under pressure. A recurring theme was the importance of speed in these assessments, as one student noted, *"Because our level of speed is being tested…this is also a part of testing."* Others saw the timed nature of Kahoot as enhancing their intellectual growth. *"It's fun and can speed up intellect in an individual,"* said one student, while another mentioned, *"It helps with the skill of speed and teamwork spirit."*

In addition, some students commented on Kahoot's effectiveness in helping them retain information. One student remarked, *"It helps retention,"* and others noted how

this type of assessment helped develop critical thinking skills. The tool was described as not only an evaluation of knowledge but a challenge that involved multiple learning domains, including psychomotor skills, as one participant noted: *"I feel it includes the psychomotor domain in assessing us as students."*

Theme 3: Collaboration and Competition

The group-based format of Kahoot appeared to foster a sense of unity and collaboration among students. Some expressed that the tool encouraged teamwork, describing the group competition as motivating. One student said, *"It is healthy and it calls for unity among students,"* while another commented on how Kahoot enhanced classroom friendship by *"boosting team collection and bonding us well as course mates."*

Competition was seen as beneficial in creating an environment of healthy rivalry. One student noted how the competition aspect *"makes it easier for me to be motivated to get at least the 1st, 2nd, or 3rd place."* This emphasis on competitive spirit not only motivated students to participate actively but also provided an additional layer of engagement.

Theme 4: Technological Adaptation and Broadening Knowledge

Despite some negative feedback, a smaller group of students saw value in adapting to the technology-based format. A few commented on how Kahoot broadened their technological skills, which they saw as essential for modern learning. One student mentioned, *"It's broadened my knowledge towards technology,"* while another felt that the online gaming environment was *"a great way to engage with the material and provide a fun and interactive way to learn."*

Reason for Non-preference:

Theme 1: Speed, Fairness, and Network Challenges

Despite the overwhelming positivity, few students raised concerns about the fairness of the assessment, particularly the emphasis on speed. Some noted that Kahoot's

scoring system seemed to reward faster responses rather than the accuracy of the answers. One student explained, *"The scoring is only based on speed, even if you pick the correct answer you don't get your full score."* Another participant agreed with this concern, stating, *"It's not really efficient…scoring is only based on speed."*

In addition to concerns about fairness, network issues were highlighted as significant challenges to the assessment's effectiveness. One student pointed out, *"I wouldn't prefer online gaming assessment because of the issue of network,"* while another elaborated on how unpredictable internet access made Kahoot assessments frustrating: *"We can't predict if the network would be good or not, so online gaming assessment is a no for me."*

These concerns about technical limitations suggest that while the online gaming approach may foster engagement and learning, external factors like internet connectivity can diminish its effectiveness for some students.

Theme 2: Skepticism

A few students expressed skepticism about using Kahoot as an assessment tool. While some felt the tool was too dependent on external factors like network reliability, others believed it did not fairly assess their knowledge. One student commented, *"I do not prefer online gaming because it is conditioning,"* while another said, *"It is not a criterion for testing one's intelligence or knowledge."* These responses suggest that some students perceived Kahoot as limited in scope, more focused on speed and competition than on deeper understanding or critical thinking.

Research Question 4: What challenges do students experience with the use of game-based learning (Kahoot!) for formative assessment?

Answer:

The analysis of student responses regarding the challenges experienced with the use of Kahoot as a formative assessment tool highlights three major themes: **network issues**, **time constraints**, and **concerns about fairness and inclusivity**. These challenges, while largely centered on technological limitations, also include issues

related to the nature of the assessment itself and its broader impact on student learning experiences.

Theme 1: Network and Connectivity Problems

A dominant theme in nearly all the responses was the issue of **network reliability**. Students repeatedly pointed out that poor or unstable internet connections are a significant obstacle to using Kahoot for assessments. Phrases such as *"bad or slow network providers," "poor internet connection," "unstable network,"* and *"network palava"* appear throughout the responses, indicating the pervasive nature of this problem.

Many students felt that the unpredictability of network performance could affect their ability to complete assessments accurately and in a timely manner. One student expressed concern that *"bad network can make it uninteresting,"* while another noted, *"network issues because it's unpredictable, which can lead to a low score."*

In addition to affecting individual performance, connectivity issues were also seen as impacting group-based assessments, leading to frustration and disorganization. As one student said, *"It's a group work, and working with groups can be stressful. Blames flying here and there."* This response underscores how network problems can exacerbate interpersonal tensions in group settings.

Theme 2: Time Constraints and Pressure

Time management emerged as a significant concern for many students. Some respondents felt that Kahoot's fast-paced nature did not allow enough time for reflection and problem-solving. One student commented, *"The challenge is that there is no enough time for the online game,"* while another said, *"There's not enough time to think."* This suggests that while Kahoot emphasizes speed and quick recall, it may not cater to students who require more time to engage critically with the questions.

Time limitations combined with network challenges were seen as a double-edged sword. For instance, one student remarked, *"The network determines your fate,"*

linking poor connectivity directly to the issue of insufficient time. This reflects a broader concern that technical difficulties, rather than academic ability, may disproportionately influence performance outcomes.

Theme 3: Fairness, Inclusivity, and Assessment Validity

Another recurring theme in the responses was the question of **fairness** and **the inclusivity of the assessment method**. Several students expressed concern that Kahoot's reliance on speed and technological access might not accurately reflect their academic abilities. One student remarked, *"It can't fully measure the extent of students' knowledge and abilities. It is prone to functionality problems like network downtime and system glitches."*

Some students were worried that network issues might unfairly impact their performance, with one participant stating, *"It's not a justifiable reason to fail an assessment because of a bad mobile network."* The underlying sentiment here is that technical difficulties, rather than intellectual competence, could lead to an unfair assessment outcome.

In addition to these concerns, students pointed out that the tool could create an **uneven playing field**, especially for those without access to reliable devices or who are less familiar with gaming technology. As one student summarized: *"Some students may not have access to the necessary technology or may have limited experience with gaming, which could create an uneven playing field."*

Theme 4: External Factors: Electricity and Resources

A significant number of respondents raised concerns about external factors, particularly **electricity and the availability of resources**. As the university in the context of the responses may face inconsistent power supply, students noted that continuous assessments using Kahoot might be hampered by such infrastructural issues. One respondent emphasized, *"Electricity is also an important factor, but it is not constant,"* while another commented on the need for reliable resources, *"It might not be sustainable because of a lack of necessary equipment and electricity."* These

observations suggest that even when network issues are resolved, there are broader structural challenges that need to be addressed.

Theme 5: Mental and Emotional Strain

In addition to technological and structural concerns, some students expressed emotional reservations about the competitive nature of Kahoot. One student remarked, *"It can instill a lot of pressure and unnecessary competition among students."* Others mentioned that the tool could foster feelings of **anxiety** or **unworthiness**, with one respondent describing the potential for *"people feeling anxious and feeling they don't know anything when assessed."* This reflects the emotional strain some students may experience when using an assessment method that is perceived as overly fast-paced and competitive.

Theme 6: Visual Problems

Although, only one student mentioned that the use of Kahoot for formative assessment of students may not be beneficial for students with colour blindness, this response is very significant and should be put into consideration when improvement on the game is to be considered.

In summary, for Kahoot to be an equitable and effective tool for continuous assessment, considerations must be made to ensure reliable internet access, appropriate timing, and fair grading mechanisms that accurately reflect students' knowledge rather than their technological access or speed.

Hypothesis Testing

Hypothesis 1: There is no significant difference in the academic performance of students who prefer game-based learning (Kahoot!) for formative assessment and those who do not.

Table 1: Mann-Whitney U Test Analysis on academic performance of students who prefer game-based learning (Kahoot!) for formative assessment and those who do not.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Academic Performance is the same across categories of Preference for Kahoot	Independent-Samples Mann-Whitney U Test	.800	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

A Mann–Whitney U test was conducted to examine differences in academic performance between the group of students who prefer Kahoot for formative assessment and those who do not. This nonparametric test was chosen due to its robustness to violations of normality and its focus on distributional differences rather than mean differences. Levene's test of p=0.841 indicated equal variances between the two groups. However, there was a violation in the use of independent t-test with respect to normality of distribution of the two groups. The result from the Shapiro-Wilk test indicated that the data was normally distributed for the academic performance of students who do not prefer Kahoot (NO GROUP) with a p-value of 0.241, while it was not normally distributed for the yes group with a p-value of 0.004. Hence, the use of Non-parametric analysis using Mann-Whitney U statistic. Below is the statistical derived from the analysis:

Group 1 (YES): Mdn = 65.0 N=66

Group 2 (NO): Mdn = 66.0 N=8

Mann–Whitney U = 249.50, p = .81 (two-tailed)

Cohen's d = -0.04 (indicating a negligible effect size)

The results indicated no statistically significant difference in academic performance between the two groups, U = 249.50, p = .81. Median scores were nearly identical, and the distributions appeared similar upon inspection. The effect size was very

small (d = -0.04), suggesting practically no difference between the groups. Given the non-significant result and the negligible difference in medians, we conclude there is no meaningful difference in academic performance based on preference group.

Discussion of Findings

The findings of this study revealed that a significant number of students prefer learning games as a tool for formative assessment not only in sex education and marital guidance but also in other courses. Preference was due to the fact that they considered it as fun, facilitating learn through collaborative effort and a way of improving one's cognitive ability. Reason for non-preference by the few was due to frustrations caused by internet challenges. Although there are limited studies that have investigated the preference of students for game-based learning, the findings of this study is in line with Makhasane and Olawande (2022), who revealed that revealed that most learners love to play games especially one that allows for competition, challenge and curiosity. Although, this study was conducted among university undergraduates in Nigeria and Makhasane et. al (2022) was conducted with primary and secondary students in South-Africa, one should expect a disagreement with findings considering the geographical location of the study and the nature of the sample. But the findings were similar which may be due to the attractiveness and mesmerism of the young towards digital devices and its affordances.

Similarly, the finding of this study aligns with Pinto et. al. (2022), who found a significant portion of students supported gamification for the reason that lectures could be made enjoyable by integrating games in the teaching-learning process. Plausible reasons for similarities in findings may be due to the popular attraction of 21st century students to innovations that enhance social interaction and learning. Similar findings were also discovered with Ismail et. al (2017), Plump et al (2017) and Kaur et. al (2020). They found that Kahoot made learning fun and useful for formative assessment, interactive and fostering active participation during lectures.

However, there seems to be a disagreement in the findings of Kariko et al (2021) with this study. Students do not prefer online quizzes for graded formative assessment. The aim of formative assessment is not for assigning grades (Okoli, 2014). Students' non preference for Kahoot for formative assessment in Kariko's study was because it was graded. For formative assessment to be effective, teachers should provide informative and rewarding feedback to students (Okoli, 2014). This feedback informs students on the extent of learning, identifying learning mistakes in need of correction.

With respect to challenges experienced by students with the use of Kahoot for formative assessment, this study revealed network issues, time constraints and pressure to attempt questions, students' view as an invalid mode to measure students' knowledge, lack of access to device and unfamiliarity with gaming technology, unreliable electricity, unavailability of resources, anxiety and the inability of students with visual impairment to participate. Many of these findings are common with other studies. Sianturi et. al (2023) found poor internet, time constraint and deficiency in the use of technology. Bhuana (2022), Rosdy et al (2021) and Wang et. al (2020) also identified poor internet connection as one of the challenges experienced by students with the use of Kahoot. Thus, one can conclude that unreliable internet connection is the commonest challenge students experience with the use of Kahoot.

Other challenges found in other studies, but not in this study include distraction caused by questions and answers displayed on different screen and audio effect (Sianturi et. al, 2023), absence of further discussions after playing Kahoot, boredom from frequent usage of Kahoot (Bhuana, 2022), the fear of not winning, inability to alter answers after submission (Wang et. al, 2020). One challenge found in this study and not in other reviewed study is the concern about students with visual impairment. The blind and those with colour blindness may not be able to participate in this form of assessment. This has great implications for consideration by the inventor of for possible inclusion of feature to enhance inclusivity for the visually impaired.

The findings of this study also reveals that there is no significant difference in the academic performance of those who prefer game-based learning and those who do not. The performance of students in the two groups were above average and can be graded B based on the grading system of the University of Lagos (Educational Foundations, 2021 pp. 46). This finding is in tandem with Ndirika (2013), who sees learning as instrumental to improving the attitude and academic performance of students in science subjects. The findings of the study synced with the establishment by Vargianniti and Karpouzis (2019), that game improved students' academic performance. Attitude matters when it comes to learning. When learning is perceived as boring, it may affect the retention of knowledge taught in the classroom, but when learning is perceived as enjoyable and fun as enhanced by the integration of learning games, students learn more which results in increased academic performance

Recommendation

Based on the findings of the study, it is recommended that:

1. Course lecturers or teachers should integrate learning games into the pedagogical delivery of their course contents
2. Network providers in Nigeria should improve their services in institutions of higher learning to enhance students' learning experience
3. The University of Lagos Management should ensure that regular power supply should be provided in institutions of higher learning, especially during work/lecture period to enable teachers and students make maximum use of learning games.
4. Lecturers should employ individualized variants of learning games for students who do not prefer group-based games. In other word games should be integrated in such ways that will benefit all learners with inclusivity in mind.
5. The developers of Kahoot! should take into consideration including features that will enable the visually impaired students to benefit from its use.

Implication for Counselling

The findings of this study have implications for counselling. In providing academic guidance and counselling as a service within the school guidance program, the school counsellor could use game-based learning during remedial classes organized for students who are underperforming in some courses or subject areas to enhance learning.

Also, counsellors should offer training and consultancy services both to staffs, students and others outside the school environment. Counselling can provide trainings for teachers and parents in using this simple game-based learning to enhance students learning and academic performance.

Conclusion

The overall sentiment from the students leans towards a preference for Kahoot as a tool for formative assessment. Most students praised the tool for being fun, engaging and an innovative departure from traditional assessment methods. The competitive and collaborative nature of the game was appreciated for fostering both individual cognitive growth and group unity. However, a subset of students expressed concerns about fairness due to the speed-based scoring system and network issues, suggesting that while Kahoot enhances learning, improvements could be made to ensure inclusivity and equity in its application. Also, there are concerns which extend beyond technical difficulties to encompass broader questions about how well such an assessment tool can accurately measure students' understanding and accommodate diverse learning needs, including those with colour blindness. Without addressing these underlying challenges, the effectiveness of Kahoot as an assessment tool may be limited, and students may experience unnecessary frustration or disadvantage.

References

Bhuana, G.P. (2022). The benefits and drawbacks of Kahoot: Students' perspective. *Journal of Language Teaching and Learning, Linguistic and Literature,10*(2),2224-2232

Department of Educational Foundations (2021). *Department Handbook 2021-2023.* Lagos: Onasb Printing Press

Ismail, M. A. A., & Mohammad, J. A. M. (2017). Kahoot: A promising tool for formative assessment in medical education. *Education in Medicine Journal, 9*(2), 19-26.

Kahoot! (2021, February 11). Formative assessment with Kahoot!: How to make it fun and effective. *Kahoot! Blog*. https://kahoot.com/blog/2021/02/11/formative-assessment-kahoot/

Kariko, A. A. T., & Ayuningtyas, P. (2021, September). *Examining students' preferences of Quizizz and Kahoot's as formative assessment and competitiveness*. In Proceedings of the 2021 International Seminar on Application for Technology of Information and Communication (iSemantic) (pp. 400–404). IEEE. http://dx.doi.org/10.1109/iSemantic52711.2021.9573176

Kaur, P., & Nadarajan, R. (2020). *Language learning and teaching using Kahoot!*. International Journal of Modern Education, 2(5), 19–28. http://dx.doi.org/10.35631/IJMOE.25003

Makhasane, M. & Olawande. D. (2022). Preferences of grade R-12 learners in South Africa for digital game-based Learning. *European Conference on e-Learning*, 21 (1), 240-249. 10.34190/ecel.21.1.909.

Ndirika, M. C. (2013). Game-based learning: A panacea for better attitude and academic achievement in basic science. *Journal of Educational and Social Research, 3*(8), 91-97. https://doi.org/10.5901/jesr.2013.v3n8p91

Okoli, C.E. (2014). *Introduction to Educational and Psychological Measurement.* Behenu Press & Publishers; Lagos

Teacher's starter guide to Kahoot! (nd.) Retrieved from https://Kahoot.com/files/2021/06/StarterGuide_0621.pdf

Pange, J., Degteva, A. & Nikiforidou, Z. (2022). ICT tools in designing preschool educational activities on historical events. Technical Annals; *International Scientific Journal in Advances in Engineering (Special Issue), 1* (1), 309-316

Pinto, F. C. M., Jaftha, N., Borg, S., Micallef, M. Z., & Chircop, T. (2022). Students' learning and gaming preferences and their expectations of gamification. *MCAST Journal of Applied Research & Practice*, *6*(1), 60–78. https://doi.org/10.5604/01.3001.001

Plump, C. M., & LaRosa, J. (2017). Using Kahoot! in the classroom to create engagement and active learning: A game-based technology solution for elearning novices. *Management Teaching Review, 2,* 151-158. https://doi.org/10.1177/2379298116689783

Rosdy, S. N. A., & Yunus, M. M. (2021). A systematic review of kahoot: perceptions and challenges among english learners and teachers. *International Journal of Academic Research in Progressive Education and Development, 10*(1), 377-391.

Sianturi, A.D., & Hung, R.T. (2022). The challenges of using kahoot*!* in teaching and learning in higher education - A systematic review*.* In Proceedings of the 6th International Conference on Digital Technology in Education (ICDTE 2022) (pp72-77) https://doi.org/10.1145/3568739.3568753

University of Lagos. (n.d.). *Building a future-ready UNILAG: The Professor Ogunsola agenda* [PDF document]. Retrieved from https://unilag.edu.ng/wp-content/uploads/Building-a-Future-Ready-UNILAG-The-Professor-Ogunsola-Agenda.pdf

Vargianniti, I., & Karpouzis, K. (2019). Effects of game-based learning on academic performance and student interest**.** In K. Karpouzis (Ed.), *Games and learning alliance: 8th international conference, GALA 2019, Athens, Greece, November 27–29, 2019, proceedings* (pp. 389-401). Springer. https://doi.org/10.1007/978-3-030-34350-7_32

Wang, A. I. (2015). The wear-out effect of a game-based student response system. *Computers & Education, 82*, 217-227. https://doi.org/10.1016/j.compedu.2014.11.004

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning – A literature review. *Computers & Education,* 149, 103818. https://doi.org/10.1016/j.compedu.2020.103818

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POTENTIAL OF AI-DRIVEN VIRTUAL LEARNING ENVIRONMENTS IN AFRICAN HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

Artificial intelligence (AI) has completely changed the educational landscape, inspiring the creation of virtual learning environments (VLEs) powered by AI. These immersive learning environments have revolutionised the way we think about education by giving students individualised, dynamic, and exciting educational experiences. The objectives of the study were to explore the current state of AI-driven VLEs in African higher education institutions **(**AHEI) and to investigate the potential benefits and challenges of implementing AI-driven VLE in AHEI. The study utilized the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the Diffusion of Innovations (DOI) theory and the Theory of Planned Behavior (TPB) which provide valuable framework to understand AI adoption in higher education, enabling educators to design and implement AI-powered tools more effectively. This study employed a comprehensive review approach as the primary data collection method to investigate the adoption and effect of AI-driven VLEs in African Higher Education. The review of existing literature was conducted, encompassing academic journals and published institutional reports. Key search engines and databases, including Google Scholar, Scopus, and Web of Science, were utilized to identify relevant sources. The inclusion criteria were resources of relevance to the research objectives and studies published. The findings demonstrate AI-driven VLEs possess the potential to transform African higher education by increasing access, improving quality, and

enhancing student outcomes. It also highlighted the benefits of AI-driven VLEs, including personalised learning, supporting students with disability and improved student engagement. The challenges encountered include unreliable internet, digital literacy gaps, high costs, and concerns about cultural relevance and equity. The paper recommended that governments and educational institutions should invest in reliable internet connectivity and collaborate with local experts to develop AI-driven VLEs tailored to the unique needs of African students.

***Keywords**: Artificial Intelligence (AI), Digital skills gap, Learning outcomes, Students' Personalised learning and Virtual Learning Environments (VLEs)*

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Introduction

Africa's higher education has a rich history, dating back to the 13th century with universities in Timbuktu and Alexandria (Lulat, 2006). Colonialism disrupted this trajectory by imposing Western knowledge systems and marginalizing indigenous customs (Mamdani, 2016). Today, African higher education faces challenges such as funding shortfalls, brain drain, and political instability (Teferra, 2007). However, significant strides have been made through investments in innovative pedagogies and digital infrastructure (Kwesiga & Chancellor, 2017). The continent now boasts over 1,000 institutions, reflecting its complexity and diversity (Association of African Universities, 2020). Integrating indigenous knowledge systems with Western epistemologies remains an ongoing challenge (Odora-Hoppers, 2009). Despite these hurdles, higher education in Africa holds immense potential to drive social justice, economic growth, and cultural renewal (Jansen, 2018), showcasing the resilience and adaptability of the sector.

In this evolving landscape, AI-driven VLEs represent a cutting-edge shift, promising to address longstanding access to and quality challenges in African higher education. The introduction of AI has transformed the education sector in Africa, leading to the development of AI-driven VLEs. The study aims to:

1. explore the current state of AI-driven VLEs in AHEI
2. explore the potential benefits and challenges of implementing AI-driven VLEs in AHEI

To meet these objectives, the following research questions were asked:

1. What is the current state of AI-driven VLEs in AHEI?
2. What are the potential benefits of AI-driven VLEs in AHEI?
3. How are these benefits influencing AHEI's effectiveness?
4. What are the challenges of implementing AI-driven VLEs in AHEI?
5. How are these challenges being resolved in AI-driven VLEs in AHEI?

The research seeks to provide insights into how AI-driven VLEs can transform African higher education by improving accessibility, personalization, and efficiency while addressing implementation hurdles. The findings could guide policymakers, educators, and institutions in leveraging AI for better educational outcomes.

AI-driven VLEs offer personalised, dynamic, and engaging educational experiences (Kim et al., 2020). AI-powered tools such as chatbots, virtual assistants, learning management systems, intelligent tutoring programs, and educational games are revolutionizing the way students learn (Dziuban et al., 2018; Chi et al., 2011; Shute et al., 2009; Tucker et al., 2020). However, challenges remain, including creating engaging eLearning content, ensuring equitable access to AI-powered resources, and developing accurate grading algorithms (Kim et al., 2020; Khoalenyane & Ajani, 2024).

This study is critical for African higher education institutions as AI-driven VLEs address significant challenges and offer transformative benefits. They help bridge the educational gap between urban and rural areas by providing equitable access to high-quality resources, which is vital given the pronounced disparities in Africa (Kim et al., 2020). Personalised learning experiences facilitated by AI improve student engagement and academic performance by adapting to individual needs (Dziuban et al., 2018). AI also supports educators by enhancing tutorial decisions, allowing them to focus more on teaching and improving student learning outcomes (Chi et al., 2011). Additionally, integrating AI into education enhances assessment and learning processes within intelligent educational systems (Shute et al., 2009), and fosters innovation in teaching methodologies by transforming them, making them more interactive and personalised, which is crucial for the future of STEM education and societal impact (Tucker et al., 2020).

This study is significant because it contextualizes AI-driven VLEs for Africa, offering evidence-based strategies to harness AI for equitable, scalable, and high-quality education. In addition, it is crucial for African higher education institutions (AHEIs), policymakers, educators, and ed-tech developers as it addresses significant gaps in existing literature and proposes AI-driven VLEs as transformative solutions. It highlights the lack of research on AI-driven VLEs in African contexts, where infrastructure, digital literacy, and socio-economic conditions differ from developed nations. The study identifies unique challenges such as infrastructure limitations, digital literacy gaps, financial constraints, cultural mismatches, and resistance to technological change. By pinpointing these barriers, it provides a roadmap for context-sensitive AI integration. The study demonstrates how AI-driven VLEs can enhance accessibility, support inclusive education, reduce long-term costs, improve engagement, and bridge equity gaps. It urges African governments and institutions to invest in digital infrastructure, develop localized AI solutions, implement digital literacy programs, and foster public-private partnerships. By addressing adoption barriers and proposing tailored solutions, the study contributes to the broader discourse on AI for inclusive and sustainable education in developing regions.

The current literature on AI-driven VLEs in African higher education highlights several key themes and findings. Studies have shown that AI technologies are being integrated into educational systems across Africa to enhance personalised learning experiences, improve administrative processes, and support teaching methodologies. However, challenges such as resource constraints, ethical considerations, and the digital divide remain significant barriers (Khoalenyane &

Ajani, 2024). This study aims to build upon this existing knowledge by providing a comprehensive review of AI-driven VLEs specifically within African higher education institutions. By utilizing the UTAUT model, this study offers a structured framework to understand AI adoption in this context, enabling educators to design and implement AI-powered tools more effectively. Additionally, this study addresses the unique challenges faced by African higher education institutions, such as unreliable internet connectivity and digital literacy gaps, and proposes solutions tailored to the needs of African students.

While AI-driven VLEs offer significant potential to revolutionize higher education in Africa by providing personalised, dynamic, and engaging learning experiences, there are still substantial challenges that need to be addressed. These include creating engaging eLearning content, ensuring equitable access to AI-powered resources, and developing accurate grading algorithms. The study seeks to highlight both the opportunities and the obstacles to provide a comprehensive understanding of the impact of AI in African higher education.

The advent of AI has further revolutionized the sector, particularly through AI-driven VLEs. These technologies offer personalised, dynamic, and engaging learning experiences, although they also present challenges such as creating engaging eLearning content, ensuring equitable access, and developing accurate grading algorithms. This study aims to provide a comprehensive understanding of the current state, benefits, and challenges of implementing AI-driven VLEs in AHEI. By addressing these research questions, the study seeks to highlight both the opportunities and obstacles in leveraging AI to transform education in Africa

THEORETICAL AND LITERATURE REVIEW

In any research study, theoretical and literature review play a crucial role in establishing the foundation and context for the investigation. This section involves a comprehensive examination of existing research and theories related to this study.

Theoretical Review

This study is grounded in three theories: the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the Diffusion of Innovations (DOI) theory and the Theory of Planned Behavior (TPB) which provide a comprehensive framework for understanding the adoption and impact of AI-driven VLEs in AHEIs.

The first is the Unified Theory of Acceptance and Use of Technology (UTAUT) model, a widely recognized framework for understanding technology adoption and usage. The theory has been defined and expanded upon by various scholars. Davis (1989) originally conceptualized technology acceptance as being driven by perceived ease of use and usefulness, laying the foundation for later models. Venkatesh et al. (2003) formalized UTAUT as a comprehensive framework, identifying four key determinants of technology adoption:

1. Performance expectancy – the degree to which a user believes the technology will enhance their performance.
2. Effort expectancy – the perceived ease of using the technology.
3. Social influence – the extent to which others' opinions affect adoption.

4. Facilitating conditions – the availability of resources and support for technology use.

Dwivedi et al. (2019) further elaborated that UTAUT integrates elements from other theories, including the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Theory of Reasoned Action (TRA).

UTAUT posits that individuals are more likely to adopt technology if they believe it will improve their efficiency, is easy to use, and is supported by peers and institutional infrastructure (Venkatesh et al., 2003). The model also acknowledges moderating factors such as age, gender, experience, and voluntariness of use that influence adoption patterns (Venkatesh et al., 2003; Dwivedi et al., 2019). An extended version, UTAUT 2, introduced by Venkatesh et al. (2012), incorporates additional constructs such as hedonic motivation (enjoyment), price value (cost-benefit analysis), and habit, recognizing their role in technology adoption.

The UTAUT model has been widely applied in educational contexts to analyze technology adoption, including AI-enabled tools in higher education (Venkatesh et al., 2003), see Table 1. for clarity. The four core constructs help explain students' and educators' acceptance of AI-powered solutions:

Performance Expectancy – Students and educators are more likely to adopt AI tools if they believe they enhance learning outcomes or teaching efficiency (Wang et al., 2020; Al-Shammari & Rosli, 2020). For instance, students may expect improved learning outcomes and personalised learning experiences, while educators may anticipate more efficient teaching processes and better student engagement.

Effort Expectancy – Perceived complexity affects adoption; educators embrace AI if it reduces workload, whereas students may resist if tools seem cumbersome (Al-Shammari & Rosli, 2020; Wang et al., 2020). If students and educators find these systems user-friendly and intuitive, they are more likely to adopt them. Simplified interfaces and accessible resources can reduce the perceived effort required to use AI tools.

Social Influence – Peer, instructor, or institutional encouragement significantly impacts adoption (Wang et al., 2020; Al-Shammari & Rosli, 2020). In AHEI, the encouragement from peers, educators, and administrators can significantly influence the acceptance of AI-driven VLEs. Positive testimonials and shared experiences can foster a supportive environment for AI adoption.

Facilitating Conditions – Access to training, technical support, and infrastructure is critical for successful AI integration (Al-Shammari, 2023; Wang et al., 2020). Reliable internet connectivity, technical support, and training programs are crucial for successful implementation. Addressing infrastructure challenges and providing adequate support can enhance the adoption of AI technologies.

By applying UTAUT, higher education institutions can design AI solutions that align with user expectations, thereby improving adoption rates. Understanding these factors enables policymakers and developers to create strategies that enhance AI integration in academic settings.

Table 1: Framework of UTAUT in the context of this study

UTAUT Constructs	Key Factors Influencing Adoption
Performance Expectancy	Clear benefits in improved learning outcomes and efficiency - academic performance, personalised learning experiences, and enhanced engagement
Effort Expectancy	Simplified user interface Adequate training provided
Social Influence	Encouragement from peers and institutional leaders
Facilitating Conditions	Access to necessary infrastructure e.g. reliable internet, modern computing facilities and technical support Professional development for educators

The second theory that underpins the study is the Diffusion of Innovations (DOI) theory. Proposed by Everett Rogers (1962), this theory explains how innovations are adopted or new technologies and ideas spread within a social system over time. It also explains how, why, and at what rate new ideas and technologies spread through cultures. The DOI theory (Rogers, 2003) provides a valuable framework for analyzing the adoption patterns, barriers, and strategies for implementing AI-driven VLEs in AHEI. According to DOI, the rate of adoption of an innovation depends on five key attributes. The attributes and how it's applied in the study are discussed.

Relative advantage is the degree to which the innovation is perceived as better than the idea it supersedes. The degree to which AI-driven VLEs are perceived as better than traditional teaching methods is worth noting. Studies show that AI-enhanced learning tools offer benefits such as personalised learning, accessibility for students with disabilities, and improved engagement, making them attractive to educators (Luckin et al., 2016; Zawacki-Richter et al., 2019).

Compatibility involves how consistent the innovation is with the existing values, past experiences, and needs of potential adopters. The extent to which AI-driven VLEs align with existing educational values, infrastructure, and cultural contexts explains its compatibility. Challenges such as digital literacy gaps, cultural relevance, and infrastructure limitations must be addressed to enhance adoption (Tarus et al., 2015; Mtebe & Raisamo, 2014).

Complexity refers to how difficult the innovation is to understand and use. The perceived difficulty in using AI-driven VLEs shows its complexity. Barriers such as lack of technical expertise and high costs hinder adoption (Scherer et al., 2019). DOI suggests that simpler innovations are adopted faster, necessitating training programs and user-friendly AI tools (Rogers, 2003).

Trialability shows the extent to which the innovation can be experimented with on a limited basis. The ability to experiment with AI-driven VLEs on a limited scale is

essential before its adoption in this resource constrained environment. Pilot programs and collaborations with local experts can facilitate gradual adoption (Al-Emran et al., 2020).

Lastly, observability refers to the extent to which the results of the innovation are visible to others. The visibility of AI-driven VLE benefits, such as improved student engagement and accessibility. Success stories encourage wider adoption (Rogers, 2003; Ifinedo, 2018).

Based on DOI Theory (see Table 2), there is therefore a need to invest in infrastructure (e.g., reliable internet) to support AI-VLE diffusion (Tarus et al., 2015). Secondly, developing training programs to reduce complexity and improve digital literacy (Scherer et al., 2019) should be implemented. The creation of localized AI solutions to enhance compatibility with African educational needs (Mtebe & Raisamo, 2014) is also imperative. Thus, implementing pilot testing and gradual scaling to demonstrate observable benefits (Al-Emran et al., 2020) is in the right direction to influence AI-driven VLEs spread and sustainability.

Table 2: Framework of Diffusion of Innovations (DOI) theory in the context of this study

DOI Attribute	Application in Study
Relative Advantage	AI-driven VLEs offer personalised learning, accessibility for students with disabilities, and improved engagement
Compatibility	Aligns with educational values, infrastructure, and cultural contexts; addresses digital literacy gaps and infrastructure limitations
Complexity	Perceived difficulty due to lack of technical expertise and high costs; simpler innovations adopted faster
Trialability	Essential for adoption in resource-constrained environments; pilot programs and collaborations facilitate gradual adoption
Observability	Visible benefits like improved student engagement and accessibility encourage wider adoption

The Theory of Planned Behaviour (TPB) (Ajzen, 1991) is the last theory that underpins this study. It provides a robust framework for understanding the factors influencing educators' and students' intentions to adopt AI-driven VLEs. According to TPB, behavioral intention, the strongest predictor of actual behavior, is shaped by three key determinants: attitudes toward the behavior, subjective norms and perceived behavioral control.

Attitudes toward the behavior refers to the individual's positive or negative evaluation of performing the behavior. If a person believes that engaging in a particular behavior will lead to favorable outcomes, they are more likely to have a positive attitude towards it. For this study, if educators and students perceive AI-enhanced learning tools as beneficial (e.g., personalised learning, efficiency), they are more likely to adopt them (Teo et al., 2018). Educators' perceptions of AI's

usefulness in grading, feedback, and adaptive learning can shape their willingness to use it (Luckin et al., 2016).

Subjective norms are the perceived social pressures to perform or not perform the behavior. It involves the influence of people important to the individual, such as family, friends, or colleagues, and whether they approve or disapprove of the behavior. Its application in this study refers to the perceived social pressure from peers, administrators, or institutions to use AI-driven VLEs. If key stakeholders (e.g., colleagues, policymakers) endorse AI in education, individuals are more likely to adopt it (Scherer et al., 2019). Institutional policies mandating AI integration or peer recommendations can drive adoption (Venkatesh et al., 2012).

Perceived Behavioral Control (PBC) is the factor that reflects the individual's perception of their ability to perform the behavior. It includes the presence of factors that may facilitate or hinder the behavior, such as resources, opportunities, and skills. The individual's belief in their ability to use AI-driven VLEs is influenced by factors such as technical skills, training, and institutional support (Ifinedo, 2018). Higher PBC increases adoption likelihood. Thus, the availability of training and technical infrastructure influences confidence in using AI tools (Dwivedi et al., 2019). There by applying TPB, researchers can identify key barriers and facilitators in AI-driven VLE adoption, helping policymakers design targeted interventions. This framework also ensures a structured analysis of psychological and social factors affecting AI-driven VLE adoption (see Table 3).

Table 3: Framework of The Theory of Planned Behavior (TPB) in the context of this study

TPB Attribute	Application in Study
Attitudes Toward the Behavior	Educators and students are more likely to adopt AI-enhanced learning tools if they perceive them as beneficial (e.g., personalised learning, efficiency)
Subjective Norms	Perceived social pressure from peers, administrators, or institutions to use AI-driven VLEs; endorsement by key stakeholders drives adoption
Perceived Behavioral Control (PBC)	Belief in one's ability to use AI-driven VLEs influenced by technical skills, training, and institutional support; higher PBC increases adoption likelihood

The integration of UTAUT, DOI theory, and TPB provides a comprehensive framework for understanding the adoption and impact of AI-driven VLEs in AHEIs. UTAUT helps identify key determinants such as performance expectancy, effort expectancy, social influence, and facilitating conditions, which influence technology acceptance. DOI theory explains the spread of AI-driven VLEs, highlighting the importance of innovative attributes, communication channels, and social systems. TPB offers insights into the role of individual attitudes, subjective norms, and perceived behavioral control in shaping behavioral intentions towards AI adoption. Together, these theories enable a nuanced analysis of the factors affecting the implementation and usage of AI-driven VLEs, providing valuable guidance for educators and policymakers to design effective strategies that

enhance educational outcomes and address challenges in African higher education.

Literature review

The integration of AI in education has garnered significant attention in recent years. By synthesizing existing research, this review will highlight key applications, benefits, and limitations of AI in educational settings.

Virtual learning environments (VLEs)

VLEs are web-based platforms that facilitate online education by providing tools for content delivery, communication, assessment, and collaboration to enhance learning experience for both students and educators. With the rapid advancement of digital technologies, VLEs have become integral to both traditional and distance education.

Virtual Learning Environments (VLEs), also known as Learning Management Systems (LMS), are digital platforms where educators and students engage and collaborate. The first VLEs appeared in the late 1990s, with notable examples like Blackboard and Moodle (Coates et al., 2005). These systems have evolved to include multimedia content, social learning features, and artificial intelligence (Dillenbourg et al., 2009). Today's VLEs, such as Canvas, Google Classroom, and Microsoft Teams, leverage cloud computing, offer mobile accessibility, and incorporate gamification elements (Alario-Hoyos et al., 2017).

VLEs, which offer creative and adaptable methods to deliver and access education, have completely changed the face of higher education (Garrison, 2022). They facilitate the creation, storage, and dissemination of educational content, course planning, and communication between students and instructors. These environments can include features such as discussion forums, quizzes, and real-time interactions, making them a comprehensive tool for modern education (Coursera, 2024).

The key features of VLEs are content management in which VLEs allow educators to upload and organize course materials, making it easy for students to access lectures, readings, and assignments. There are also communication tools, with platforms including email, chat, and discussion forums to facilitate interaction between students and instructors. Assessment and feedback is another key feature where VLEs can automate quizzes and assignments, providing immediate feedback to students. The last feature is flexibility, where VLEs support both synchronous (real-time) and asynchronous (self-paced) learning, catering to different learning styles and schedules (Coursera, 2024).

The features of VLEs offer numerous benefits, which are particularly evident in universities. Universities now depend heavily on VLEs as a means of expanding their reach, improving accessibility, and improving student learning (Moore et al., 2024). VLEs allow learners to access materials anytime, anywhere, supporting self-paced learning (Means et al., 2013). This is particularly beneficial for working professionals and students in remote areas. Despite physical distance, one of the main benefits of VLEs is their capacity to provide students with a sense of belonging and community. According to Shea (2007), virtual classrooms, discussion boards, and collaboration tools promote social presence and a sense of

belonging by facilitating connection and involvement. Shea (2007) conducted research, for example, and discovered that students who took part in online conversations had greater levels of engagement and happiness than their non-participating peers.

Additionally, personalised learning experiences are provided by VLEs, enabling students to access resources that are specifically suited to meet their requirements and learn at their own speed (Dziuban et al., 2018). AI-driven VLEs adapt content based on learner performance, offering personalised pathways (Luckin et al., 2016). Teachers may monitor students' progress, pinpoint areas for growth, and offer focused assistance with the use of adaptive technology and learning analytics (Siemens, 2012). For instance, Dziuban et al.'s (2018) study discovered that adaptive learning systems raised student engagement and enhanced learning results.

One other benefit is the integration of AI in VLEs which has transformed the higher education landscape in Africa, offering innovative and flexible ways to deliver and access education (Garrison, 2022). AI-driven VLEs have the potential to address some of the challenges facing African higher education, such as limited access, high student-to-teacher ratios, and inadequate infrastructure (Moore, 2024). Currently, AI-driven VLEs are being used in some African universities to provide personalised learning experiences, automate grading, and enhance student engagement (Dziuban et al., 2021). For instance, the University of South Africa's (UNISA) AI-powered VLE provides students with personalised learning materials and adaptive assessments (UNISA, 2020).

Moreover, VLEs have improved accessibility and inclusivity of higher education, especially for students with impairments, students from different geographic regions, and students with competing obligations (Moore, 2024). By offering immersive and interactive learning possibilities, virtual laboratories, simulations, and virtual reality experiences improve the educational process (Crompton et al., 2024). For example, research conducted in 2017 by Crompton discovered that virtual reality experiences enhanced student engagement and learning results. With regards to enhanced engagement, interactive features such as discussion forums, quizzes, and video lectures improve engagement (Sun et al., 2008). In addition, gamification elements (badges, leaderboards) further motivate learners (Deterding et al., 2011).

While these benefits have a significant positive impact on AHEI, there are challenges, such as maintaining social interaction. VLEs can lead to feelings of isolation as students miss out on face-to-face interactions, which are crucial for developing social skills and a sense of community (Kahu, & Nelson, 2017). There are technical issues too related to unreliable internet and technology access causing disruptions and frustration (National University, 2021). The issue of self-motivation and time management can be a challenge for students. VLEs require high levels of self-discipline and time management, which can be challenging for some students (Wolters & Brady, 2021). Moreover, there may be limited feedback for students. Online learning may limit the immediacy and personalization of feedback compared to traditional classroom settings (E-Student, 2023). Cheating and academic integrity have come to play in higher education assessments currently. Ensuring academic integrity is more challenging in virtual environments, requiring robust monitoring solutions (Sabrina et al., 2022).

Accessibility issues are more profound in Africa. Not all students have equal access to necessary technology and internet connectivity, exacerbating educational inequalities (Moore et al., 2018). The lack of infrastructure and internet connectivity in many African countries also limits access to VLEs (International Telecommunications Union (ITU), 2024). Additionally, there is a shortage of skilled educators and technicians who can design and implement AI-driven VLEs (Shchetyna, 2023). Another challenge is the need for culturally relevant and inclusive AI-driven VLEs that consider the diverse needs and contexts of African students (Crompton et al., 2024). Furthermore, there are concerns about data privacy and security (Chen, 2024), as well as the potential for AI to replace human teachers (Gašević et al., 2023).

To address these gaps in VLEs, strategies should focus on enhancing social interaction to mitigate isolation, improving technical infrastructure for reliable internet access, and developing tools to support self-motivation and time management. Additionally, implementing systems for immediate and personalised feedback, ensuring academic integrity through advanced monitoring solutions, and bridging the digital divide are crucial. Training educators and technicians to effectively use AI-driven VLEs and creating culturally relevant, inclusive content tailored to diverse student needs will further enhance the effectiveness of VLEs in higher education.

Applications of AI-Driven Virtual Learning Environments (VLEs)

Education has undergone a revolution thanks to AI, which has altered how we assess, learn, and teach students. By providing successful, individualized, and productive learning experiences, AI has the potential to drastically change the education sector (Luckin et al., 2024). One of the key applications of AI in education is adaptive learning. AI-powered adaptive learning systems adjust the course materials' level of complexity based on each student's performance to provide a personalised learning environment (Dziuban, 2018). It has been shown that applying this tactic can improve learning outcomes and increase student engagement (Chi et al., 2011).

Furthermore, chatbots and virtual assistants driven by AI are being used to assist students with their inquiries, freeing up teachers to focus on more challenging issues (Kim et al., 2020). AI can evaluate and offer comments on student writing using Natural Language Processing (NLP), which helps students' writing abilities (Wang et al., 2021). Additionally, by offering individualized accommodation and assistance, AI has the potential to improve accessibility for students with impairments (Anderson, 2018). Also, enhanced accessibility is provided, that is AI technologies, such as speech recognition and text-to-speech, can support students with disabilities, making learning materials more accessible and inclusive (Arias-Flores et al., 2025). This implies that both personalised learning and support for students with disabilities are about customizing the learning experience to meet individual needs. By leveraging AI, VLEs can create an inclusive environment where all students, regardless of their abilities, can access and engage with educational content in a way that suits them best. This holistic approach ensures that every student receives the support they need to thrive academically.

In addition, we have the Intelligent Tutoring Systems (ITS) which is an AI-driven ITS that provides personalised instruction and feedback to students, simulating one-on-one tutoring. These systems can identify areas where students struggle

and offer targeted support to improve understanding and retention (VanLehn, 2011). The automated grading and feedback is also used in higher education institutions where AI can automate the grading of assignments and exams, providing consistent and objective evaluations. This reduces the workload on educators and allows for quicker feedback to students (Balfour, 2013).

Conversely, we have predictive analytics. Here the AI can analyze student data to predict academic performance and identify at-risk students. This enables institutions to intervene early and provide necessary support to improve student outcomes (Arnold & Pistilli, 2012). The virtual assistants are also worth mentioning. These AI-powered virtual assistants can help students with administrative tasks, such as scheduling, reminders, and answering frequently asked questions. This enhances the overall student experience and allows educators to focus more on teaching (Okonkwo & Ade-Ibijola, 2021). Although AI has the potential to revolutionise education, its research, and application must be handled responsibly.

AI-driven VLEs offer major benefits but face several gaps. Personalization through adaptive learning improves engagement and outcomes (Luckin et al., 2024; Dziuban, 2018), yet over-reliance on AI can neglect curriculum standards and affect collaborative skills. AI enhances accessibility for students with disabilities (Arias-Flores et al. 2025; Anderson, 2018), but socioeconomic disparities limit access, widening the digital divide. Intelligent Tutoring Systems (ITS) provide personalised tutoring (VanLehn, 2011) but may reduce human interaction and lack emotional intelligence. Automated grading offers quick feedback (Balfour, 2013) but struggles with subjective assessments and potential biases. Predictive analytics identify at-risk learners (Arnold & Pistilli, 2012), raising ethical concerns about bias and privacy. Virtual assistants improve efficiency (Okonkwo & Ade-Ibijola, 2021), but over-automation can reduce problem-solving skills. Research gaps include limited longitudinal studies on AI's long-term impact, lack of teacher training programs for AI-integrated classrooms, and the need for ethical policy frameworks to regulate AI use in education. Addressing these gaps is crucial for maximizing the effectiveness of AI-driven VLEs in enhancing learning experiences.

Methodology

This study employed a comprehensive review approach as the primary data collection method to investigate the adoption and effect of AI-driven VLEs in AHEI. A comprehensive review approach systematically collects, evaluates, and synthesizes existing research on a specific topic. It aims to provide a detailed and unbiased summary of the current state of knowledge, identify gaps in the literature, and suggest areas for future research (Taherdoost, 2022).

In conducting a comprehensive review for this study, several systematic steps were taken to ensure thoroughness and accuracy. Firstly, we defined the research questions to set the direction for the entire review process. Next, we developed a protocol, that is, created a detailed plan outlining the methods and criteria for the review. This included defining inclusion and exclusion criteria, search strategies, and data extraction methods (Lasserson et al., 2021). For this study, the inclusion criteria were all resources related to the objectives of the study. Then we conducted a literature search, that is, performed a search of relevant databases and sources to identify studies that meet the inclusion criteria. We used academic databases such as PubMed, Scopus, Google Scholar and institutional reports

published. Next step, we screened and selected studies by reviewing the titles and abstracts of the identified studies to determine their relevance. Full-text screening was then conducted to confirm eligibility based on the predefined criteria.

Later, we systematically extracted relevant data from the included studies. This involves recording key information such as study design, sample size, interventions, outcomes, and results. We also evaluated the quality and risk of bias using appropriate tools and checklists. This step ensured the reliability and validity of the findings. Next, we analyzed and synthesized the data from the included studies using qualitative synthesis. Qualitative synthesis is a method used to combine results from multiple qualitative studies. It aims to generate new insights and understandings by integrating findings from different contexts and perspectives (Barnett-Page & Thomas, 2009). We then wrote a comprehensive report detailing the methods, findings, and conclusions of the review.

The report followed the guidelines for transparency and reproducibility to ensure that the research process is clear, replicable, and trustworthy. Finally, we periodically updated the review to incorporate new evidence and maintain its relevance (Lasserson et al., 2021). The time frame of this comprehensive review was from July 2024 to February 2025. The methodology enabled an examination of the current state of AI-driven VLEs in AHEIs identifying the current state, benefits and challenges for future development (see Figure 1).

The quality of included studies was assessed using the GRADE approach, which evaluates factors such as study limitations, consistency of results, directness of evidence, precision of estimates, and risk of publication bias. This method ensured a thorough evaluation of the reliability and validity of the findings. Additionally, the quality assessment considered the study design, sample size, interventions, outcomes, and results, using tools specific to certain study designs to identify potential flaws in methods or implementation. Lastly, the risk of bias evaluation was conducted using appropriate checklists and tools, ensuring that the findings were reliable and valid by minimizing the impact of biases on the overall conclusions (Cochrane, 2025). These systematic steps provided a robust framework for assessing the quality of the included studies, enhancing the credibility and reliability of the review's findings.

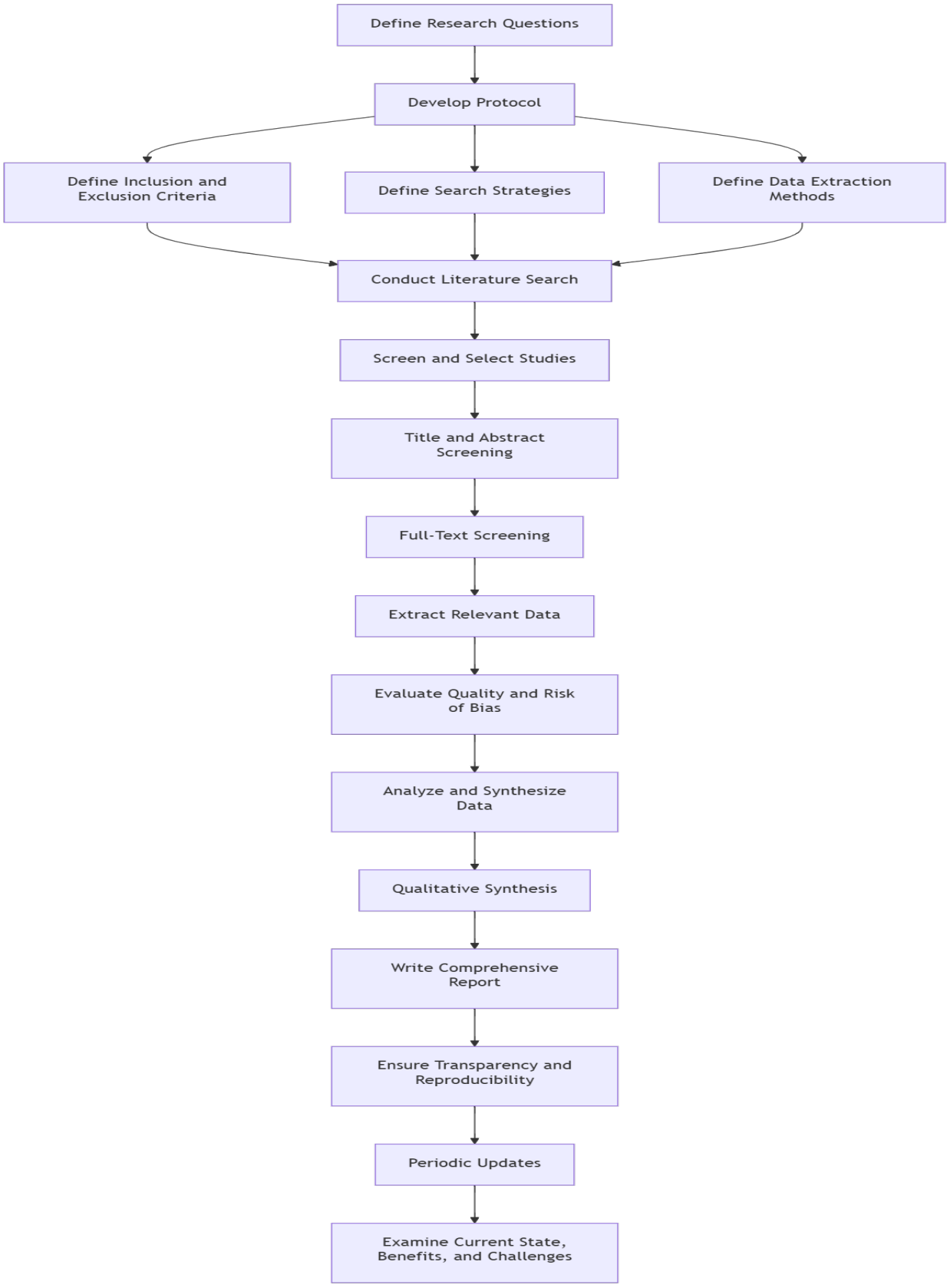

Figure 1: Flow diagram of study selection process

Findings and discussion

In examining the potential of AI-driven VLEs in AHEI, the findings and discussion section is pivotal. This section will delve into the empirical evidence and theoretical insights gathered during the study, providing a comprehensive analysis of how AI technologies are being integrated into educational systems across the continent. The findings will highlight the themes that emerged from the review which are the current state, potential benefits, and challenges associated with the adoption of AI-driven VLEs.

The current state of AI-driven VLEs in African higher education

The advent of AI-driven VLEs in African higher education has been met with enthusiasm, with several institutions adopting this innovation. The findings of the current state of AI-driven VLEs in African higher education is discussed based on case studies from various higher education institutions in Africa.

A case study at Mohammed VI Polytechnic University in Morocco is one such example (Baba et al., 2024). The study evaluated the effect of an AI-driven personalised educational platform on students' academic achievement and educational progress. The platform, designed for mobile devices, allowed instructors to easily upload information, and learners could interact with an AI mentor through a chat interface seamlessly integrated into their mobile course materials. This study compared two groups of students. One group had access to a mobile personalised learning platform powered by AI, whereas the control group did not have access to it. A comparative analysis of mobile educational experiences, levels of engagement, and academic outcomes across these groups was done. In addition, qualitative feedback was gathered from educators and students to evaluate the mobile usability and effectiveness of the system. The results of the study demonstrate that the AI-driven mobile-tailored learning system significantly improves the experience of mobile learners. The increased levels of engagement, improved understanding, and superior academic achievements support this claim. This study not only supports the potential of AI-driven personalised mobile learning in higher education but also emphasizes the importance of continuous innovation to improve its usefulness and effectiveness.

The adoption of AI-driven VLEs in African higher education is not limited to Morocco. In South Africa, the University of the Witwatersrand has implemented an AI-powered virtual learning platform that uses machine learning algorithms to personalize learning for students (University of the Witwatersrand, 2023). The platform has been shown to improve student engagement and academic performance, particularly among historically disadvantaged students.

In Ghana, institutions are also making strides in integrating AI-driven VLEs. For example, the Kwame Nkrumah University of Science and Technology (KNUST) has implemented AI-powered tools for scheduling and classroom management, which help streamline administrative tasks and enhance the learning experience (Knowledge Innovations, 2024). Additionally, platforms like eLearnAfrica have been pivotal in providing personalised lessons and real-time feedback, particularly during the pandemic, ensuring continuity in education (Knowledge Innovations, 2024). Also, The African Institute for Mathematical Sciences (AIMS) in Ghana has integrated AI tools to enhance their educational offerings. These tools provide personalised learning experiences and real-time feedback, particularly in STEM

subjects, helping to improve student outcomes (Knowledge Innovations, 2024). Additionally, Accra Technical University (ATU) is exploring the use of AI labs to support innovative learning. These labs facilitate real-time collaboration and hands-on learning experiences, preparing students for the demands of the Fourth Industrial Revolution (The Ghana Report, 2025). See Table 4 for clarification.

The adoption of AI-driven VLEs in African higher education shows promising results, particularly in enhancing engagement, academic performance, and personalised learning. Comparing these findings with studies from other regions reveals both similarities and differences in implementation, challenges, and outcomes.

African case studies, such as those from Mohammed VI Polytechnic University (Morocco) and the University of the Witwatersrand (South Africa), demonstrate that AI-driven VLEs significantly improve student engagement and academic performance (Baba et al., 2024; University of the Witwatersrand, 2023). Similar trends are observed in Western contexts, where AI-powered platforms like Carnegie Learning's intelligent tutoring systems in the Hamad Bin Khalifa University in Qatar, Munster Technological University in Ireland, Queen Mary University of London in the UK, Princess Sumaya University for Technology in Jordan, University of Houston in the USA, Alfaisal University in Saudi Arabia, and Chicago State University in the USA have led to measurable improvements in student outcomes, particularly in Science, Technology, Engineering, and Mathematics (STEM) subjects (Ahmad et al.,2024).

In addition, a study conducted at Universidad Europea de Madrid, in Spain focused on improving inclusive learning using an AI-powered chatbot designed to assist university students. The chatbot demonstrated high proficiency, with positive evaluations from students regarding usability, accuracy, interaction, and utility (Ruiz Lázaro et al., 2024).

In Vietnam, a study at Ho Chi Minh City University of Technology and Education (HCMUTE) evaluated the integration of ChatGPT into teaching and learning dynamics. The AI tool was found to enhance student learning behaviors and academic tasks, although concerns about overreliance and academic dishonesty were noted (Nguyen et al., 2024)

In all, AI-driven VLEs have the potential to significantly improve student outcomes in African higher education. The case studies from Morocco, South Africa and Ghana demonstrate the effectiveness of these innovations in enhancing engagement, understanding, and academic performance. Comparisons with other regions highlight similar positive impacts, although challenges such as overreliance and academic dishonesty persist. Continuous innovation and standardized evaluation frameworks are essential to maximize the benefits of AI in education.

Table 4: Current state of AI-driven VLEs in African higher education based on case studies in study

Institution	Country	AI-Driven VLE Implementation	Outcomes
Mohammed VI Polytechnic University	Morocco	AI-driven personalised educational platform for mobile devices	Improved engagement, understanding, and academic achievement
University of the Witwatersrand	South Africa	AI-powered virtual learning platform using machine learning algorithms	Enhanced student engagement and academic performance, particularly among historically disadvantaged students
Kwame Nkrumah University of Science and Technology (KNUST)	Ghana	AI-powered tools for scheduling and classroom management	Streamlined administrative tasks and enhanced learning experience
eLearnAfrica	Ghana	Personalised lessons and real-time feedback	Ensured continuity in education during the pandemic
African Institute for Mathematical Sciences (AIMS)	Ghana	AI tools for personalised learning experiences and real-time feedback in STEM subjects	Improved student outcomes
Accra Technical University (ATU)	Ghana	AI labs for innovative learning and real-time collaboration	Prepared students for the Fourth Industrial Revolution

Potential benefits of AI driven VLE in AHEI

The potential benefits of AI-driven VLEs in African higher education are numerous and significant (Table 5). One of the primary benefits is the ability to increase access to education, particularly in regions where traditional brick-and-mortar institutions are scarce or inaccessible (UNESCO, 2019). AI-driven VLEs can provide high-quality educational content and resources to students across the continent, helping to bridge the educational gap and promote inclusivity (Sey & Mudongo, 2021).

Another benefit is the personalization of learning experiences and educational content, which can be tailored to individual students' needs and abilities (Dziuban et al., 2018). AI can help identify learning gaps and provide targeted interventions, ensuring that students receive the support they need to succeed (Crompton et al., 2024). AI can have Intelligent Tutoring Systems (ITS) which provide personalised instruction and feedback, simulating one-on-one tutoring to improve student understanding and retention (VanLehn, 2011). This approach has been shown to improve student engagement and academic performance (Luckin et al., 2024).

AI algorithms can analyze student data and adapt the learning environment to optimize student outcomes, leading to improved academic performance and increased student engagement (Crompton et al., 2024). It is worth noting that AI can also analyze student data to predict academic performance and identify at-risk students, enabling early interventions to improve student outcomes (Arnold & Pistilli, 2012). AI has improved the accessibility of learning materials in that AI technologies, such as speech recognition and text-to-speech, has supported students with disabilities, making learning materials more accessible and inclusive (Arias-Flores et al., 2025). For instructors, AI-driven VLEs have provided real-time feedback and assessment, freeing them to focus on more complex and creative tasks (Wang et al., 2020). AI can automate administrative tasks such as scheduling, grading, and feedback, reducing the workload on instructors and allowing them to focus more on teaching (Balfour, 2013).

AI-driven VLEs accommodate many students, making it easier to scale educational programs and reach a broader audience, particularly in regions with limited access to traditional educational resources (Knowledge Innovations, 2024). Furthermore, AI-driven VLEs facilitate collaboration and knowledge sharing among students and educators across Africa, promoting a sense of community and fostering a culture of innovation and entrepreneurship (Holmes & Porayska-Pomsta, 2023).

The benefits of AI-driven VLEs in African higher education align with findings from other regions, though contextual differences influence adoption and effectiveness. In Africa, AI-driven VLEs help bridge gaps in regions with limited physical institutions (UNESCO, 2019). AI-enhanced online learning has expanded access to education in rural areas of Latin America. The transformative impact of AI in personalizing learning experiences, supporting teachers and students, and optimizing educational management, particularly in under-resourced regions have been revealed (World Bank, 2024). However, Africa faces unique infrastructural challenges, such as inconsistent internet connectivity and electricity, which are less pronounced in developed regions (Sey & Mudongo, 2021).

Moreso, AI-driven personalization in Africa mirrors trends in the U.S. and Europe, where adaptive learning improves student outcomes (Dziuban et al., 2018; VanLehn, 2011). However, while Luckin et al., (2024) discusses various aspects of AI integration in education in the Western institutions, African institutions may face various challenges in integrating AI due to financial limitations that lead to the adoption of less advanced technological solutions (Crompton et al., 2024).

While AI-driven VLEs offer comparable benefits globally, Africa’s adoption is hindered by infrastructural, financial, and training gaps. Successful models from Global North can be adapted, but localized solutions are essential for sustainable

implementation.

Table 5: Summary of potential benefits of AI driven VLE in AHEI

Theme	Benefits
Increased Access to Education	- Geographical Reach: Provides high-quality educational content to students in remote or underserved regions. - Inclusivity: Helps bridge the educational gap and promote inclusivity across the continent.
Personalised Learning Experiences	- Tailored Content: Customizes educational content to individual students' needs and abilities. - Targeted Interventions: Identifies learning gaps and provides personalised support through Intelligent Tutoring Systems (ITS).
Improved Student Outcomes	- Optimized Learning: Analyzes student data to adapt the learning environment for better academic performance and engagement. - Early Interventions: Predicts academic performance and identifies at-risk students for timely support.
Enhanced Accessibility	- Support for Disabilities: Utilizes AI technologies like speech recognition and text-to-speech to make learning materials more accessible.
Support for Instructors	- Real-Time Feedback: Provides immediate feedback and assessment, allowing instructors to focus on complex and creative tasks. - Administrative Automation: Automates tasks such as scheduling, grading, and feedback, reducing instructors' workload.
Scalability and Collaboration	- Large-Scale Education: Accommodates a large number of students, making it easier to scale educational programs. - Community Building: Facilitates collaboration and knowledge sharing among students and educators, fostering a culture of innovation and entrepreneurship.

Challenges associated with AI VLEs in AHEI

The adoption of AI-driven VLEs in African higher education has been met with enthusiasm but also raises concerns about the challenges and limitations of this technology (Table 6). One of the challenges is the issue of access to reliable internet connectivity, which is a prerequisite for virtual learning (Sey & Mudongo, 2021). Many African countries still struggle with poor internet penetration, making it difficult for students to access VLEs (Internet World Stats, 2020). There is often a disparity in access to necessary technology and internet connectivity, which can exacerbate the digital literacy gap. Students from lower socioeconomic backgrounds may have less exposure to digital technologies, further hindering their ability to engage with AI-driven VLEs (Abrams, 2025). Many AHEI face challenges related to inadequate infrastructure, including limited access to high-speed internet and modern computing facilities. These limitations hinder the effective implementation of AI-driven VLEs (Ragolane & Patel, 2024).

Another challenge is the lack of digital literacy among many students and educators, which can hinder the effective use of AI-driven VLEs (Crompton, 2017). Understanding how AI works and how to leverage AI tools for educational purposes

is crucial. AI-driven VLEs often require more advanced digital skills, including the ability to interact with AI tools, understand data analytics, and use various digital resources effectively (Joseph et al., 2022). Knowing how to use AI for personalised learning, data analysis, and automated feedback is also essential (Abrams, 2025). Without proper training and ongoing support, both students and educators may struggle to use AI tools effectively, leading to underutilization of the available resources (Joseph et al., 2022). Integrating digital literacy into the curriculum is essential for preparing students and educators to use AI-driven VLEs effectively (Abrams, 2025). Theis is because there is a shortage of skilled AI professionals and educators trained to use AI technologies effectively. This skills gap can impede the adoption and integration of AI in educational settings (Kurien & Soglo, 2024). Educational policies need to support digital literacy initiatives, including funding for technology and professional development for educators.

Additionally, the cost of devices and data plans can be prohibitively expensive for many students, exacerbating existing inequalities in access to education (Holmes & Porayska-Pomsta, 2023). Implementing AI-driven VLEs requires substantial financial investment in technology, infrastructure, and training. Many African institutions operate under tight budgets, making it challenging to allocate sufficient resources for AI initiatives (Kurien & Soglo, 2024).

AI-driven VLEs may not be able to replicate the social and cultural nuances of traditional classroom learning, potentially leading to a sense of isolation and disconnection among students (Palos, 2023). Also, in some regions, there may be cultural attitudes that undervalue digital literacy or prioritize traditional learning methods over digital ones. Some educators and students may be resistant to adopting new technologies due to a lack of confidence or fear of the unknown (Joseph et al., 2022).

Moreover, there are concerns about the quality of AI-generated content, which may not be tailored to the specific needs and contexts of African students (Dziuban et al., 2018). The lack of African representation in the development of AI-powered educational tools also raises concerns about cultural bias and relevance (Wang et al., 2020). There is also a concern of ensuring the privacy and security of student data. Many institutions lack robust data protection frameworks, which can lead to vulnerabilities and potential misuse of sensitive information (Ifenthaler & Schumacher, 2016; Maina & Kuria, 2024). The reliance on AI-driven VLEs may perpetuate existing power dynamics, with some students having greater access to technology and digital skills than others (Crompton et al., 2021).

Conversely, the integration of AI in education presents several ethical challenges that must be addressed to ensure responsible use. One major concern is algorithmic bias, where AI systems may perpetuate existing inequalities due to biased training data. This can lead to unfair treatment of students from marginalized groups (Dwivedi et al., 2023). Another issue is the potential replacement of human educators. While AI can enhance educational experiences, it should complement rather than replace human teachers to preserve the essential human elements of empathy and mentorship in education (Gašević et al., 2023).

Data privacy and security are critical in this digital age, especially with the rise of AI in education. Key concerns include data breaches, which can lead to identity theft and financial loss, and inadequate data protection, making systems

vulnerable to attacks. Privacy risks arise from the extensive collection of personal data, often leaving users feeling they lack control. AI systems often require vast amounts of student data, raising questions about how this data is collected, stored, and used. Ensuring robust data protection measures and transparent data governance policies is essential to safeguard student privacy (Chen, 2024). Also, the accountability of AI systems must be considered. Clear guidelines and ethical frameworks are needed to hold AI developers and educational institutions accountable for the impact of AI technologies (Teachers Guide, 2025).

The challenges associated with AI-driven VLEs in AHEI share similarities with those in other regions but also exhibit distinct differences due to socioeconomic, infrastructural, and cultural factors. In Africa, unreliable internet connectivity and inadequate digital infrastructure are major barriers to AI-driven VLE adoption (Sey & Mudongo, 2021; Ragolane & Patel, 2024). Similar challenges exist in other developing regions, such as South Asia and Latin America, where rural and underserved areas face limited internet penetration (UNESCO, 2023). However, developed regions like North America and Europe generally have better infrastructure, though rural areas in these regions still experience connectivity gaps (National Institute of Standards and Technology [NIST], 2019).

In addition, African institutions struggle with low digital literacy among students and educators (Crompton, 2017; Joseph et al., 2022). In contrast, Western countries tend to have higher baseline digital literacy, though disparities persist among marginalized groups. There is therefore the need for inclusive digital skills policies that address these inequalities and support lifelong learning for all adults (Eynon, 2021).

Table 6: Summary of challenges associated with AI driven VLEs in AHEI

Theme	Challenges
Access to Technology and Internet	- Poor internet penetration in many African countries - Disparity in access to necessary technology and internet connectivity - Inadequate infrastructure, including limited access to high-speed internet and modern computing facilities
Digital Literacy	- Lack of digital literacy among students and educators - Need for advanced digital skills to interact with AI tools and use digital resources effectively - Shortage of skilled AI professionals and educators trained to use AI technologies
Financial Constraints	- High cost of devices and data plans - Substantial financial investment required for technology, infrastructure and training - Tight budgets in many African institutions
Social and Cultural Barriers	- Difficulty replicating social and cultural nuances of traditional classroom learning - Resistance to adopting new technologies due to lack of confidence or fear of the unknown - Cultural attitudes that undervalue digital literacy or prioritize traditional learning methods
Quality and Relevance of Content	- Concerns about the quality of AI-generated content - Lack of African representation in the development of AI-powered educational tools, raising concerns about cultural bias and relevance
Privacy and Security	- Ensuring the privacy and security of students - Lack of robust data protection frameworks
Ethical and Regulatory Issues	- Potential for AI to perpetuate existing power dynamics - Ethical issues such as bias in AI algorithms and the potential for AI to replace human educators - Absence of comprehensive regulatory frameworks and policies governing the use of AI in education

Addressing Challenges in AI-Driven VLEs in AHEI

To address the challenges associated with AI-driven VLEs in African higher education, several strategies can be implemented. Improving internet connectivity is crucial; governments and private sectors should invest in infrastructure to ensure reliable and affordable internet access (Queiros & de Villiers, 2016). Bridging the digital literacy gap requires integrating digital skills into the curriculum and providing ongoing training for both students and educators

(Joseph, 2025), as well as improving technological literacy through digital literacy initiatives (Setyanugraha & Wahyuni, 2024). This can be supported by educational policies that fund technology and professional development.

Addressing socioeconomic disparities involves providing subsidized devices and data plans to students from lower-income backgrounds. There is a significant digital divide and varying access to internet and mobile networks in low-income countries. Therefore, dedicated teachers, resilient educators, and the right EdTech tools are needed to support education (Jordan et al., 2021). Governments and development organizations should prioritize funding for EdTech in underserved schools to promote equity. Enhancing infrastructure by upgrading computing facilities and ensuring access to high-speed internet is essential for the effective implementation of AI-driven VLEs (Ade-Ibijola & Okonkwo, 2023).

To tackle the lack of digital literacy, comprehensive training programs should be established to help educators and students understand and leverage AI tools effectively (Burke & Crompton, 2024). Promoting cultural acceptance of digital literacy through awareness campaigns can help overcome resistance to new technologies. Ensuring the quality and relevance of AI-generated content involves including African representation in the development of educational tools to avoid cultural bias.

In addition, addressing ethical concerns is essential for the responsible deployment of AI technologies, especially in Africa. The lack of comprehensive regulatory frameworks and policies governing AI in education can create uncertainties and hinder the widespread adoption of AI-driven VLEs) (Maina & Kuria, 2024). To address these concerns, it is necessary to reduce bias by using diverse datasets and conducting regular audits to ensure fairness, accuracy, and inclusiveness in AI-driven educational tools. Ensuring transparency through explainable AI and human override options is also important to build trust, enhance understanding, and ensure ethical decision-making.

Conversely, defining clear accountability for AI decisions and maintaining human oversight should be prioritized to ensure responsible use, mitigate risks, and uphold societal values. Protecting privacy with strict data laws such as General Data Protection Regulation (GDPR) and anonymizing student data is crucial to safeguarding students' personal information, ensuring compliance with legal standards, and maintaining trust in educational institutions. Promoting equity by providing equal access to AI tools and funding edtech in underserved schools by the government and other development organizations is essential to ensure that all students, regardless of their socioeconomic background, can benefit from advanced educational technologies. Using AI to assist, not replace, teachers, thereby preserving empathy and mentorship in education, should be encouraged to develop the educational experience while preserving the essential human elements.

Moreso, designing AI to foster student autonomy, choice, and critical thinking is vital to enhance the overall learning experience and prepare students for the complexities of the modern world. By promoting these skills, AI-driven educational tools can help students become more independent learners, make informed decisions, and develop the ability to analyze and solve problems critically. This approach not only improves academic outcomes but also equips students with essential skills for their future careers and personal growth. Finally, fostering

collaboration among educators, developers, and policymakers is necessary for effective policy and dialogue to create and implement effective policies and strategies that ensure the successful integration of AI in education (see Table 7).

Table 7: Summary of strategies to address challenges associated with AI driven VLEs in AHEI

Challenges	Strategies for AHEI
Internet Connectivity	Invest in infrastructure to ensure reliable and affordable internet access
Digital Literacy	Integrate digital skills into the curriculum and provide ongoing training for students and educators
Socioeconomic Disparities	Provide subsidized devices and data plans to students from lower-income backgrounds
Infrastructure	Upgrade computing facilities and ensure access to high-speed internet
Ethical Concerns	Reduce bias by using diverse datasets and conducting regular audits; ensure transparency through explainable AI and human override options
Privacy	Protect privacy with strict data laws like GDPR and anonymize student data
Equity	Provide equal access to AI tools and fund EdTech in underserved schools
Teacher Support	Use AI to assist, not replace, teachers to preserve empathy and mentorship
Student Autonomy	Design AI to foster student autonomy, choice, and critical thinking
Collaboration	Foster collaboration among educators, developers, and policymakers for effective policy and dialogue

It is worth noting that implementing AI-driven VLEs in AHEI can lead to potential unintended consequences. Bias and discrimination may arise as AI systems can amplify existing biases in training data, resulting in unfair treatment of marginalized groups (Marr, 2023). Privacy concerns are significant due to the extensive collection and analysis of personal data, which could be misused or inadequately protected (NAIAC, 2023). In addition, the digital divide might worsen, as students with limited internet access or digital literacy skills could struggle to benefit from these technologies, increasing educational inequality (NAIAC, 2023). Job displacement is another risk, with AI potentially automating educational tasks and displacing educators and administrative staff, necessitating retraining efforts (Gašević et al., 2023). Ethical dilemmas arise regarding the transparency and accountability of AI decision-making processes, requiring

alignment with ethical standards to avoid negative societal impacts (Chen, 2024). Lastly, cultural relevance is a concern, as AI-driven VLEs developed in different cultural contexts may not be fully applicable to African settings, potentially alienating students and educators (NAIAC, 2023).

Limitations

The comprehensive literature review used in this study has several limitations. The selection process for studies can introduce bias if the criteria are not clearly defined or consistently applied (Haddaway, 2020). There is a tendency to include only published studies, potentially overlooking relevant unpublished or grey literature (Rahman, 2020). Additionally, the quality of included studies can vary significantly, impacting the reliability of the synthesis (Haddaway, 2020). Evaluating the quality of each study requires careful and consistent assessment, which can be challenging (Rahman, 2020).

Conclusion

The future of AI-driven VLEs in African higher education is promising, with potential to revolutionize the way students learn, and teachers teach. AI-driven VLEs are being enthusiastically adopted in AHEI, significantly improving student engagement, understanding, and academic performance. Case studies from Morocco, South Africa and Ghana highlight the transformative potential of these technologies in advancing education across the continent.

The key points from this discussion highlight the benefits of AI-driven VLEs. AI-driven VLEs in African higher education significantly increase access to quality education, particularly in underserved regions, by providing high-quality content and resources. They personalize learning experiences, improve student engagement and academic performance, and support students with disabilities. Additionally, these environments facilitate collaboration and knowledge sharing, helping to foster a culture of innovation and entrepreneurship across the continent.

However, this adoption faces challenges, including unreliable internet connectivity, digital literacy gaps, high costs, and inadequate infrastructure. Additionally, concerns about cultural relevance, data privacy, and ethical issues such as bias in AI algorithms and the potential replacement of human educators need to be addressed. Overcoming these challenges is essential to ensure equitable and inclusive access to quality education across the continent.

Recommendations and future research directions

To fully harness the benefits of this technology, several directions and recommendations must be considered. Policymakers should allocate funds to enhance internet connectivity and technological infrastructure in educational institutions, ensuring equitable access to AI-driven VLEs. They need to establish clear guidelines and policies for the ethical use of AI, focusing on data privacy, security, and bias mitigation. Supporting research initiatives to develop context-specific AI solutions tailored to African students' needs is crucial. Additionally, facilitating partnerships between educational institutions, industry experts, and international organizations will help share the best practices and drive innovation in AI-driven education.

Educators should enhance digital literacy by participating in training programs to improve their skills and effectively integrate AI tools into the curriculum. They should adopt AI-driven VLEs to create personalised learning experiences tailored to individual student needs and learning styles. Maintaining academic integrity is crucial, ensuring the quality and relevance of AI-generated content by adhering to established standards and continuously monitoring effectiveness. Also, educators should use AI to develop interactive and engaging learning activities that promote critical thinking and collaboration among students.

Lastly, institutions should offer comprehensive training programs for faculty and staff to ensure effective use of AI tools. Establishing an AI governance body is essential to oversee implementation, address ethical concerns, and ensure regulatory compliance. Ensuring equity of access involves providing all students and staff with equal access to AI tools and resources, addressing any disparities. Furthermore, institutions should develop robust quality assurance frameworks to continuously monitor and improve the effectiveness of AI-driven VLEs. These measures will help maximize the benefits of AI in education and ensure its responsible and equitable use.

To fully harness the benefits of AI-driven VLEs in AHEIs, future research should focus on these key areas:

1. Assess the current digital infrastructure in AHEIs and identify needs for upgrading internet connectivity and technological resources. Research should explore cost-effective and sustainable models to bridge the digital divide.
2. Develop and evaluate AI-driven VLEs tailored to the unique cultural, linguistic, and educational contexts of African students. This includes creating AI algorithms that reflect Afrocentric perspectives and address specific challenges in African higher education.
3. Examine the effectiveness of digital literacy programs for educators and students. Research should identify the most effective training methods and tools to enhance digital skills and ensure successful AI integration in the classroom.

The implications for practice are significant, as government, educational institutions and policymakers must prioritize infrastructure development, digital literacy training, and quality assurance frameworks to ensure effective integration and utilization of AI-driven VLEs. Future research should also explore the ethical implications of AI-driven VLEs, including issues related to data privacy, algorithmic bias, and the digital divide.

This study contributes to the field of AI-driven VLEs in African higher education by providing empirical evidence of their positive effect on student engagement, understanding, and academic performance. It highlights the transformative potential of these technologies through case studies from various African institutions, demonstrating their effectiveness in increasing access to quality education and personalizing learning experiences. Additionally, the study underscores the potential benefits, and the challenges associated with the adoption of AI in AHEI, offering valuable insights for policymakers, educators, and researchers.

References

Abrams, Z. (2025, January 1). Classrooms are adapting to the use of artificial intelligence. Monitor on Psychology, 56(1), 70. https://www.apa.org/monitor/2025/01/trends-classrooms-artificial-intelligence

Ade-Ibijola, A., & Okonkwo, C. (2023). Artificial intelligence in Africa: Emerging challenges. In D. O. Eke, A. A. Adeniran, & T. A. Oyelade (Eds.), Responsible AI in Africa: Challenges and opportunities (pp. 101–117). Springer International Publishing. https://doi.org/10.1007/978-3-031-08215-3_5

Ahmad, K., Iqbal, W., El-Hassan, A., Qadir, J., Benhaddou, D., Ayyash, M., & Al-Fuqaha, A. (2024). Data-driven artificial intelligence in education: A comprehensive review. IEEE Transactions on Learning Technologies, 17, 12–31. https://doi.org/10.1109/TLT.2023.3314610

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Arias-Flores, H., Valencia-Aragón, K., Calle-Jimenez, T., & Sanchez-Gordon, S. (2025). Artificial intelligence and assistive technologies: A systematic review of educational applications for disabilities. In M. Antona & C. Stephanidis (Eds.), HCII 2025, LNCS 15780 (pp. 283–292). Springer. https://doi.org/10.1007/978-3-031-93848-1_19

Alario-Hoyos, C., Estévez-Ayres, I., Pérez-Sanagustín, M., Delgado Kloos, C., & Fernández-Panadero, C. (2017). Understanding learners' motivation and learning strategies in MOOCs. International Review of Research in Open and Distributed Learning, 18(3), 119–137. https://doi.org/10.19173/irrodl.v18i3.2996

Al-Shammari, E. T. (2023). Readiness and acceptability for use of e-government services in Kuwait: A case study. Electronic Government, an International Journal, 19(5), 607–618. https://doi.org/10.1504/EG.2023.133104

Alshammari, S. H., & Rosli, M. S. (2020). A review of technology acceptance models and theories. Innovative Teaching and Learning Journal, 4(2), 12–22. https://itlj.utm.my/index.php/itlj/article/view/51

Anderson, M. (2018). Inclusive intelligence: The impact of AI on education for all learners. Center for Innovation, Design, and Digital Learning (CIDDL). https://ciddl.org/inclusive-intelligence-the-impact-of-ai-on-education-for-all-learners/

Arnold, K. E., & Pistilli, M. D. (2012). Course Signals at Purdue: Using learning analytics to increase student success. Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (LAK '12), 267–270. ACM. https://doi.org/10.1145/2330601.2330666

Association of African Universities. (2020). Our journey to 2025: Strategic plan (2020–2025). https://www.aau.org/wp-content/uploads/2020/11/AAU-STRATEGIC-PLAN-MAIN.pdf

Baba, K., Faddouli, E., & Cheimanoff, N. (2024). Mobile-optimized AI-driven personalised learning: A case study at Mohammed VI Polytechnic University. International Journal of Interactive Mobile Technologies, 18(4).

Balfour, S. P. (2013). Assessing writing in MOOCs: Automated essay scoring and calibrated peer review. Research & Practice in Assessment, 8, 40–48. https://www.rpajournal.com/dev/wp-content/uploads/2013/05/SF4.pdf

Barnett-Page, E., & Thomas, J. (2009). Methods for the synthesis of qualitative research: A critical review. BMC Medical Research Methodology, 9(1), 59. https://doi.org/10.1186/1471-2288-9-59

Burke, D., & Crompton, H. (2024). Navigating the future: AI applications in K–12 learning environments. In H. Crompton & D. Burke (Eds.), Artificial intelligence applications in K–12: Theories, ethics, and case studies for schools (pp. 215–225). Routledge. https://www.routledge.com/Artificial-Intelligence-Applications-in-K-12-Theories-Ethics-and-Case-Studies-for-Schools/Crompton-Burke/p/book/9781032576176

Chen, H. (2024). The ethical challenges of educational artificial intelligence and coping measures: A discussion in the context of the 2024 World Digital Education Conference. *Science Insights Education Frontiers*, *20*(2), 3263-3281.

Chi, M., VanLehn, K., Litman, D., & Jordan, P. (2011). An evaluation of pedagogical tutorial tactics for a natural language tutoring system: A reinforcement learning approach. International Journal of Artificial Intelligence in Education, 21(1–2), 83–113.

Coates, H., James, R., & Baldwin, G. (2005). A critical examination of the effects of learning management systems on university teaching and learning. Tertiary Education and Management, 11(1), 19–36. https://doi.org/10.1080/13583883.2005.9967137

Cochrane. (2025). How to GRADE the quality of the evidence. Cochrane Consumers and Communication Group. Retrieved from http://cgf.cochrane.org/sites/cgf.cochrane.org/files/uploads/uploads/how_to_grade.pdf

Crompton, H. (2017). Mobile learning and higher education: Challenges in context. Routledge. https://www.routledge.com/Mobile-Learning-and-Higher-Education-Challenges-in-Context/Crompton-Traxler/p/book/9781138238770

Crompton, H., Jones, M. V., & Burke, D. (2024). Affordances and challenges of artificial intelligence in K–12 education: A systematic review. Journal of Research on Technology in Education, 56(3), 248–268. https://doi.org/10.1080/15391523.2023.2269483

Coursera. (2024, November 21). What is virtual learning? https://www.coursera.org/articles/what-is-virtual-learning

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://www.jstor.org/stable/249008

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: Defining "gamification". In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments (pp. 9–15). ACM. https://doi.org/10.1145/2181037.2181040

Dillenbourg, P., Järvelä, S., & Fischer, F. (2009). The evolution of research on computer-supported collaborative learning. In N. Balacheff, S. Ludvigsen, T. de Jong, A. Lazonder, & S. Barnes (Eds.), Technology-enhanced learning (pp. 3–19). Springer. https://doi.org/10.1007/978-1-4020-9827-7_1

Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2019). Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. Information Systems Frontiers, 21, 719–734. https://doi.org/10.1007/s10796-017-9774-y

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., & Wright, R. (2023). Opinion paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. International Journal of Information Management, 71, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

Dziuban, C. (2018). Adaptive learning: A new approach to personalised education. Educational Technology Research and Development, 66(3), 1–12. https://doi.org/10.1007/s11423-020-09793-2

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: The new normal and emerging technologies. International Journal of Educational Technology in Higher Education, 15, Article 3. https://doi.org/10.1186/s41239-017-0087-5

Eynon, R. (2021). Becoming digitally literate: Reinstating an educational lens to digital skills policies for adults. British Educational Research Journal, 47(1), 146–162. https://doi.org/10.1002/berj.3686.

E-Student. (2023, January 10). 10 biggest disadvantages of e-learning. https://e-student.org/disadvantages-of-e-learning/

Garrison, M. (2022). Confronting the digital Leviathan in education: On cybernetic pedagogy and data-intensive algorithmic technologies. In Handbook of critical approaches to politics and policy of education (pp. 229–240). Routledge.

Gašević, D., Siemens, G., & Sadiq, S. (2023). Empowering learners for the age of artificial intelligence. Computers and Education: Artificial Intelligence, 4, 100130. https://doi.org/10.1016/j.caeai.2023.100130

Haddaway, N. (2020, October 19). 8 common problems with literature reviews and how to fix them. Impact of Social Sciences. https://blogs.lse.ac.uk/impactofsocialsciences/2020/10/19/8-common-problems-with-literature-reviews-and-how-to-fix-them/

Holmes, W., & Porayska-Pomsta, K. (Eds.). (2023). The ethics of artificial intelligence in education: Practices, challenges, and debates. Routledge. https://www.routledge.com/The-Ethics-of-Artificial-Intelligence-in-Education-Practices-Challenges-and-Debates/Holmes-Porayska-Pomsta/p/book/9780367349721

Ifenthaler, D., & Schumacher, C. (2016). Student perceptions of privacy principles for learning analytics. Education Tech Research Dev 64, 923–93. https://doi.org/10.1007/s11423-016-9477-y

Ifinedo, P. (2018). Roles of perceived fit and perceived individual learning support in students' weblogs continuance usage intention. International Journal of Educational Technology in Higher Education, 15(1), Article 7. https://doi.org/10.1186/s41239-018-0092-3

Internet World Stats. (2020). Internet usage in Africa. Internet World Stats. http://www.internetworldstats.com

International Telecommunications Union (ITU). (2024). High costs, poor infrastructure leave 62% of Africans offline: State of digital development in Africa. Leadership News. https://leadership.ng/high-costs-poor-infrastructure-leave-62-of-africans-offline-itu/

Jansen, J. (2018). The future prospects of South African universities (Viewpoints No. 1, June). Centre for Development and Enterprise. https://www.cde.org.za/wp-content/uploads/2018/06/Viewpoints-The-future-prospects-of-South-African-Universities-Jonathan-Jansen.pdf

Jordan, K., David, R., Phillips, T., & Pellini, A. (2021). Education during the COVID-19: Opportunities and constraints of using EdTech in low-income countries. Revista de Educación a Distancia (RED), 21(65).

Joseph, G. V., Athira, P., Thomas, A. M., Jose, D., Roy, T. V., & Prasad, M. (2022). Impact of digital literacy, use of AI tools and peer collaboration on AI-assisted learning: Perceptions of university students. International Journal of Education and Development using Information and Communication Technology, 18(4), 45–63. https://files.eric.ed.gov/fulltext/EJ1434328.pdf

Joseph, E. (2025). Public-private partnerships for revolutionizing personalised education through AI-powered adaptive learning systems. In N. Baporikar (Ed.), Public private partnerships for social development and impact (pp. 265–290). IGI Global. https://doi.org/10.4018/979-8-3373-3471-4.ch011

Kahu, E. R., & Nelson, K. (2017). Student engagement in the educational interface: understanding the mechanisms of student success. Higher Education Research & Development, 37(1), 58–71. https://doi.org/10.1080/07294360.2017.1344197

Khoalenyane, N. B., & Ajani, O. A. (2024). A systematic review of artificial intelligence in higher education—South Africa. Scientific Studies and Educational Research Review, 11(1), 17–26. https://doi.org/10.5281/zenodo.15258127

Kim, J., Merrill, K., Xu, K., & Sellnow, D. D. (2020). My teacher is a machine: Understanding students' perceptions of AI teaching assistants in online education. International Journal of Human–Computer Interaction, 36(20), 1902-1911.

Knowledge Innovations. (2024, October 7). AI-powered learning: A new era for Ghanaian students. Knowledge Innovations. https://www.knowledgeinnovations.com/2024/10/07/ai-powered-learning-a-new-era-for-ghanaian-students/

Kurien, A., & Soglo, B. A. (2024). A study on the AI landscape of universities in Africa. Tshwane University of Technology. https://www.tut.ac.za/images/news/2024/October/AI-Landscape_in_Universities_in_Africa-Report.pdf

Kwesiga, J., & Chancellor, V. (2017). Remembering Frank Kalimuzo: Lessons for universities in cultivating a culture of service and distinguished leadership. Makerere University. https://100.mak.ac.ug/wp-content/uploads/2022/08/Joy-Kwesiga-Keynote-Speech-on-Kalimuzo.pdf

Lasserson, T. J., Thomas, J., & Higgins, J. P. T. (2021). Chapter 1: Starting a review. In J. P. T. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. J. Page, & V. A. Welch (Eds.), Cochrane Handbook for Systematic Reviews of Interventions (version 6.5). Cochrane. https://training.cochrane.org/handbook/current/chapter-01

Luckin, R., & Holmes, W. (2016). Intelligence unleashed: An argument for AI in education.
Pearson. https://www.pearson.com/content/dam/corporate/global/pearson-dot-com/files/innovation/Intelligence-Unleashed-Publication.pdf

Luckin, R., Rudolph, J., Grünert, M., & Tan, S. (2024). Exploring the future of learning and the relationship between human intelligence and AI: An interview with Professor Rose Luckin. Journal of Applied Learning and Teaching, 7(1). https://doi.org/10.37074/jalt.2024.7.1.27

Lulat, Y. G. (2006). Comparative perspectives on Islamic identity and issues of education in the aftermath of September 11, 2001. Comparative Education Review, 50(3), 518–527. https://doi.org/10.1086/505285

Maina, A. M., & Kuria, J. (2024). Building an AI future: Research and policy directions for Africa's higher education. IST-Africa Institute. http://www.ist-africa.org/conference2024/files/ISTAfrica2024_FinalProgramme.pdf

Mamdani, M. (2016). Between the public intellectual and the scholar: Decolonization and some post-independence initiatives in African higher education. Inter-Asia Cultural Studies, 17(1), 68–83. https://doi.org/10.1080/14649373.2016.1140260

Marr, B. (2023, June 18). The 15 biggest risks of artificial intelligence. Bernard Marr. https://bernardmarr.com/the-15-biggest-risks-of-artificial-intelligence/

Means, B., Toyama, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. Teachers College Record, 115(3), 1–47.

Moore, R., Vitale, D., & Stawinoga, N. (2018). The digital divide and educational equity. Insights in Education and Work, 1–10. American Institutes for Research.

Moore, D. E., Moore, S. R., Ireen, B., Iskandar, W. P., Artazyan, G., & Murnane, E. L. (2024, May). Teaching artificial intelligence in extracurricular contexts through narrative-based learnersourcing. In Proceedings of the CHI Conference on Human Factors in Computing Systems (pp. 1–28). ACM. https://doi.org/10.1145/3613904.3642198

Mtebe, J. S., & Raisamo, R. (2014). Investigating perceived barriers to the use of open educational resources in higher education in Tanzania. *The International Review of Research in Open and Distributed Learning*, *15*(2). https://doi.org/10.19173/irrodl.v15i2.1803

National Artificial Intelligence Advisory Committee (NAIAC). (2023). Findings: The potential future risks of AI. AI.gov. https://ai.gov/wp-content/uploads/2023/11/Findings_The-Potential-Future-Risks-of-AI.pdf

National Institute of Standards and Technology (NIST). (2019). Rural America, rural economies and rural connectivity. https://pages.nist.gov/GCTC/uploads/blueprints/2019-Ag-Rura-Blueprint.pdf

National University. (2021). Challenges of distance learning for students. https://www.nu.edu/blog/challenges-of-distance-learning-for-students/

Nguyen, T. N. T., Van Lai, N., & Nguyen, Q. T. (2024). Artificial Intelligence (AI) in education: A case study on ChatGPT's influence on student learning behaviors. Educational Process: International Journal, 13(2), 105–121. https://doi.org/10.22521/edupij.2024.132.7

Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. Computers & Education: Artificial Intelligence, 2, 100033. https://doi.org/10.1016/j.caeai.2021.100033

Palos, B. (2023). The future of AI-powered e-learning and remote education. The Palos Publishing Company. https://palospublishing.com/the-future-of-ai-powered-e-learning-and-remote-education/

Queiros, D. R., & de Villiers, M. R. (2016). Online learning in a South African higher education institution: Determining the right connections for the student. International Review of Research in Open and Distributed Learning, 17(5), 165–185. https://doi.org/10.19173/irrodl.v17i5.2552

Ragolane, M., & Patel, S. (2024). Transforming Educ-AI-tion in South Africa: Can AI-Driven Grading Transform the Future of Higher Education. Journal of Education and Teaching Methods, 3(1), 26-51.

Rahman, M. (2020). Advantages and disadvantages of literature review. How and What. https://www.howandwhat.net/advantages-disadvantages-literature-review/

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). Free Press.

Sabrina, F., Azad, S., Sohail, S., & Thakur, S. (2022). Ensuring academic integrity in online assessments: A literature review and recommendations. International Journal of Information and Education Technology, 12(1), 1–7. https://doi.org/10.18178/ijiet.2022.12.1.1587

Setyanugraha, A. T., & Wahyuni, A. (2024). The application of digital literacy improves technological literacy in the scope of education in Talang Duku Village. Al-Hijr: JIIET: Journal International Inspire Education Technology, 3(1), 39–45. https://doi.org/10.55849/jiiet.v3i1.595

Sey, A., & Mudongo, O. (2021). Case studies on AI skills capacity-building and AI in workforce development in Africa. Research ICT Africa. https://researchictafrica.net/research/case-studies-on-ai-skills-capacity-building-and-ai-in-workforce-development-in-africa/

Shchetyna, M. (2023, July 12). Solving the educator shortage crisis with AI. SoftServe Blog. https://www.softserveinc.com/en-us/blog/solving-the-educator-shortage-crisis-with-ai

Shea, P. (2007). A systems view of learning in education. International Journal of Educational Development, 27(6), 637–646. https://doi.org/10.1016/j.ijedudev.2006.06.016

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. Computers & Education, 128, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

Shute, V. J., Levy, R., Baker, R., Zapata, D., & Beck, J. (2009, July). Assessment and learning in intelligent educational systems: A peek into the future. In S. D. Craig & D. Dicheva (Eds.), Proceedings of the AIED 2009 Workshop on Intelligent Educational Games (pp. 99–109). Brighton, UK. https://myweb.fsu.edu/vshute/pdf/peek.pdf

Siemens, G. (2012, April). Learning analytics: Envisioning a research discipline and a domain of practice. In Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (pp. 4–8). ACM. https://doi.org/10.1145/2330601.2330605

Sun, P.-C., Tsai, R. J., Finger, G., Chen, Y.-Y., & Yeh, D. (2008). What drives a successful e-learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers & Education, 50(4), 1183–1202. https://doi.org/10.1016/j.compedu.2006.11.007.

Taherdoost, H. (2022). What are different research approaches? Comprehensive review of qualitative, quantitative, and mixed method research, their applications, types, and limitations. *Journal of Management Science & Engineering Research*, 5(1), 53-63. https://doi.org/10.30564/jmser.v5i1.4538

Tarus, J. K., Gichoya, D., & Muumbo, A. (2015). Challenges of implementing e-learning in Kenya: A case of Kenyan public universities. *The International Review of Research in Open and Distributed Learning*, *16*(1). https://doi.org/10.19173/irrodl.v16i1.1816

Teachers Guide. (2025, February 24). The ethics of artificial intelligence (AI) in education. Teachers Guide. https://teachersguide.net/the-ethics-of-artificial-intelligence-ai-in-education/

Teferra, D. (2007). Higher education in sub-Saharan Africa. In J. J. F. Forest & P. G. Altbach (Eds.), International handbook of higher education (pp. 557–569). Springer. https://doi.org/10.1007/978-1-4020-4012-2_28

Teo, T., Sang, G., Mei, B., & Hoi, C. K. W. (2018). Investigating pre-service teachers' acceptance of Web 2.0 technologies in their future teaching: a Chinese perspective. Interactive Learning Environments, 27(4), 530–546. https://doi.org/10.1080/10494820.2018.1489290

The Ghana Report. (2025, January 15). Revolutionising education through the metaverse: The case for AI labs in African tertiary institutions. The Ghana Report. https://www.theghanareport.com/revolutionising-education-through-the-metaverse-the-case-for-ai-labs-in-african-tertiary-institutions/

Tucker, C., Jackson, K. S., & Park, J. J. (2020, June). Exploring the future of engineering education: Perspectives from a workshop on artificial intelligence and the future of STEM and societies. Paper presented at the 2020 ASEE Virtual Annual Conference. https://peer.asee.org/34648.

UNESCO. (2019). Global education monitoring report 2019: Migration, displacement and education – Building bridges, not walls. UNESCO Publishing. https://gem-report-2019.unesco.org/

UNESCO. (2023). Global education monitoring report 2023: Technology in education – A tool on whose terms? UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000385723

University of South Africa (UNISA). (2020). Reshaping the agenda of distance education. https://www.unisa.ac.za/sites/corporate/default/News-&-Media/Articles/Reshaping-the-agenda-of-distance-education

University of the Witwatersrand. (2023, January). Approach to the use of AI in teaching and learning at Wits. https://www.wits.ac.za/media/wits-university/learning-and-teaching/cltd/documents/AI-in-teaching-and-learning-at-Wits.pdf

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. Educational Psychologist, 46(4), 197–221. https://doi.org/10.1080/00461520.2011.611369

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. MIS Quarterly, 36(1), 157–178. https://doi.org/10.2307/41410412

Wang, H., Tao, D., Yu, N., & Qu, X. (2020). Understanding consumer acceptance of healthcare wearable devices: An integrated model of UTAUT and TTF. International Journal of Medical Informatics, 139, 104156. https://doi.org/10.1016/j.ijmedinf.2020.104156

Wang, Y., Liu, C., & Tu, Y.-F. (2021). Factors affecting the adoption of AI-based applications in higher education: An analysis of teachers' perspectives using structural equation modeling. Educational Technology & Society, 24(3), 116–129. https://www.jstor.org/stable/27032860

Wolters, C.A., & Brady, A.C. (2021). College Students' Time Management: a Self-Regulated Learning Perspective. Educ Psychol Rev 33, 1319–1351. https://doi.org/10.1007/s10648-020-09519-z

World Bank. (2024). Artificial intelligence revolution in education: What you need to

know. https://www.worldbank.org/en/region/lac/publication/innovaciones-digitales-para-la-educacion-en-america-latina

Zawacki-Richter, O., Marín, V.I., Bond, M. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education* 16, 39. https://doi.org/10.1186/s41239-019-0171-0

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ONLINE LEARNING IN DISTANCE EDUCATION: THE PLIGHT OF DISTANCE LEARNERS IN GHANA

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ABSTRACT

Distance education (DE) in Ghana continues to evolve as new approaches to teaching and learning are constantly being integrated into educational programmes. The latest addition is the introduction of online learning to supplement or replace the face-to-face sessions conducted across study centres. Even though COVID-19 forced some educational institutions to adopt hybrid teaching and learning, the DE programmes at the University of Cape Coast (UCC) were slow to adopt these modalities of instruction. This study aimed to explore the online learning experiences of students who enrolled in DE courses at the main campus of UCC. The purpose of the study was to report on the challenges associated with online learning and bridge the digital divide gap. The study utilised a narrative inquiry approach with a sample of 12 students to explore their experiences and challenges as distance learners and to also note differences in digital barriers between those employed and self-employed/unemployed. Students found online learning to be convenient and improved their digital skills. However, the students felt that the high cost of internet data, poor quality of the internet, distractions, and limited interaction hindered the full benefit of online learning. Those employed and who used the online meeting tools at the workplace served as support systems for the others. It is, therefore, recommended that the necessary steps be put in place to address these challenges. Additionally, instead of online learning replacing face-to-face sessions, blended learning should continue to be used to maintain good social and pedagogically appropriate interactions.

Keywords: distance learning, distance education, digital divide, online learning, Ghana.

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INTRODUCTION

The reason for pursuing an educational programme varies, especially when considering the factors that influence the choice of study programmes. Unfortunately, not everyone gets the opportunity to get admission to tertiary institutions. For various reasons, an individual may face limitations in applying for a regular programme, especially those working and with family responsibilities (Amponsah, 2010; Badu-Nyarko et al., 2017). Moreover, most of these higher educational institutions (HEIs) lack the needed infrastructure to admit the increasing number of prospective students (National Council for Tertiary Education [NCTE], 2018). To compensate for this deficiency, the HEIs make use of modules and learning management systems (LMS) to engage students in teaching and learning on a distance basis instead of investing more in infrastructure development which is more costly (McPheea & Pickren, 2017). Interestingly, DE continues to grow in Ghana as a result of the increase in demand for tertiary education certificates among individuals, who may be interested after completion of the programme to acquire a job, seek promotion, gain knowledge to advance their career, personal fulfilment, and for vocational purposes (Amponsah et al., 2018; Ginsberg & Wlodkowski, 2010; Lim &Wang, 2016).

Students pursuing DE programmes were issued with printed materials to facilitate teaching and learning during the beginning years of DE in Ghana (Badu-Nyarko et al., 2017). In recent times, students undertaking higher educational programmes on a distance basis have their modules in soft copy form and are also making use of LMS as well as being engaged in online teaching and learning. Some of these transformations were a result of the pressure presented by COVID-19 (Adarkwah, 2021a; Amponsah & Bekele, 2023; Osabwa, 2022) and the need for HEIs to be competitive (International Telecommunication Union, [ITU] 2017). Adopting and using technology in addition to using distance learning modes have also been identified to increase enrollment levels among demographically excluded students (Kumi-Yeboah et al., 2023), especially those in rural areas. However, to be able to participate in the digital world, new skills are required by individuals and especially students. Students are expected to expand their range of skills (Vuorikari et al., 2022) irrespective of gender, age, educational and socioeconomic background to participate in DE where hybrid teaching and learning approaches are used.

DE at the University of Cape Coast (UCC), according to Segbenya et al. (2019) started in 1998 through the establishment of the Centre for Continuing Education (now College of Distance Education [CoDE]). However, the then centre admitted its first batch of three-year Diploma in Education students during the 2000/2001 academic year. Per the structure of the programmes run by CoDE at UCC, students are issued with printed course modules at the beginning of the semester and they are required to attend bi-weekly lectures, write quizzes (assessment tests) and also write an end of semester examination. The bi-weekly lectures are in the form of tutorial sessions where students meet with a facilitator and a discussion session is carried out. However, in recent times, the distribution of printed course modules is now supplemented with a soft copy which students are expected to download from their online portal. Even though COVID-19 forced most educational institutions to adopt more hybrid teaching and learning, the DE programme at UCC took more time to follow other educational institutions. It was not until the 2022/2023 academic year that the CoDE decided to adopt online learning in addition to the traditional face-to-face sessions for students.

As noted by UNESCO (2023), the application of digital technology in education is uneven; therefore, countries and, most importantly, educational institutions should be circumspect in its application. In the African context, numerous researchers

(Adarkwah, 2021b; Amponsah & Bekele, 2023; Krönke, 2020; Lembani et al., 2020) have also identified unequal access to technology and its related resources. This makes it possible for DE students at UCC to be at a crossroads with the realities of the digital divide. Warf (2019) suggests that the integration of information and communication technology (ICT) and online learning into education should encourage students to understand and appreciate the important role ICT plays in the lives of individuals and why they should embrace its use. Again, applying technology to education should not eliminate the essence of addressing educational challenges of equity and inclusion, quality education, and efficiency (UNESCO, 2023). Moreover, though students must be brought to speed with the changing needs of the globe and technological advancement, Saade and Bahli (2005) believe that integrating technology into education does not translate to quality education, especially with the problem of access and internet familiarity. This can reduce the interest of students and compel them to opt for face-to-face instruction rather than embracing technology-enhanced forms of learning.

Undoubtedly, investing in technological tools and providing training on how to use them are steps to bridge the technological divide. Yet, it will be challenging if DE students find themselves "distance" in this technological era of education. These students may feel "distance" because they may have little access to digital resources available on campuses of educational institutions while their counterparts pursuing regular courses have more access to the resources. Students pursuing regular programmes are mostly fortunate to utilise available ICT infrastructure provided by HEIs. These students can have access to computer labs equipped with computers, faster internet connections, and electricity, and they can also consult ICT personnel employed by educational institutions to help resolve any challenge the students face. This uneven access by DE students forces them to use their resources as compared to those provided by the institution, which may be in better condition and work better when used for learning. As identified by Agormedah et al. (2020), students relied mostly on smartphones to participate in the online learning sessions. and Most of these smartphones had limited functionalities compared to laptops. The authors also identified a gap between rural and urban areas in terms of technological infrastructure and internet access.

It is believed that DE is more convenient for workers and individuals with family responsibilities because classes are mostly carried out during weekend periods. DE learners are often believed to be between the age range of 25 to 50 years mostly pursue such an educational programme (Moore & Kearsley; 2005). However, studies looking at the experiences of DE students employed and those self-employed or unemployed in online learning and using digital resources are limited at UCC and Ghana as a whole. Srichanyachon (2014) indicated that students with no knowledge or prior experience in online learning are likely to experience difficulties without a support system or technical assistance. Therefore, getting the lived experiences of DE students from UCC will help attract attention to their plights for a better support system to be made available for the students. The digital divide may have "divided" the DE students; therefore, further investigation into the plight of such students can help improve the quality of their education. Further, identifying the challenges of DE students can also help facilitate the adoption of effective strategies to achieve goal 4 of the Sustainable Development Goal (SDG), especially within the Sub-Saharan region which faces similar challenges. Therefore, the following questions are worth answering as we explore the experiences of the students:

1. What are the experiences of DE students at UCC during online teaching and learning?

2. What challenges are DE students likely to face in the absence of using digital resources available on the UCC campus?
3. How different are the digital barriers faced by unemployed or self-employed students from those employed in organisations with digital resources?

To understand the phenomena under study and address the questions posed above, the remaining sections of the study look at the review of related studies, research design, sampling, results and discussions, conclusion and recommendations. Suggestions for further research are also presented to help conduct future studies to obtain information on how to ensure effective online learning and distance education towards the achievement of SDG 4.

LITERATURE REVIEW

Distance Education and the Digital Divide

DE in Ghana has been in existence for almost two decades now. It started as an opportunity to allow individuals working and with family a convenient means to access higher education (Allen & Seaman, 2007). The DE programme has gone through a lot of transformation from the initial correspondence course format to the current utilisation of e-learning and other digital technologies with face-to-face sessions (Edumadze et al., 2017). Indeed, while study materials were previously mailed to students during the correspondence study era and students were expected to give feedback by completing questions attached to the study materials, the incorporation of online teaching and learning has expanded access to DE and open access to HE. There is potential in DE, as indicated by Lembani et al. (2020), to ensure the quality of education at all levels of education and within any geographical area, including rural or marginalised communities. As already indicated, COVID-19 forced more HEIs to adopt online learning. Even though the number of HEIs using online learning in the Global North was considered to be high, only 29% of such institutions adopted online learning within the African context (Koninckx, et al., 2021).

Within the DE space, especially in Ghana, students are faced with the challenge of tutors not being able to effectively lead the class due to experience and failure to implement what they (tutors) have been taught during training periods as revealed by Badu-Nyarko and Amponsah (2016). The authors further noted that students felt that tutorial periods, which were held face-to-face, were not adequate to enable them to understand the programme they were pursuing. As a result, students may feel isolated by the distance learning system and may even feel not motivated (Badu-Nyarko & Amponsah, 2016) to get the best out of what they learn and feel imparted to cause a positive change in their community, workplace and the nation as a whole. Most of these students pursuing DE are also already considered to be "distance" because having full access to resources of an educational institution is mostly far from them. The introduction of ICT and its related technologies like LMS and online learning are likely to create more distance between them and students pursuing regular courses on campus.

Additionally, the integration of technology in education is not just to make education accessible to individuals geographically divided but to also equip students with skills that would ensure they cope and take advantage of digital technologies used at the workplace. Thus, digital skills are crucial skills required by DE students to survive in their education pursuit otherwise, there is the likelihood of students dropping out (Gan & Sun, 2021). Yet, adult learners in DE have been recognised to face difficulties in the use of ICT for learning. Safford and Stinton (2016) found from their study that adult learners found it difficult to locate, store and even

retrieve information in digital form because the learners were less exposed to ICT. Lembani et al. (2020) believe that incorporating digital or ICT can lead to unequal access by students since digital resources are unequally distributed within communities, countries and the world at large. This creates a digital divide, which is believed to be the gap that exists between those who have access to, adopt, use and benefit from ICT tools especially computers and the internet and those who do not or are denied such an opportunity (Fink & Kenny, 2003; Gan & Sun, 2021).

Keniston (2004) argues that no matter the economic status of a country, some individuals are denied the opportunity to take full advantage of information technology and therefore a digital divide can exist anywhere in the world. This makes the conceptualisation of the digital divide by Chen (2015) more interrogative with an emphasis on privileged and underprivileged individuals in a particular society. Thus, those privileged individuals will have the opportunity to have access, be able to use and benefit from digital tools and related technologies while those underprivileged may not have the opportunity. Individuals employed in organisations with access to computers and the Internet are more likely to benefit from online learning and gain competencies in the use of ICT tools than those individuals who are self-employed or unemployed without access to computers and the internet. More importantly, Kim and Kim (2001) posit that the digital divide goes beyond the availability and use of ICT devices but such usage must translate or show improvement in the quality of the life of the individual. This presupposes that reducing the gap in the digital divide should also be targeted at improving the lives of people and not just putting in place infrastructure and training individuals on how to use them.

Theoretical underpinning

This study is underpinned by the technology acceptance model (TAM). Propounded by Fred Davis (1989), the author asserts that a technological system's acceptance is vital to the success or failure of the technology in terms of whether people will use it or not. According to the author, acceptance of the technology by potential users is influenced by two factors including perceived utility and perceived ease of use. These two factors are influenced by external variables and the factors subsequently influence the attitude and the behavioural intentions of the user to use the technology and then predict the actual use of the technology. TAM has developed into a crucial paradigm for comprehending factors that influence people's decisions to embrace or reject technology (Marangunić & Granić, 2015). It was also thought that the perceived usability of technology was influenced by the perceived simplicity of use (Davis, 1989; Masrom, 2007). According to Alfadda and Mahdi (2021), TAM has garnered empirical evidence for its ability to predict technology acceptance and adoption with robustness and parsimony. It elucidates how an individual's behavioural intention to accomplish a job determines their behavioural performance. TAM has been used in numerous studies testing factors influencing user acceptance of online learning (Farahat, 2012; Lazim et al., 2021) and the use of online applications like Zoom (Alfadda & Mahdi; 2021) spreadsheet applications (Mathieson, 1991), e-mail (Szajna, 1996), web browser (Morris & Dillon, 1997).

A limitation of the TAM relates to the user behaviour variable, which is often assessed using subjective methods like behavioural intention and interpersonal influence. Lai (2017) also posits that by looking at the factors identified in TAM by Davis (1989), the model cannot be completely used to understand all the factors that influence the acceptance of a particular technology by users and therefore calls for extension of TAM. Other extensions have been made and aside from perceived usability and ease of use, other researchers have identified self-efficacy, computer anxiety, performance expectations, social factors, experience, subjective norm,

information quality, enjoyment, accessibility and content enjoyment as some of the external factors (Abdullah & Ward, 2016; Kemp et al., 2019; Lai, 2017; Robinson, 2019; Salloum et al., 2017). However, TAM by Davis (1989) has been widely used and produced positive results. As such, in this study, the application of TAM by Davis (1989) is to help explore the extent students of CoDE are likely to accept online learning and use the platform for their learning. As already noted, online learning is one of the new trends in DE in Ghana which is mediated by technology and just as Davis (1989) opines, students are more likely to accept and participate in online learning when they perceive that online learning will help improve their performance. Again, the model also posits that students are more likely to assess whether the online tools are easy to use or not. Once they accept that the tools are easy to use, it will influence their attitude and behavioural intentions which will lead to the use of the platforms.

METHODOLOGY

The research design adopted for this study was the narrative inquiry. According to Clarke (2023), narrative inquiry involves trying to make meaning of experiences through and by stories of what individuals go through. Moreover, the narrative inquiry adopted for this study is grounded in the meaning shared by Clandinin and Rosiek (2007) who posit that narrative inquiry is,

> Framed within this view of experience, the focus of narrative inquiry is not only on individuals' experiences but also on the social, cultural, and institutional narratives within which individuals' experiences are constituted, shaped, expressed, and enacted. Narrative inquirers study the individual's experience in the world, an experience that is storied both in the living and telling and that can be studied by listening, observing, living alongside another, and writing, and interpreting texts (pp. 42–43).

In simple terms, the authors hold that the underlying basis of narrative inquiry is to understand and inquire about the experiences of individuals, as they are being socially and contextually constructed. Therefore, this approach was adopted to help us make sense of the knowledge and experiences of DE students at UCC as they engage in online learning. Exploring such experiences by the students through this approach will also help us to thoroughly understand their encounter with online learning rather than just presenting simple data.

Sample and sampling procedure

With a total of 95 study centres across Ghana, only one of the centres is located on the main campus of the university. Thus, the Cape Coast study centre was purposively selected for this study because that is the main campus of the university and that is where most of the infrastructure of the university is found. Moreover, it is assumed that the study centre has the complete infrastructure of the university and DE students are likely to have full access to the digital resources of the university as compared to those in other study centres. During the 2022/2023 academic year, students were informed that online learning was going to be added to the face-to-face session. This means that instead of the regular bi-weekly sessions, students were going to do less face-to-face to enable the online session to also run. All UCC DE students at the Cape Coast study centre were identified as the population for the study. In terms of sampling, the maximum variation purposive technique was used to select respondents with diverse variations and significant common patterns that may permeate the variations of the participants (Palinkas et al., 2015). Specifically, this technique allowed for the selection of DE students who are either employed, self-employed or unemployed. Twelve (12) students were

purposively selected by identifying whether they were employed, self-employed or unemployed. To capture diverse perspectives and inclusivity, gender variations were recognised. Again, an equal number of four students each pursuing distance programmes at the diploma, first degree, and postgraduate programmes, were recruited to take part in the interview sessions to get the diverse variations and commonalities in their experiences. The summary of the demographic characteristics is presented in Table 1 below.

Table 1: Demographic characteristics of participants

Variable	**Number**
Gender:	
Male	4
Female	8
Total	12
Programme status	
Diploma	4
1st Degree	4
Postgraduate	4
Total	12
Employment status	
Employed	6
Self-employed	3
Unemployed	3
Total	12

Source: Field data

Data collection

A semi-structured interview guide was used as the main instrument for the study. This allowed for consistency and at the same time broader perspectives on the research questions for the study. The questions in the semi-structured interview guide were gathered from the review of the literature. The six open-ended questions and other emerging questions from the interactions were probed to help gather rich and detailed information from the participants. This also allowed participants the opportunity to express themselves freely. Each of the interviews was conducted face-to-face at the university during their revision and examination week (two Saturdays and one Sunday). The interviews were conducted in English and lasted between 15 to 20 minutes. The participants were first informed about the study and the need for them to be part of it. They were informed that the study was voluntary and they could at any point opt out of the interview if they felt they were not comfortable with it. They were further assured of the confidentiality of the information they provided. The interviews with the participants were recorded using a voice recorder and notes were also taken while the interview was ongoing. We acknowledge that as graduate students in a tertiary education institution in Ghana, our experiences with the digital divide and online learning challenges may influence our interpretation of the data collected from the participants. However, to reduce these biases, we employed participant validation by allowing them to review the preliminary findings to ensure that the analysis reflect their experiences shared. We have also provided a detailed account of the data collected from the participants and the direct quotes from them will help provide authenticity to readers.

Data analysis

The data was then transcribed and analysed into themes and sub-themes manually. Thematic analysis, specifically the guidelines of Braun and Clarke (2006), and Clarke and Braun (2013), was used for the analysis. With these guidelines, we first read through the transcripts carefully to highlight all information-rich quotes. We then prepared a coding scheme, as the next step, to help the analysis of the transcribed data in line with what Braun and Clarke (2006) recommend, similar themes from the text were grouped while different themes were separated. To ensure the themes told compelling stories, the themes were then reviewed and refined with the original data and the codes, in line with the fourth step of the guideline. The experiences of the students formed the themes and just as Clarke and Braun (2013) emphasised in their last stage of the thematic analysis, this write-up is presented from the data to tell a persuasive and coherent story. Some of the participants were contacted to validate the findings of the data collected in order to enhance the credibility of the data. The anonymity of the participants was preserved through the use of pseudonyms.

Through the analysis of the results from the data, the ensuing themes and sub-themes emerged. The presentation of results follows the emerged themes and sub-themes and is also presented in a summary form in Table 2 below.

Table 2: Emerged Themes and Sub-themes

Themes	**Sub-themes**
Online learning effectiveness	Convenience in online learning
	New skills acquired
	Interaction during online
	Face-to-face sessions and recording
	Support services received
	Devices used
	Participation
Challenges of students	Cost of data
	Network issues
	Distractions from others
	Access to recordings
	Training
Effective online learning	Internet data
	Support service
	Access to recordings

FINDINGS

The study was interested in exploring the online learning experiences of students who enrolled in DE courses at the main campus of UCC. The sub-sections below present the results of the study based on the three themes and 15 sub-themes that emerged from the data analysis as shown in Table 2.

Online learning effectiveness

Participants shared varying views on the effectiveness of online learning. All the 12 participants expressed that online learning was a good move by the university but it could be the best approach only if the university was able to address the challenges associated with online learning.

Convenience in online learning

Online learning can provide comfort to participants especially if they previously had to move from one place to another to participate in learning. Unlike face-to-face where all students are expected to converge at a point to participate in learning, online learning provides students with convenience by allowing them to stay wherever they are, as long as they can connect to the internet with the right device, to participate in learning. These sentiments were expressed by all the participants who noted that online learning was convenient for them because they could join from any geographical area without taking a car to campus during the weekend.

"*I would say online learning is good even though I can't give it 100 percent but it has brought a lot of good to the distance education programme. It is convenient because there is no need for you to take a car and come to campus but you can stay wherever you are and participate in class. All you need is an internet connection and your phone and you are good to go*" [Bellan].

The participants also stressed that online was more convenient because they could multitask while in class.

"*Oh, I think the online classes are more convenient than going to class almost every two weeks. You see, classes are on weekends and you are denied all other activities during that period. But when you're in online class, you can cook, and sort out your other things while you listen to class on your phone. It is better that way*" [Trudie].

As DE students, most of them are workers who are expected to be at work during the week days and the weekends for classes. Such routines can deny them the opportunity to take an active part in social activities and at the same time carry out household chores. Thus, their expressions of convenience also reflect their ability to undertake these other activities and that of the classes at the same time. The students also expressed that the online classes helped them to save on their transportation costs because the majority of them had to commute from their place of abode to the study centre during face-to-face sessions.

New skills acquired

Eight of the participants indicated they had benefitted from online learning even amid the challenges they faced. One of the benefits was the acquisition of digital skills. Some of them indicated that it was through online learning that they got to use online applications like Zoom and Google Meet. This has enabled them to hone their skills in digital literacy which are part of the 21st century skills needed in the work environment. One of the participants buttress this point as follows:

"*Oh yes! I can say I'm an expert in using Zoom and Google Meet for online learning and meetings because of the online learning. I have even helped my boss to set up online meetings on three occasions. I can say I'm an ambassador now because I have also taught some of my office colleagues how to use those platforms*" [Anna].

Such experience shared by the student gives hope that higher educational institutions are making progress in breaking the industry-academia skill gap. That is, students can acquire competencies that enable them to apply at the workplace just like digital literacy skills. Moreover, such skills, as expressed by the participants, also make the participants relevant to the workplace and also become

trainers to other workers who might lack such exposure to the digital tools. However, participants had their reservations about how interactions and class sessions fared.

Interaction during online learning

The participants also talked about the interactions that take place during online learning. Most of them revealed that there was less interaction in the online class which affected the effectiveness of the online class. They specifically stressed the inadequate engagement with the facilitator since the facilitator during a face-to-face session would allow students to share their views on topics for discussions. However, in the online sessions, facilitators hardly ask students to share their opinions. One of the participants had this to say:

"*Unlike the face-to-face session, the facilitator could easily call out a student and ask the student to explain or answer a question and because everyone is looking at you, you have to talk. But with the online, the facilitator can even call you and you can pretend you did not hear and blame the network for that*" [Ben].

This implies that it is not deliberate that some facilitators have decided not to allow students to share their views, but rather the behaviour of the students had informed such a move from the facilitators. Since some students are unwilling to share their opinions and also blame the internet, most facilitators are likely to ignore the opportunity for students to contribute to discussions. Yet, three of the participants noted that facilitators allow students to ask questions and seek clarifications anytime students did not understand what was being taught. Aside from the limited interaction between facilitators and students, four of the participants mentioned that there was little interaction between students.

"*We don't interact with each other much during online classes. It is mostly the lecturer who talks and if you talk while he or she is teaching you will be seen as disturbing. In our normal class, you can ask a friend and the friend can even clarify what the lecturer said. We are human beings too and the human connection is also important a little joke from friends can even help you connect to what is being taught. I do miss these interactions*" [Trudie].

"*In the classroom (traditional classroom), the facilitator could read your facial expressions to detect whether you understand what is being taught or not. But with online, it is hard for the facilitator to see you and because of the number of students*" [Naa].

On the whole, the arguments put forward by these students express their desire for more human connections in the form of interactions during the online learning periods. The students expect their facilitators to engage them more by asking students questions. Again, the online environment is expected to mimic the face-to-face sessions where students can easily interact with each other while class is ongoing in order to help them express their human needs as social animals. Such lack of interactions could prompt the students to rather prefer face-to-face sessions to online which assures students of such constant interactions. This is also expressed by the participants in the next sub-theme.

Face-to-face sessions and recording

The postgraduate students who took part in the interview were selective in terms of the type of courses that should be taught online. For them, it was not okay to have courses with calculations to be taught online. According to one student:

"*Courses that involve calculations should not be done online. It is difficult to follow lecturers doing calculations because sometimes the network is not stable and you can hardly understand what the lecturer is illustrating. The lecturer may be demonstrating on a whiteboard but the writing looks blurry and you can hardly see it*" [Paul].

Three of the postgraduate students also further indicated that they always took solace in the recorded videos from the online class since they could watch the recorded version and get clarification. In other words, students have mixed feelings when it comes to the type of course being studied online. Some of them felt that courses that would require the lecturer to demonstrate on the board must be done face-to-face. This will enable the students to follow the demonstration and also ask questions for clarification. Moreover, the strength of the internet is also considered a factor because having strong internet connectivity could enable students to follow demonstrations and interact with the facilitator. Nonetheless, the views of the students also bring to the fore the need to add asynchronous learning to the synchronous one. This was expressed by one of the students who expressed that:

"*One other good thing about online learning is that you get the opportunity to re-watch videos recorded during lecture time. Most of the lectures are recorded and even if you cannot join or your network is bad, you can watch the lecture again"* [Bellan].

Thus, the study found that students prefer courses with no or few demonstrations to be held online while courses that require calculations or demonstrations from the facilitator to be done face-to-face. Alternatively, the students also expressed their willingness to partake in calculation courses online when they can have access to recorded videos as well as have more reliable internet connectivity. This will provide them with the opportunity to rewatch the demonstrations for clarification and understanding. This further shows the importance of engaging with students effectively during online learning since students require more interactions and demonstration of what is being taught.

Support service received

The study sought to find out from the participants the kind of support they received during the online classes. It was noted that such supports were received from their colleagues rather than the university. One of the participants shared that:

"*I remember when we first started the online class, most of us were skeptical because that was our first time so most of us went to the university campus. Most of us were helped by other colleagues who had used those tools before at their workplace. I think COVID helped because it was through COVID that most of my colleagues who were conversant with Zoom were able to use it. Some of my colleagues were also not able to log in because they faced some challenges so they joined other colleagues to listen to the lectures. But for now, most of us are proficient in its use so we stay away from campus and only come to campus for the face-to-face*" [Bellan].

Thus, some of the students initially faced challenges in using the online tools because it was their first time. This forced them to seek support from the university campus and unfortunately, they could not get such support from the university. They had to rather fall on colleagues with such digital skills. Two of the participants further indicated that the ICT personnel of the university were not available on weekends. Aside from this, there was no communication from the university on the

availability of such support systems according to the participants. It was further noted that students who were employed and had access to digital technologies at the workplace possessed the skills in using the tools and that enabled them to assist their colleagues who needed help. From those who mentioned support services, to participate well in online learning they require exposure to the tools used online. This will help them easily use the tools on the device they prefer to use.

Devices used

Participants were asked to indicate the device they owned and used for online classes and whether the device was the best to help them participate well in the online class or not. Out of the 12 students interviewed, all of them owned smartphones and seven of them also owned laptops in addition. Two of the unemployed and two of the employed did not have a laptop. Interestingly, of those who have, only two of them preferred to use their laptops for online learning if they were at home.

"*I prefer to use my laptop for classes instead of my phone. I get messages while using my phone and that distracts me from being active in class. I use the internet connection on my phone to give my laptop internet and I put my phone on silence to avoid any distractions*" [Emma].

It was noted from the interview that most of the laptop owners mostly used it to transfer lecture slides from their phones to the laptop in order to print out the slides and read them instead of reading them from their phones. Smartphones were preferable because the students could easily have access to internet connectivity through their network provider. Students who needed to use their laptops had to rely on the internet from their phones or had to visit their workplace to connect to the Wi-Fi of their organisation.

Participation

All the participants were of the view that most students were mostly absent during online classes as compared to face-to-face. Some of the participants had this to say:

"*When you compare the number of students who attend the face-to-face and the online, the online has low attendance. Moreover, you may see us online but we will be doing different things while class is ongoing*" [Naa].

"*Oh! The number of students who used to attend online classes has reduced koraa. Most students don't come*" [Bellan].

According to some of the participants, the situation was so because of the challenges that students mostly face during online learning since those interviewed indicated a number of challenges that sometimes impede their engagement in online learning. One of the graduate participants also emphasised that some students deliberately decide not to join online because they have the opportunity to watch the recorded version. They could easily download and watch the sessions again and have all the needed information as compared to the challenges they were likely to encounter when they joined online. Again, all the participants acknowledged that the first two sessions of the online sessions had most of their mates joining but some had refused to join again because of the challenges outlined below.

Challenges of students

Cost of data

All the participants in the interview mentioned the high cost of data as their major challenge with online learning. According to them, the university did not support them with data and even though the internet was available on campus they did not have access to the password.

"*As a master's student, you are expected to have six hours of lecture per course and imagining you are using Zoom or Google Meet, means you have to spend almost 1 gigabyte of data every day. We were promised to receive data from the university during the orientation and just don't know, maybe it will be sent tomorrow*" *[Trudie].*

"*Why should the university give regular students internet data and not us? We pay more fees than them but we have never been given data*" *[Emma].*

As already noted, the majority of the students rely on internet connectivity from their phones. This also means that the students needed to have enough airtime to purchase the internet data from their network provider or had to connect to a Wi-fi. Such cost was borne by the students instead of the university providing such support. It could also be noted that the university had internet facilities available on the university campus that students could connect to but unlike the regular students, DE students did not have access to it. The extent of the digital divide was expressed by the participants when they indicated that regular students had unlimited data access at a higher speed than distance students who may have to use their data at a high cost with a lower speed data connection. Moreso, if the DE students decide to use the internet on the university campus, they had to travel just like coming for a face-to-face session and the essence of having an online class instead of face-to-face, for them, would have been defeated.

Network issues

Another major challenge highlighted by the students was a poor network with the internet since the students were using internet service available on their phones. The participants explained that the internet connectivity on their phones was slow as compared to the Wi-Fi connection. It was further revealed that the internet connectivity was also dependent on where you are located since the internet reception will be determined by how strong the signals from the network provider are. Such bad internet connection can affect the interest of students as well as affect the flow of learning which was expressed by the students. Again, some of the students added that such a challenge had been a major contributor to the reasons some students have refused to participate in online learning. Two of the students had this to say:

"*Aside from the high cost of data, the network is also sometimes bad. You sometimes struggle to log in and even if you are lucky you are faced with constant breaks in the interaction. You have to be going on and off on several occasions and by the time you realise you would have missed 2 or more slides and the lecturer will not go back for you*" [Mary].

"*I am a staff of UCC so I have access to the internet when I am on campus and it is very fast. So if I have time I come to the office and do the online. But if you are home or outside campus, hmmm, the network is always bad and slow*" [Paul].

In addition, it can be noted that students employed and with internet facilities at the workplace are more likely to have alternative internet access compared to those unemployed when faced with bad internet connection. That is, using the office Wi-Fi provides more reliable and fast internet access and can mitigate the challenge of bad internet services. However, this may come as an extra cost if students employed have to move from their houses to the office. They are likely to pay for the means of transportation if they are not closer to their workplaces.

Distractions from others

Ten of the participants expressed that a lot of distractions take place while in online classes. The distractions were mostly from other colleagues who unmute their microphones while unknowingly and sometimes knowingly and the noise from their microphones distract the class.

"*Some of my course mates are very old and most of the time when they join the class they leave the microphones unmuted and you could just hear all sorts of noise from the background and you could often hear the lecturer mentioning names to mute their mic. These things happen very often so you sometimes even do get what is being taught*" [Emma].

Three of the participants also indicated that lecturers also get distracted trying to admit students into the online platform. According to the students, they are placed on waiting when they initially log in to the online class and the lecturers who had the host controls had to let the students in. Unfortunately, some lecturers keep the students in the waiting room for a longer period because the lecturers felt that the students were late while other lecturers forget there was an option of waiting room and it was the host that must let students in.

Access to recordings

All the undergraduate students revealed that their classes were not recorded by their lecturers and as such they could not get the opportunity to follow discussions that took place when students experienced poor networks or when their data was finished.

"*It is very unfortunate that the lecturers do not record the class sessions. You don't get access to recorded videos. It is only slides we receive and sometimes it becomes difficult to understand what is in the slides*" [Mary].

Hence, the students called for not only synchronous learning but asynchronous as well to help them access videos and sessions they missed. However, the graduate students had the opportunity to re-watch the recorded classes and such practice helped them to appreciate the importance of online learning.

Training

It was also noted from the interview that most of the students had challenges logging in and effectively using the online tools because they lacked training. This made them struggle and had to seek help from proficient colleagues. They were of the view that the university should have taken them through training sessions before the start of the online and such training could have facilitated an easy transition. Specifically, one of the students stated that:

"*It was too bad I had no idea about what Zoom and the rest were. It was very challenging in the beginning and I was expecting the university to at least train us on how to use them but they didn't*" [Frema].

Thus, out of the 12 participants, only three were proficient in the use of the online tools before the online learning began. All three proficient students were individuals who were employed and had acquired the skills at the workplace. Two of the unemployed students and one of the employed students also admitted that if not the online adopted by the university they had no idea what Zoom was. The study further obtained that two of the participants were still in the learning stage to effectively use the online tools. They posit they were not regular participants in the online sessions and they were also old age and needed more time to effectively use the tools.

Effective online learning

All the participants revealed that online learning was important and should be maintained by the university. They suggested the university should provide distance students equal access to university resources and support as provided to regular students.

Internet data

One of the ways suggested by the students to make online learning effective was having access to internet data and high-speed and reliable internet connectivity. The students felt that it was the responsibility of the university to help them get access to the internet data since regular students have access to the internet of the university. Five of the participants suggested that the university could lease with the telecommunication companies to have internet packages for DE students. According to them, once the university was fronting such effort, the likelihood of students getting a specialised offer that guaranteed speed was high and that could reduce the frustration students go through any time they wanted to join class online. Two of the students stated:

"*Since the university has high-speed internet access on campus for regular students, they should also at least provide us with internet data to ease the burden of buying data all the time for lectures*" [Emma].

"*For me, I think the university can't do it all by itself. They need to collaborate with the government and the telecommunication companies to improve internet access. If network problems are prevalent in Cape Coast, how much more those in the rural areas?*" [Paul].

The above highlights the importance of collaboration between academic institutions, government and the industry to enhance the provision of quality internet connections. From their suggestion, the university is expected to draw closer to the industry to build quality relationships that would promote the interest of the university, the industry and the students as a whole. The students also emphasised that telecommunication companies have different packages but the institutional ones are less expensive and more reliable than individuals buying data from the network providers.

Support service

Three of the participants recommended support services for lecturers to help manage the online classroom. According to them, they felt the lecturers mostly have a hard time managing the online class, especially using the online tools. The lecturers sometimes forget to record the sessions for graduate students and students had to keep reminding them. Some also expressed that they had to be in the waiting room for long before the lecturer would be reminded to let them in. Aside from these, students mostly distract the class by unmuting themselves unknowingly and the noise from their background causes a lot of disturbances. Specifically, one of the participants indicated that:

"*You see, the university can do more to make online learning more effective. Some of the lecturers struggle to coordinate and facilitate the class all by themselves so they need to get someone to support them. We should also be given training about the dos and don'ts in online learning because some of our mates really disturb and distract us with their mics on*" [Anna].

Thus, apart from lecturers getting support, students must also be given training on how to conduct themselves during classes. Though students might learn how to join the online classroom, the participants felt that the etiquette in the online environment must be provided to all students to reduce distractions. According to one of the students, even though lecturers often announce to students to mute themselves, some end up ignoring such directives while others unintentionally unmute themselves because they are still not proficient in the use of the platform.

Access to recording

All the undergraduate students noted that lecturers should record the class and also make the link available to students. The students acknowledged the digital divide since they do not have equal access to reliable internet. Thus, to help all students gain equal access, the participants felt that the recorded videos, when made available to them, could help bridge such unequal access. A student had this to say:

"*Me I think the lecturers should record the class while the online is going on and later give us access to the link for us to watch. It will really help ensure effective learning even if you encounter network problems*" [Mary].

This re-echoes the call for asynchronous learning to enable students to access recorded videos to reinforce learning. Moreover, students who face network challenges as well as those who could not join the class, could get the opportunity to watch the videos to gain an understanding of what was taught.

DISCUSSION OF FINDINGS

The study sought to explore the online learning experiences of students who enrolled in DE courses at the main campus of UCC. The study adopted TAM to help explore the extent students of CoDE are likely to accept online learning and use the platform for their learning. From the analysis of the experiences of DE students at UCC on online learning, it could be noted that the integration of online learning into DE has brought a lot of benefits. Specifically, the participants noted online learning is more convenient, enables them to multitask, and enhances their digital skills by using platforms like Zoom and Google Meet. Additionally, the experiences shared by graduate students can also be inferred that they have seen improvement in their education because of the opportunity to watch recorded lectures for first-hand clarification of what the lecturer had said. This adds credence to other studies that have found that online learning as well as using LMS are beneficial to students

(Aljaraideh & Bataineh, 2019; Adarkwah, 2021b; Cavus, 2015; Tagoe & Cole, 2020) and can help students to accept and participate in online learning as emphasised in TAM. Also, it can be pointed out that an external factor in relation to TAM that influences the students in this study to continue using online learning is the convenience they enjoy instead of attending face-to-face sessions. The convenience can be attached to the perceived usefulness as indicated in TAM. Nonetheless, these findings are against the views of students revealed in the studies of Egielewa et al. (2021) and Mpungose (2020) who indicated students' unwillingness to continue with virtual learning after COVID because of the difficulties students faced. While the experiences of students in this study show positive signs of the benefits of online learning, it is important to encourage students to be more focused during online learning to avoid just being online without following what the lecturer may be teaching as expressed by Bean, et al. (2019). Yet, Passmore (2009) cited by Osabwa (2022) aver that the active engagement of students in online learning can be improved by the level of competence of the instructors. A competent instructor with the right pedagogical training can put together activities to ignite the active participation of the students even in online learning. Having access to mobile phones and computers with internet and using them shows a good step in improving the digital literacy of students, however, such digital literacy as expressed by Krönke (2020) is at the basic level if they are not used frequently. Again, because mobile phones have limited functionalities compared to laptops, those who use laptops to engage in online learning may likely improve their digital skills more than those who use mobile phones. The students cannot be blamed for this since the only means most of them have to get an internet connection is through their phones which is provided by the type of telecommunication company they subscribe to. This further reveals the digital divide existing between regular students and distance students because regular students, as expressed by the participants, could have an alternative to internet service provided by their mobile phone telecommunication company by using Wi-Fi provided by the university.

The major challenge faced by DE students in this study is poor internet connection and high cost of internet data which is contrary to the study of Arthur-Nyarko & Kariuki (2019) who identified electricity as the major factor affecting online learning in Ghana. The issue of poor internet connection is experienced by almost all the participants in this study regardless of their employment status and it affects the quality of the learning as expressed by Bean, et al. (2019). The students also acknowledged the distractions coming from other students who do not mute their mics, do not have access to online class recordings and lack training on how to use online learning tools as contributing factors to their challenges in online learning. These challenges and especially the poor quality of the internet reflect the extent of the digital gap that has been identified by earlier studies that exist within the African continent by the International Communication Union (ITU 2017), Adarkwah (2021b), Krönke (2020) Gan and Sun (2021), Lembani et al. (2020). This might be one of the reasons why students may prefer to use their phones rather than to use computers for online learning since students sometimes have to be moving around searching for good internet services provided by telecommunication companies. As stated in TAM, if these challenges are not addressed it can affect the extent students will accept and participate in online learning. In terms of differences in the digital divide among employed and unemployed students, the study found that those employed with internet facilitate at their workplace are likely to use the facilitate when facing challenges with their phones. The employed students stressed the quality of internet access from Wi-Fi at work just that the challenge they would have was to move from their convenient place to the workplace.

The experiences of the students show there is still hope for the integration of online learning into distance education in Ghana. When the right structures are put in place students are more likely to accept and participate fully as well as benefit from online learning which will improve the human resource capacity of the country. For instance, the students call for improvement in internet connectivity and training in online learning and acquisition of ICT skills. This is not out of place since Safford and Stinton (2016) suggested that the first step in making online learning effective is training which will help students to cope with such a system. This suggestion has also been supported by other authors like Adarkwah (2021b), Tagoe and Cole (2020), and West et al. (2007). The suggestions of these students also fall in line with the strategies offered by Osabwa (2022) to higher educational institutions to consider the capacity development of infrastructure, staff and students. According to the author, HEIs must endeavour to train their teaching staff on how to use innovative technologies, offer course content and curriculum in digital tools to students, provide support services and put in place supportive infrastructure to help bridge the digital gap. Unfortunately, HEIs cannot do all these on their own. They need the support of the government and other important stakeholders to enable HEIs to put in place some of these infrastructures. Just like those employed in this study emphasised using better internet at the workplace than outside the workplace or campus, it is evident that telecommunication companies can offer quality internet services to even ordinary clients if the companies get evidence of profitable initiative. The students also recommend the recording of online classes and links to the recordings made available to them. This was part of the suggestions made by the Association of African University (2020) to African Universities amid COVID-19 to facilitate other forms of teaching and learning aside from face-to-face.

CONCLUSION

This paper seeks to explore the experiences of DE students at UCC in using online learning. The challenges likely to be faced by students in the absence of using digital resources available on the UCC campus and the differences in the digital divide between students employed and unemployed were also looked at in the study. The adoption of online learning in addition to face-to-face learning in DE in Ghana shows a step in the right direction even as educational institutions edge towards bridging the digital divide and fostering the acquisition of digital skills. Distance students at UCC in this study believe they had experienced benefits like convenience and improved digital skills while engaged in online learning. The convenience experienced by the students can fall in line with the external factors in TAM because that seems to be a major reason why they considered online learning to be useful and could encourage them to continue learning online. Aside from the benefits, the challenges they face make them experience the bane of the digital divide when compared with their regular student counterparts. The challenge of the high cost of internet data, poor internet access, lack of support services, limited interaction between students and lecturers and among students, and lack of training require swift interventions to improve the prospects of integration of online learning into face-to-face sessions. These challenges cannot be addressed by HEIs alone but require the support of government, telecommunication companies, other private organisations and international communities to play their parts to ensure fruitful teaching and learning. Further, the experience of the participants also highlights the limited interaction between students and lecturers and interaction among students during online learning. This is why the university needs to continue with blended learning to encourage collaborative learning and support between students and lecturers, as well as among students (Ngai et al., 2018) to foster positive interaction and promote the psychological well-being of the students. The online learning experiences of DE students employed and those self-employed or unemployed showed some differences, especially in the use of meeting tools in the

initial stage. Those who had used the tools at their workplace before the start of the online were proficient and comfortable in the use of the tools and were able to give a helping hand to those who lacked the skills. Thus, education has shown another great impart since those who lacked the skills have eventually gained experience and found online learning to be convenient.

LIMITATIONS

One of the main limitations of this study is the small size of the sample. This does not allow for generalisation. The study was also limited to only one of the study centres of the university as compared to the other 95 centres. Moreover, the experiences of regular students were also not captured to allow an effective comparison. In the future, a large-scale quantitative study can be conducted to allow for greater generalisation of the findings of the study. Other studies could also explore the experiences of DE faculty members. Despite these challenges, it is believed that this study has been able to capture the views, experiences and challenges of DE students, with special reference to students employed and unemployed, in online learning to help bridge the digital gap, especially in the global south.

REFERENCES

Abdullah, F., & Ward, R. (2016). Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors. *Computers in Human Behaviour*, *56*, 238-256.

Adarkwah, M. A. (2021a). An Outbreak of Online Learning in the COVID-19 Outbreak in Sub-Saharan Africa: Prospects and Challenges. *Online Submission*, *21*(2), 1–10.

Adarkwah, M. A. (2021b). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*, *26*(2), 1665–1685. https://doi.org/10.1007/s10639-020-10331-z

Agormedah, E. K., Henaku, E. A., Ayite, D. M. K., & Ansah, E. A. (2020). Online learning in higher education during COVID-19 pandemic: A case of Ghana. *Journal of Educational Technology and Online Learning*, *3*(3), 183-210.

Alfadda, H. A., & Mahdi, H. S. (2021). Measuring students' use of Zoom application in language courses based on the technology acceptance model (TAM). *Journal of Psycholinguistic Research*, *50*(4), 883-900.

Allen, I. E., & Seaman, J. (2007). *Making the grade: Online education in the United States, 2006*. Sloan Consortium. PO Box 1238, Newburyport, MA 01950.

Aljaraideh, Y., & Al Bataineh, K. (2019). Jordanian Students' Barriers of Utilizing Online Learning: A Survey Study. *International Education Studies*, *12*(5), 99-108.

Amponsah, S. (2010*). The evolution and implementation strategies of the University of Ghana bachelor of Arts distance education programme. Unpublished M.Phil. Thesis* University of Ghana.

Amponsah, S., & Bekele, T. A. (2023). Exploring strategies for including visually impaired students in online learning. *Education and Information Technologies*, *28*(8), 9355-9377.

Amponsah, S., Torto, B. A., & Badu-Nyarko, S. K. (2018). Ghanaian mature students' motivation to pursue degree programmes through distance education. *International Review of Education*, *64*, 585-606.

Aljaraideh, Y., & Bataineh, K. A. (2019). Jordanian students' barriers of utilizing online learning: A survey study. International Education Studies, 12(5), 99–108.

Alt, D. (2018). Science teachers' conceptions of teaching and learning, ICT efficacy, ICT professional development and ICT practices enacted in their classrooms. Teaching and Teacher Education, 73, 141–150. https://doi.org/10.1016/j.tate.2018.03.020.

Amanortsu, G., Dzandu, M. D., & Asabere, N. Y. (2013). Towards the access to and usage of information and communication technology (ICT) in polytechnic education. International Journal of Computer Applications, 66(1), 23–33.

Antwi, S., Bansah, A. K., & Franklin, T. (2018). The information technology challenge in teaching senior high school geography in Ghana. Issues and Trends in Educational Technology, 6(1), 16–37.

Anyorigya, D. A. (2020). COVID-19: Halt challenge-ridden online learning in universities – NUGS to Government. Retrieved from citinews: https://citinewsroom.com/2020/04/covid-19-halt-challenge- ridden-online-learning-in-universities-nugs-to-government/

Arthur-Nyarko, E., & Kariuki, M. G. (2019). Learner access to resources for eLearning and preference for eLearning delivery mode in distance education programmes in Ghana. International Journal of Educational Technology, 6(2), 1–8.

Asante, J. N. (2014). The state of ICT integration in the early years in Ghana schools. Literacy Information and Computer Education Journal, 3(1), 1751–1757.

Asunka, S. (2008). Online learning in higher education in sub-Saharan Africa: Ghanaian University students' experiences and perceptions. International

Review of Research in Open and Distance Learning, 9(3), 1– 23. https://doi.org/10.19173/irrodl.v9i3.586.

Avgerou, C. (2008). Information systems in developing countries: A critical research review. Journal of Information Technology, 23,133–146. https://doi.org/10.1057/palgrave.jit.2000136.

Ayebi-Arthur, K., Aidoo, D. B., & Wilson, K. B. (2009). A study on the use of the internet in senior high schools in the Cape Coast metropolis of Ghana. Ghana Journal ofEducation and Teaching, 8,1–16.

Bacow, L. S., Bowen, W. G., Guthrie, K. M., Lack, K. A., & Long, M. P. (2012). Barriers to Adoption of Online Learning Systems in U.S. Higher Education. New York: Ithaka S+R. Retrieved from https://sr. ithaka.org/wp-content/uploads/2015/08/barriers-to-adoption-of-online-learning-systems-in-us-higher- education.pdf

Badu-Nyarko, S. K., & Amponsah, S. (2016). Assessment of Challenges in Distance Education at University of Ghana. *Indian Journal of Open Learning*, *25*(2), 87–103. http://login.ezproxy.lib.umn.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&db=eue&AN=126432780&site=ehost-live

Badu-Nyarko, S. K., Benneh, C. O., & Amponsah, S. (2017). *Implementation Strategies of the University of Ghana Distance Education Programme*. *03*(March 2016), 101–108.

Bean, M. V., Aldredge, T., Chow, K., Fowler, L., Guaracha, A., McGinnis, T., et al. (2019). Effective practices for online tutoring. Sacramento: Academic Senate for California Community Colleges.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101

Cavus, N. (2015). Distance learning and learning management systems. *Procedia-Social and Behavioral Sciences*, *191*, 872-877.

Chen, B. (2015). Exploring the digital divide: The use of digital technologies in Ontario public schools. *Canadian Journal of Learning and Technology*, *41*(3).

Cho, S. K., & Berge, Z. L. (2002). Overcoming barriers to distance training and education. *USDLA Journal*, *16*(1), 16-34.

Clandinin, D. J., & Rosiek, J. (2019). Mapping a landscape of narrative inquiry: Borderland spaces and tensions. In *Journeys in narrative inquiry* (pp. 228-264). Routledge.

Clarke, M. (2023). Evidence, Stakeholders and Decision Making: Managing COVID-19 in Irish Higher Education. In *The Impact of Covid-19 on the Institutional Fabric of Higher Education: Old Patterns, New Dynamics, and Changing Rules?* (pp. 39-63). Cham: Springer International Publishing.

Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The Psychologist, 26*(2), 120–123.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. MIS Quarterly,13(3), 319–339.

Edumadze, J., Ogoe, J. I., Essilfie, G., Edumadze, G. E., Osei-Gyasi, A. A., & Graham, R. E. (2017). E-learning at the University of Cape Coast, Ghana-are our distance education students technologically ready?

Egielewa, P., Idogho, P. O., Iyalomhe, F. O., & Cirella, G. T. (2022). COVID-19 and digitized education: Analysis of online learning in Nigerian higher education. *E-learning and Digital Media*, *19*(1), 19-35.

Farahat, T. (2012). Applying the technology acceptance model to online learning in the Egyptian universities. *Procedia-Social and Behavioral Sciences*, *64*, 95-104.

Fink, C., & Kenny, C. J. (2003). W(h)ither the digital divide? *Info The Journal of Policy, Regulation and Strategy for Telecommunications, 5(6), 15– 24.*

Gan, I., & Sun, R. (2021). Digital divide and digital barriers in distance education during COVID-19.

Ginsberg, M. B., & Wlodkowski, R. J. (2009). *Diversity and motivation: Culturally responsive teaching in college*. John Wiley & Sons.

Ibrahim, A. I., Sulaiman, N., & Ali, I. (2022). Simultaneous multidimensional impacts of active learning revealed in a first implementation in the MENA region. *Proceedings of the National Academy of Sciences*, *119*(47), e2108666119.

International Telecommunication Union. (2017). Measuring the Information Society Report 2017. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2017/ MISR2017_Volume1.pdf.

Kim, M. C., & Kim, J. K. (2001, July). Digital divide: Conceptual discussions and prospect. In *International Conference Human Society@ Internet* (pp. 78-91). Berlin, Heidelberg: Springer Berlin Heidelberg.

Koninckx, P., Fatondji, C., & Burgos, J. (2021). COVID-19 impact on higher education in Africa.

Keniston, K. (2004). Introduction: The four digital divides. In K. Keniston & D. Kumar (Eds.), IT experience in India: Bridging the digital divide. SAGE Publications.

Kumi-Yeboah, A., Kim, Y., Yankson, B., Aikins, S., & Dadson, Y. A. (2023). Diverse students' perspectives on privacy and technology integration in higher education. *British Journal of Educational Technology*, *54*(6), 1671-1692.

Krönke, M., & Olan'g, L. (2020). Democratic dividend: The road to quality education in Africa. Afrobarometer Policy Paper 66.

Lai, P. C. (2017). The literature review of technology adoption models and theories for the novelty technology. *JISTEM-Journal of Information Systems and Technology Management*, *14*, 21-38.

Lazim, C. S. L. M., Ismail, N. D. B., & Tazilah, M. D. A. K. (2021). Application of technology acceptance model (TAM) towards online learning during covid-19 pandemic: Accounting students perspective. *International Journal of Business, Economics and Law*, *24*(1), 13-20.

Lembani, R., Gunter, A., Breines, M., & Dalu, M. T. B. (2020). The same course, different access: the digital divide between urban and rural distance education students in South Africa. *Journal of Geography in Higher Education*, *44*(1), 70-84.

Lim, C. P., & Wang, T. (2016). A framework and self–assessment tool for building the capacity of higher education institutions for blended learning. In C. P. Lim, & T. Wang (Eds.), Blended learning for quality higher education: Selected case studies on implementation from Asia–Pacific (pp. 1–22). Bangkog, Thailand: UNESCO

Marangunić, N., & Granić, A. (2015). Technology acceptance model: a literature review from 1986 to 2013. *Universal access in the information society*, *14*, 81-95.

Masrom, M. (2007). Technology acceptance model and e-learning. *Technology*, *21*(24), 81.

Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behaviour. *Information Systems Research*, *2*(3), 173-191.

McPhee, S., & Pickren, G. (2017). Blended learning with international students: a multiliteracies approach. *Journal of Geography in Higher Education*, *41*(3), 418-433.

Moore, M. G., & Kearsley, G. (2011). *Distance education: A systems view of online learning*. Cengage Learning.

Morris, M. G., & Dillon, A. (1997). How user perceptions influence software use. *IEEE Software*, *14*(4), 58-65.

Mpungose, C. B. (2020). Emergent transition from face-to-face to online learning in a South African University in the context of the Coronavirus pandemic. *Humanities and social sciences communications*, *7*(1), 1-9.

National Council for Tertiary Education. (2018). Summary of basic statistics on public tertiary education institutions. NCTE.

Ngai, C. S., Lee, W. M., Ng, P. P., & Wu, D. D. (2018). Innovating an integrated approach to collaborative eLearning practices in higher education: The case study of a corporate communication e-platform. Studies in Higher Education, 44(11), 1990–2010. https://doi.org/10.1080/03075079.2018.1482266.

Norris, P. (2001). *Digital divide: Civic engagement, information poverty, and the Internet worldwide*. Cambridge University Press.

Osabwa, W. (2022, February). Coming to Terms With COVID-19 Reality in the Context of Africa's Higher Education: Challenges, Insights, and Prospects. In *Frontiers in Education* (Vol. 7, p. 643162). Frontiers.

Oyedemi, T. D. (2012). Digital inequalities and implications for social inequalities: A study of Internet penetration amongst university students in South Africa. *Telematics and informatics*, *29*(3), 302-313.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health and mental health services research*, *42*, 533-544.

Passmore, D. A. (2009). *A phenomenological study of nursing faculty's experiences in transitioning from a classroom to an online teaching role*. University of South Florida.

Robinson, T. (2019). Using the technology acceptance model to examine technology acceptance of online learning technologies by non-traditional students. *I-Manager's Journal of Educational Technology*, *16*(1), 21.

Saadé, R., & Bahli, B. (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in online learning: an extension of the technology acceptance model. *Information & Management*, *42*(2), 317-327.

Safford, K., & Stinton, J. (2016). Barriers to blended digital distance vocational learning for non-traditional students. *British Journal of Educational Technology*, *47*(1), 135-150.

Salloum, S. A., Al-Emran, M., Monem, A. A., & Shaalan, K. (2017). A survey of text mining in social media: Facebook and Twitter perspectives. *Advances in Science, Technology and Engineering Systems Journal*, *2*(1), 127-133.

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modelling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, *128*, 13-35.

Segbenya, M., Oduro, G. K. T., Peniana, F., & Ghansah, K. (2019). Proximity and choice of College of Distance Education (CoDE) of the University of Cape Coast for further studies. *International Journal of Educational Management*, *33*(5), 1012-1034.

Srichanyachon, N. (2014). The barriers and needs of online learners. Turkish Online Journal of Distance Education, 15(3), 50–59.

Szajna, B. (1996). Empirical evaluation of the revised technology acceptance model. *Management Science*, *42*(1), 85-92.

UNESCO. (2023). *Global Education Monitoring Report 2023: Technology in education -A tool on whose terms?* (1st ed.). UNESCO.

Vuorikari Rina, R., Kluzer, S., & Punie, Y. (2022). *DigComp 2.2: The Digital Competence Framework for Citizens-With new examples of knowledge, skills and attitudes* (No. JRC128415). Joint Research Centre (Seville site).

Warf, B. (2019). Teaching digital divides. *Journal of Geography*, *118*(2), 77-87.

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TEACHING WITH DIGITAL TECHNOLOGY IN BASIC SCHOOLS IN GHANA: IDENTITIES, CHALLENGES AND IMPLICATIONS IN A DIGITAL ERA

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ABSTRACT

Though scholars have made attempts at disproving this, it is generally perceived that the present generation of students possess better digital competencies than their adult teachers. Using a qualitative, multiple case study design, this research explored Ghanaian teachers' perspectives on their students' digital identities, the challenges they encounter in usage of digital technology, as well as the implications of teaching in a digitalized era. A total of 24 teachers from public and private basic schools in Accra, Ghana was included in the study. Teachers perceived their students as digital natives based on the era of birth, technological assistance, frequency of usage and school environment. Challenges faced by teachers in using digital technology to teach included limited resources, lack of training, reluctance to change and time constraints. Findings showed the need for a paradigm shift from traditional methods of teaching to innovative modes, embracing the digital mindset, and providing platforms for students to co-construct their knowledge. Authors recommend that schools, academic related institutions and the government prioritize the usage of digital technologies for teaching and learning by formulating appropriate policies that allow technology-driven curriculum design and teaching as well as ensuring continuous professional development of digital skills of teachers.

***Keywords**:* Teachers, Identities, Digital technology, Basic schools and Digital skills development.

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Introduction

The last few years have seen an unprecedented evolution and transformation in ICT-driven teaching and learning. Across the globe, systems particularly in developing countries were rudely awoken to the new reality that digital technologies had become the lifeline to successful and continuing education (Adarkwah, 2021). More than ever, the Covid-19 pandemic brought about the need to reimagine the role of digital technologies in education (Singh, 2021). In Ghana, and other jurisdictions, the onset of the Covid-19 pandemic further altered and shaped teaching methods and practices by accelerating the use of educational technologies and online tools. These developments have had significant implications for teachers and learners in the use of digital technologies (Agormedah, Henaku, Ayite & Ansah, 2020).

It is the popular assumption that young people are more adept at and have higher competencies in using digital technology than their parents and elders. Prensky (2001) who coined the term 'digital natives' and 'digital immigrants' discussed how the differences between 'digital native' students and their 'digital immigrant' teachers lie at the root of today's educational challenges. There are fears that teachers lack the requisite skills and capacity to adequately facilitate and enhance students understanding, use, engagement and application of technology for learning (Wang & Zhao, 2023; Tou, Kee, Koh, Camire & Chow, 2020).

Literature provides several contexts in which teachers' challenges with the use of technology in teaching are provided. In Pakistan, low speed of the internet, absence of infrastructure, limited online teaching experience and inadequate training were identified as key challenges in the use of technology amongst educators at several levels (Akram, Abdelrady, Al-Adwan, & Ramzan, 2022). The lack of training opportunities, lack of resources, and teachers' inability to use modernized technology were cited as major drawbacks in Nkengbeza, Mbuzi & Chainda (2022) study on challenges faced by primary school English teachers in Namibia in integrating media technology in the teaching and learning of English. These have ripple effects on teachers' competencies and the adoption and integration in teaching and learning.

Similarly studies in Ghana to evaluate the challenges basic school tutors face when integrating Information and Communication Technology (ICT) into their instruction and learning activities, showed limited number of ICT tools, the absence of fully subscribed software packages that run on them, the lack of electric outlets in the classroom, poor internet connectivity and power fluctuations as some of the key findings (Nettey, Osei Mensah, Asafo-Adjei & Babah, 2024; Ananga & Sakyi, 2023; Abedi, 2023; Mensah et al., 2023). Despite these bottlenecks, teachers expressed keen interest in integrating ICTs into their teaching practices

While several studies have explored the behaviours and characteristics of 'digital natives' and 'digital immigrants' (Creighton, 2018; Kesharwani, 2020; Kinkl & Strach, 2021; Demeshkant et al., 2022), there is a notable scarcity of research in Ghana focusing on basic school teachers' perspectives regarding these dynamics ('natives and immigrants') and their implications for 21st-century teaching and learning. In addition, studies have been predominantly undertaken in contexts other than Africa and Ghana and within pre-tertiary and tertiary level jurisdiction. Further, majority of studies employed quantitative methods. This study therefore seeks to address this gap by employing the qualitative method to explore teachers' perceptions on students' identities, their challenges with using digital technology to teach and the implications for teaching in a digitized era. Data gathered from this study will inform the development and implementation of strategies and support systems required by government, institutions and schools to improve and reform teachers' preparation and professional development towards harnessing technology for education.

The paper addresses the following questions:

1. What perceptions do teachers have about their students' digital identities?
2. What challenges do teachers face in teaching with digital technology?
3. What are the implications for teaching in a digitalized era?

Justification of the Study

The study would contribute to theory by operationalizing digital identities in the classroom context. By examining how teachers perceive digital identities, the study throws more light on how digital citizenship concepts apply in basic school settings. Findings will extend existing frameworks to include perceptions on 'digital natives' and 'immigrants' within the Ghanaian or African school contexts. In terms of practice, the study would contribute to a more diverse understanding of how identity dynamics influence teaching and pedagogy in both public and private schools. The findings would be useful to teachers, schools and institutions across the globe with similar educational settings and environments as well as policy makers and regulators interested in the integration of learning in basic education

Theory and Literature Review

Digital Natives and Digital Immigrants

Prensky (2001)'s digital natives and digital immigrants' theory was used as a guide for this study. The term 'digital natives' and 'digital immigrants' were formulated in 2001 by Prensky, in relation to a cohort of students whose technological savviness was distinct from that of their teachers. 'Digital natives' was used to describe a generation of individuals born after the 1980's and who had largely been exposed to digital technology and digital reality all their life. 'Digital immigrants' on the other hand referred to a group of individuals born before the 1980s. Their exposure to technological devices and tools came at a much later stage in life (Kesharwani, 2020). With early access to digital technologies, 'digital natives' usually engross themselves in a networked world and are more comfortable adopting education and digital technologies than their digital immigrant counterparts.

Several scholars however disagreed with Prensky (2001) over the subject 'digital natives', and 'digital immigrants' (Gallardo-Echenique et al., 2015; Bennett et al., 2008; Selwyn, 2009). They argued that Prensky's classifications were not based on empirical studies and that variables other than age such as the cost of using technology, the ease of its accessibility and immediacy were contributing factors to individuals' use of technology. In addition, it might be too simplistic to classify a particular generation as a distinct societal group. According to Hargittai (2010), young peoples' attitude towards technology usage was not necessarily similar. It was highly probable that youth who came from poor sociological backgrounds with no access to digital technologies could display less competency at using technology. The issue of technological divides with regards to wealth, income and family status could also be at play. Youth with lower socio-economic status may not have had the same access to technologies and therefore might have shown less savviness in usage.

Adayi et al. (2021) added that location and education factors contributed significantly to an individual's capability to effectively use digital technology and therefore found it yet again overly simplistic to maintain the stance that all young adults were technologically savvy. In addition, there could be young adults born after the 1980's who could have less skill in using information technology than their older counterparts. Watson (2013) further opined that student's usage of technologies differed from country to country and within institutions and thus students born in the digital age but who were not well exposed to technology usage within a particular geographical territory may not have exhibited characteristics of digital natives. An empirical exploration of these concepts: 'digital natives' and 'digital immigrants' in the context of a developing society is then warranted, and thus is the focus of the current paper.

Digital Gaps between Teachers and Students

Empirical research has proved inconsistencies between teachers and students regarding ownership and usage of technological devices. In some instances, teachers possessed better computer skills, than students whilst in other instances, students were better poised to embrace technology more than their teachers (Spiteri & Chang Rundgren, 2020; Jain et al. 2021).

Mogapi et al. (2023) investigated student-teacher digital divides in selected primary schools in Botswana. It was revealed that learners used technology much quicker than their teachers. Additionally, longer serving teachers were found to be less interested in the use of technology. In Nigeria, Modeme & Onwuegbuna (2023) explored the extent to which there existed a digital divide between students and teachers in the application of digital technologies during music lessons. It emerged that students were rated higher than their teachers in terms of application whilst teachers were excellent in traditional class settings.

Similarly, Tou et al. (2020) assessed and compared Singaporean Physical Education teachers' attitudes towards information and communication technologies using demographics such as age and teaching experience. Findings were that teachers' attitudes towards ICTs were significantly different between teachers of different ages and teaching experiences. In the area of modern and innovative subjects, higher scores were found among older teachers. In subjects like Physical Education, older teachers recorded significantly higher scores.

Findings from African, Singapore and European contexts above showed direct contrasts where in the case of Nigeria and Botswanna, students were more knowledgeable in digital technology and information. On the other hand, teachers were more knowledgeable in Singapore and Spain, which could be explained by the strong emphasis towards technology by Singapore and Spain's governments. Government's prioritization of technology would usually translate into teachers' preparedness and practice. In addition, situational factors regarding the number of hours required by Singaporean teachers to train in professional development were very significant to these outcomes suggesting that continuous programmes were more intense and effective in such contexts.

The Future of Teaching and Learning

The forced need for acclimatizing with the aftermaths of the Covid-19 pandemic, advancement in learning technologies, and the inception of artificial intelligence have triggered a redesign of the teaching-learning processes toward approaches in which digital resources are the main protagonists in a reality according to the information society (Arora & Srinivasan, 2020). Given the nature of the challenge, digital tools and different software have been positioned as resources with better results than traditional teaching (Reimers & Schleicher, 2020; Uluyol & Sahin, 2016). Similarly, the need to promote quality education that adopts digital tools to achieve greater sustainability in education systems is highlighted in SDG Goal 4 (Tjoa & Tjoa, 2016).

From a South African perspective, Mhlanga & Moloi (2020) saw the Covid-19 period as the start of a process that will move education to the 4IR where digital learning will become the norm, with a few instances of physical or face-face classrooms. They opined that in order to be relevant in teaching and learning in the new paradigm shift, both teachers and students will need to be knowledgeable in new learning technologies. Ilori & Ajagunna (2020) whilst conducting a review on reimagining the future of education noted that the dawn of smart communication systems, artificial intelligence, robotics, virtual reality and digital textbooks have provided a new outlook to what is learnt in schools. Just as technologies brought about smart communication systems, the 4th industrial revolution model education is rapidly evolving and as such, curriculum development and review must be dynamic, and it must keep pace with the technological advances and skills required in the 21st century.

In a study in South Africa, which investigated the pedagogical paradigm shift in 21st century teaching and learning in secondary schools, findings showed that teacher-centered pedagogies were continually in use as the main instructional style and nonetheless, pre-empted passiveness on the part of learners (Sikhakhane, Govender & Maphalala, 2020). There seemed to be a compromise on active learning approaches and making meaningful intellectual gains. Teachers mentioned the absence of support in terms of computer hardware and software. In another vein, a Ghanaian study explored the adoption of a new and innovative curriculum grounded in 21st century pedagogy (Takyi, Korankye & Akobila, 2025). It however emerged that there was a need for a reform of the system that extends beyond transforming the curricula. While teachers received innovative and learner-centred training, their classrooms remained rigid and overcrowded. There was a call for education policy makers to design pedagogical reforms with investments in the physical learning environment. Both Ghanaian and South African studies mirrored how context influenced the success of moving into new

and innovative paradigms of teaching. In both cases, training may have equipped teachers with learner-centred approaches, nonetheless the lack of adequate spaces and infrastructure did not enable the intended teaching approaches to materialize. This beckons for an alignment between pedagogical reforms and investments in the physical environment.

The research questions which are grounded in the three thematic areas in the literature above provide a holistic framework for understanding teachers' and students' identities and digital technology usage as well as future implications for teaching practice within a Ghanaian context. The future of teaching and learning cannot be separated from the digital eco-systems that teachers inhabit and from the interpretations that they bring to these ecologies. By placing these intersections within the discourse of digital identities, digital gaps between teachers and paradigm shifts in teaching, the study aims to generate evidence-based guiding information that would support more equitable, effective and future oriented digital teaching.

Materials and Methods

This is a qualitative study that employed a multiple case study design. Teachers' views were explored in-depth, from public and private school settings. Teachers were selected from 2 public and 2 private schools. The study employed extreme or deviant case sampling method in selecting the schools. The reasoning behind Extreme Case sampling is that lessons may be learned about unusual conditions or extreme outcomes that are relevant to improving more typical programmes (Patton, 1990). In this regard, the study explored teachers' perceptions regarding students' identities and their challenges with digital technology from the supposedly well-resourced schools (private) and the less- endowed schools (Public). These two categories of schools are classified as extreme in nature: Public basic schools in Ghana are characterized by lack of infrastructure, resources, and financial dependence on the public purse. Whereas the private schools are supposedly better endowed, more financially independent and are believed to achieve better academic results.

Each category of schools selected offered a rich context for studying identities and challenges in usage of digital technology from different divides. Only two schools were selected in each category due to limitation of funds, convenience and proximity.

Homogenous sampling technique was also adopted. Selection criteria were based on teachers who taught between Junior High School (JHS) levels 1-3 in public schools and between years 7- 9 in private schools. This allowed participants with similar experiences to share their stories on digital technology usage. 6 teachers were selected from each school. Altogether 24 teachers were sampled.

Participants

A total of 24 teachers participated in the study. 6 teachers were selected from each school (2 public and 2 private). There were 14 male teachers and 10 female teachers. Teachers' ages ranged between 27 and 57 years for public schools and 24 and 60 years for private schools. Teachers were selected from varied subject areas including Math, English, Integrated Science, Physics, Chemistry, Social Studies, Home Economics, French, Religious and Moral Education, Information

Communication Technology (ICT), Music, Business Studies, Basic Design Technology and Physical Education.

Study Context

The phenomenon of using digital technology was explored from the supposedly well-resourced schools and the less-endowed schools. Public schools in Ghana are characterized by a lack of infrastructure and total dependence on government support whereas private schools are better resourced and financially independent (Opoku, Cuskelly, Pedersen & Rayner, 2021).

Data Collection Procedure

In-depth interviews were used. The use of in- depth interviews in this study allowed the unearthing and exploration of views, beliefs and deeper meanings offered by teachers about their students' identities, their challenges in using digital technology to teach and the implications of teaching in a digital era. A semi-structured interview guide with open ended questions were used (Please find attached interview guide in the appendix). Interviews were conducted privately and lasted about 45 minutes to an hour. Participant's submissions were audio recorded.

Data Credibility

A code-recode strategy was employed. The same data was coded twice, giving two weeks' time interval between each coding. The results from the two codings were compared to see if they were similar or different. Results showed very minimal differences. We applied the member-check principles to enhance data credibility. We also engaged in peer reviews to validate the truthfulness of data. We used Turnitin software to conform to the data similarity index standard, 20% with regards to University of Ghana policy.

Ethics

Participants showed their willingness to be part of the study by signing consent forms prior to the start of the research. Participants were assured of anonymity and confidentiality. Steps were taken to ensure that participant's submissions were not traced to their names. Any information that had the potential of identifying its source were anonymized during transcription. Ethical clearance was granted by the Ethics Committee for the Humanities (ECH), University of Ghana ECH 115/17-18).

Data Analysis

According to Attride-Stirling (2001), "If qualitative research is to yield meaningful results, it is imperative that the material under scrutiny is analyzed in a methodical manner…." (p.386). In view of this, we made use of Braun & Clarke (2020) six-step process of engaging with data, coding and developing of themes known as thematic analysis. It was an iterative process and we engaged in reflexive introspection to comprehend, interpret and gain insights into the data (Trainor & Bundon, 2021).

The first step involved repeatedly playing and transcribing the audio recordings. This was followed by reading the transcriptions and evaluating them in order to identify patterns of connectedness (Miles, Huberman & Saldana, 2014). The next step was the code generation phase, where initial codes were generated. This stage involved coding categories in the data and organizing all the occurrences of text in the data where that code occurred (Clarke & Braun, 2013). The generated codes were subsequently organized and grouped into themes which were then examined, labelled and defined to correspond with the study's research questions and pertinent literature. The themes were further categorized into sub-themes with each sub-theme representing different aspects of the main themes. This formed the basis of analysis for the study The final phase focused on completing the report, during which we incorporated direct quotes from the participants to illustrate the different sub-themes. Table 1 provides a summary of the themes, sub-themes and examples of the narratives from the participants.

Findings

In this section, we present the findings of this study. Three main themes emerged: Defining digital natives, challenges with using digital technology in teaching and transforming teaching practice for digital natives. Please find a table of summaries below. The findings are discussed under sub-themes. Each sub- theme is supported with direct quotes from participants.

Table 1: Summary of Main Ideas

Main Theme	Sub-Themes	Summary of main ideas from data/ codes	Quotes
Defining digital natives	• Time and Era of Birth	• students more responsive and skillful due to the time and era in which they were born	*…, they were born in an era where social media is the thing. (PV T 8)*
	• Technical Assistance Offered to Teachers	• students displayed more superiority by informing teachers about new tools and assisting them during class.	*…. Sometimes they assist us, you know in trying to set up these tools for teaching for them. (PVT 1)*
	• Frequency and Regularity of Use	• teachers had limited, whilst students, had ample time at their disposal to engage in online activities	*They are always with the mobile phones. ……We don't have time, we're always struggling for time to do other*

Main Theme	Sub-Themes	Summary of main ideas from data/ codes	Quotes
			things, etc. (PB T 6)
	• School environment and social background	• Students from more endowed school environments were likely to be digital natives	*……. when you look at their economic backgrounds, it is very low and so for them, they can't have easy access to digital tools…..(PT 4)*
	• Social media natives, not digital natives	• Students were rather adept at using social media applications and not digital tools	*I wouldn't say they are natives… but the only one they'd be used to is this normal Facebook, WhatsApp, chatting. (PBT 3)*
Challenges with using digital technology in teaching	• Limited access to resources	Difficulties using technology to teach due to lack of infrastructure.	*… the school does not have a single computer for the students.* (PBT 6)
	• Reluctance to change	• Teachers were more comfortable sticking to their traditional way of doing things.	*some of us may be reluctant to adopt new teaching methods or technologies due to comfort with traditional approaches. (PBT 3)*
	• Time constraints	• Teachers saw the use of digital technology as a hindrance to timely completion of syllabuses.	*So, the fear that it will slow down the teaching is a hindrance (PVT 5)*
	• Lack of training	• Teachers attributed their lack of efficiency in usage of	

Main Theme	Sub-Themes	Summary of main ideas from data/ codes	Quotes
		digital tools to limited digital skills training	*…to be honest we do not have regular training on digital skills acquisition. (PBT 6)*
Transforming teaching practice for digital natives	• Shifting from traditional to new methods of teaching	• Teachers to adopt modern paradigms of teaching and pedagogy and move from traditional methods	*It means teachers of this time should channel more of their teaching through digital means that already interests students (PVT 6)*
	• Students becoming partners in constructing knowledge.	• Shared responsibility with students through active engagement, discussions and shared experiences	*Now we are moving from the age of lecturing to facilitation (PVT 6)*
	• Embracing a digital mindset	• Teachers required to be open minded and adaptable to new technology.	*We must be thinking digital going forward and that means that we should embrace new knowledge and new ways of thinking (PVT 3)*

Research Question 1: What are teachers' perceptions about their student's digital identities?

Natives by Virtue of Time and Era of Birth

Views sampled from respondents showed a diversity in opinions in teachers' beliefs about their student's digital identities. Teachers in both public and private schools classified students as "Natives" based on the time and era in which they were born. A teacher in a private school shared her opinions:

> *…the kinds of things that you struggle with, they'd just get it done and because it came at their time and they're in tune with technology…(Private School Teacher 2)*

> *…. they were born in an era where social media is the thing. For some of them, their whole world is social media,—…. (Private School Teacher 8)*

A teacher in a public school noted:

> *They were born in an age where technology has become the order of the day, it's everywhere, so they are very comfortable and conversant with everything on the phone, (Public School Teacher 6)*

They argued that some of them (teachers) got to the university before using electronic gadgets like computers, iPad, phones, etc. Thus, students proved to be more responsive and skilful in anything technological due to the time and era in which they were born.

Natives by Virtue of Technical Assistance Offered to Teachers

Teachers in public and private schools noted that students could be categorized as natives based on the assistance and support they sometimes provided teachers during the course of work. They indicated that most students were quick to learn on matters of technology. Some private school teachers commented:

> *…. sometimes they assist us, you know in trying to set up these tools for teaching for them, so I think it's very true, they are quick to learn some of these things. (Private School Teacher 1)*

> *even at times when we're using our laptop or the internet or other things in the class, we get stuck on the way and we have to invite some of them to help us out. (Private School Teacher 5)*

Similar sentiments were expressed by teachers in public schools:

> *My child was going to the café and I didn't think it was a good idea because they do play other games, so I even beat him concerning it. But then later I realized that his going there even helped me because at times when I need some information from the internet, I fall on my child for assistance. (Public School Teacher 2)*

According to the teachers, students displayed a lot more superiority in knowledge by informing them about new and latest apps and by providing direction to them on how to access and use these apps.

Natives by Virtue of Frequency and Regularity of Use

Discussions further centered on how actively students and teachers patronized technology platforms and online applications. Teachers perceived that student

spent a lot of time engaged on the internet through social media. Teachers remarked:

> *They are often on WhatsApp most of the times even in class. You know interestingly one of them was asked in a Geography class what they'd consider before they move to a new settlement …. well the first thing the person mentioned was wi-fi. (Private School Teacher 4)*

> *"Whenever I go on social media, I see them all over there. Sometimes I leave and they're still there, so I believe they're more inclined to it, they use it more than us." (Private School Teacher 2)*

Another teacher remarked:

> *They are always with the mobile phones. They are ahead, far ahead, they will hear the news before us. We ~~the elderly ones~~ don't have time, we're always struggling for time to look after children, do other things, etc. (Public School Teacher 6)*

Teachers noted that students were far advanced. They opined that the amount of time spent on technology-based activities and the frequency of use of these gadgets and online platforms gave them an upper hand when it came to use of technology.

Natives by Virtue of Social Status and School Environment

Teachers observed that the environment and social backgrounds or setting of the students and teachers were key factors that determined whether they were technologically inclined, or not. A teacher commented:

> *In our school, social media is used for about 40% of our work so if you're in the international school environment and you learn to adapt, you'd be able to get to your students, because that's their major form of communication and they respond better and so we also try our best to catch up with them. (Private School Teacher 3)*

On the other hand, public school teachers noted that their school policy did not allow students to bring or use digital gadgets in school and therefore did not support development of digital skills of both teachers and students. Furthermore, they did not have adequate infrastructure. An interviewee commented:

> *When they come to school, we don't allow them to use the gadgets. They only use the computer when they have ICT. This is the situation where they go to the lab and they don't have sufficient laptops or the computer, so you see that they can't be "natives" due to their school environment. (Public School Teacher 5)*

Other teachers noted:

> *Those who are from good homes have been exposed right from infancy. But if you have the kinds of children we have here when you look at their economic backgrounds, it is very low and so they can't have easy access to digital tools...(Public School Teacher 4)*

Discussions centered on how the socio-economic background of students also mattered in issues of technology. Teachers from public schools argued that students within the setting in which they found themselves usually came from very poor backgrounds.

Social Media Natives, not Digital Natives

Interestingly, some teachers disagreed with the assertion that most students were "digital natives" whilst teachers were immigrants. In their view, students were only adept or skillful at using social media apps like WhatsApp, Facebook, Instagram, Telegram, etc. They rather classified students as "social media natives" and not "digital natives".

> *Because I know students in terms of using the social media apps like WhatsApp, Instagram, they are more abreast with the times. But ~~let's say~~ if you're talking about other technology, let's say Word, Excel, PowerPoint, and maybe other applications, students might be found wanting…(Public School Teacher 5)*

> *I wouldn't say they are natives. I don't know, but the only one they'd be used to is Facebook, WhatsApp chatting and aside that, I don't think they use it for any beneficial things. From my observation, they are not really Natives (Private School Teacher 3)*

Other teachers shared further reasons why they felt teachers were more of "natives" than their students.

> *knowing a lot more about social media and being on the internet, doesn't mean that they know all the online security and safety etiquettes. As teachers, we make it our duty to guide them because as much as they are there, they don't know how to secure some of their data and other things... How can immigrants guide natives? (Public School Teacher 3)*

Research Question 2: What challenges do teachers face in using digital technology to teach?

Limited Access to Resources

When asked about their setbacks with using digital technology, teachers responded that limited access to resources was one of the major challenges they experienced in schools. The cost of accessing these digital tools were a major deterrent to their access and usage

> *the physical cost, a real challenge for us. Apart from that, the cost of purchasing the internet bundle is also a deterrent for us in the basic schools. (Public School Teacher 1)*

> *To the teacher in the public school owning a laptop comes at a cost, bundling internet comes at another cost. So the cost alone is enough to put the person off from accessing these devices. (Private School Teacher 3)*

A French teacher shared her sentiments on the non-availability of gadgets and devices for teaching:

> *For instance, though we have an ICT teacher, the school does not have a single computer for the students. So it is the ICT teacher who brings a laptop to school and then goes round almost all the classes… (Public School Teacher 6)*

A mathematics teacher in a public school shared his opinions:

> *We don't have a computer lab. The building down there is supposed to be a computer lab. but it has not even been commissioned (Public School Teacher 3)*

The narratives above highlight some of the difficulties teachers faced in utilizing technology in the classroom. There was lack of physical and technological resources leading to low usage in teaching.

Reluctance to Change

Teachers attitude to change emerged as a major setback in their usage of digital technology. Some of them explained that change was not an easy transition to make especially when they were very much used to their traditional methods of teaching.

A private school teacher commented:

> *….it's not that we don't like it or do want to use it but the difficulty is in the transition. (Private School Teacher 4)*

Still sharing their views on the subject, private school teachers believed getting used to innovations and new things was a major challenge. Some of them reported:

> *I think some teachers don't easily adapt to change. They would rather say "This is how I always do it'. So if there's a new style of doing it they feel reluctant to try it, openness to new technology, to new things that are coming (private school teacher 1)*

> *I think some of us may be reluctant to adopt new teaching methods or technologies due to comfort with traditional approaches. (Public school teacher 3)*

Getting used to new technologies was not that simple for teachers, especially when resources were not readily available. They were not too conversant with the use of digital tools or technology and would rather stick to their usual way of doing things**.**

Time Constraints

Many teachers saw the use of technology in teaching as time-consuming for various reasons: these included slowing down teaching, inability to finish the syllabus on time, extra time spent in preparation for lessons, and time spent staying updated with modern trends. A science teacher narrated:

> *We sometimes think it's going to slow down our teaching So, the fear that it will slow down the teaching is a hindrance (Private School Teacher 5)*

> *We have a syllabus to complete within a certain time, specifically when we're teaching final year students**.** So if you always have to resort to technology, it would take away your time…(Public School Teacher 1).*

A teacher in A private school teacher maintained that although they made use of digital tools and e-learning in their school, they spent a lot of time planning lessons carefully integrated with e-learning and digital technology, which took a lot of time and effort.

> *I have to be honest… sometimes, finding the time to plan lessons that use technology can be challenging since we have other teaching responsibilities. (Private School Teacher 4)*

Incorporating technology into lessons often requires additional preparation. Teachers may need to create digital resources, set up online platforms, or customize learning materials, which can be more time-consuming than traditional methods.

Lack of Training

Teachers bemoaned the fact that they sometimes lacked the efficiency in fully utilizing digital technology due to their limited knowledge. They argued that they hardly engaged in training that allowed them to improve upon their skills. A teacher explained:

> *…to be honest we do not have regular training on digital skills acquisition. Our incompatibility with these tools sometimes*

> *makes us shy away from using them…(public school teacher 6)*

They believed they needed more awareness and knowledge on its usage, how to regulate its use by students during classes and how to make learning more engaging and relevant.

> *because some of us do not have knowledge about these things, it would be difficult for us to use them. I think creating more awareness and sensitization through training on the many ways it would help us in teaching would be the way forward……(Public school teacher1).*

Another teacher shared her experience and believed that the lack of training resulted in their adherence to their old methods and traditional modes of teaching:

> *It is quite disturbing for some of us because I want to be able to use it in teaching. I know its benefits, but I am constrained by the lack of knowhow…..the lack of training is a challenge for us (Public School Teacher 4)*

Teachers in private schools however shared different views on the subject: they went through regular training and had to continuously update their skills in order to keep up with modern ways of teaching. Some teachers shared their experiences

> *We teach the IGCSE curriculum and because of the environment in which we find ourselves, we have regular trainings on digital technology. We go for trainings on a monthly basis. In fact, if you teach here you have to be abreast with modern trends. (Private School Teacher 3)*

> *Training is an integral part of what we do here. We actually see it as part of our professional development as teachers. Apart from that most of the students here are technology savvy which means that we have to keep up with new knowledge (Private School Teacher 5)*

Teachers in private schools saw training as an essential intervention that could bridge the gap in their digital competencies. In their view the training would provide more awareness and enable them develop significant skills that would improve their output as educators.

Research question 3: What are the implications of teaching in a digital era?

Shifting from Traditional Methods of Teaching and Learning to New Methods

Respondents shared their opinions on what they thought would be the implications of teaching 21st century students and students who in some cases were more technologically advanced. A private school teacher narrated:

> *The traditional way of teaching, white board to students and then the teacher does the talking all of the time is gradually*

> *fading. With all these media available you give the children the steps to accomplish them, and all you have to do is just be there to direct them to find the answers. (Private School Teacher 1)*

Teachers remarked that the old methodologies of teaching were phasing out as students easily got bored and disinterested. From their viewpoint, facilitating and directing lessons using technology, including social media and online research enabled teachers communicate their messages effectively and generated sustained interest in lessons.

> *It means teachers of this time should channel more of their teaching through digital means that already interests students but if maybe we're using the old methodology which doesn't interest them, then you'd find it difficult to get their attention. (Private School Teacher 6)*

A public-school teacher shared her views:

> *It means that teaching is taking a different turn and the old way of doing things must give way to the new, if the best means that you have to go the way of technology which is the current trend, then why not? (Public School Teacher 2)*

Another private school teacher shared his views:

> *The traditional kind of teaching is past and gone. As teachers we should read the trends. You may not have a projector or interactive smartboards, but in your own way, you can print those things that you want to use as teaching and learning materials and resources, bring them to class when they see it, it's better than they imagining it…(Private School Teacher 3)*

Comments from respondents re-emphasized the need to change methods and synchronize with that of latest technology and trends. Traditional teaching methods in their view should give way to newly enhanced learning methods. Other public-school teachers remarked:

> *If the world is changing, we have to change with the world. If everybody is gearing towards technology, as teachers, we must find a way to modernize our old systems so we can also be abreast with time… (Public School Teacher 2)*

Teachers appreciated the added value of teaching with technology and thus stressed the need to embrace it wholly. They saw the need to adapt to education trends globally and thus believed in moving towards new paradigms of learning,

Students Becoming Partners in Constructing Knowledge

Findings revealed that teachers believed that teaching digital natives would mean students should be co-constructors of knowledge. This meant teachers would

provide support to students and guide them towards finding information and using information.

> *Now we are moving from the age of lecturing to facilitation. We support students to learn on their own and we are there to make corrections, to help them navigate, finding information for themselves. (Private School Teacher 6).*

> *There's a new reality we must face if we want to teach our native students…. gone are the days past when as students, you only got access to what your teacher told you… but they also learn from other sources and share with us. (Private School Teacher 4)*

Some teachers noted that this aspect of the learning enables students to challenge the status quo especially where there is the opportunity to compare information sourced with what teachers present. A public-school teacher shared his experience:

> *And sometimes students can challenge you…. So, if you don't factor all these as a teacher, you'd probably look incompetent. (Public School Teacher 6)*

The narratives suggest that teaching digital native would imply shared responsibility with students where both parties actively engage in discussions, share insights and perspectives and contribute to the learning experience.

Embracing a Digital Mindset

Teachers reiterated that there was the need for them to be adaptable and open to new digital tools and embrace the right mindset for teaching with technology. According to some teachers:

> *whether we like it or not, we as teachers should have an open mindset about using technology in the classroom (Public School Teacher 1)*

> *This would mean that we as teachers do continuous training. We must be thinking digital going forward and that means that we should embrace new knowledge and new ways of thinking that allows us to see the possibilities of making digital technology a part of our day-to-day instruction. (Private school Teacher 3)*

Participants also saw the need for school management to be visionary by thinking digital and by finding ways to integrate technology into the entire curriculum. Management having a digital mindset would mean they would encourage teachers' acquisition of digital skills.

> *Well, the school management must have a vision that embraces digital technology in teaching and learning. (Public School Teacher 4)*

> *Here is the case where in most basic schools, phones and digital gadgets are banned in schools. If our educational institutions under the government prioritise digital education, then it would be easier to get policies that support its usage in schools (Public School Teacher 3)*

For the teachers, embracing a digital mindset meant a number of things: adapting wholly to usage of digital technology, continuous training and development and prioritization of digital technology in schools. This would lead to compatibility of use of digital tools, upgrading of teachers' skills, implementation of policies for digital tools usage, which would result in more effective integration in schools.

Discussion

The study investigated teachers' perceptions on student's identities and its implications for teaching and learning. It also explored the challenges teachers faced when employing digital technology in the classroom. Teachers argued that by virtue of the social media era in which students had grown up, students were more conversant, confident and knowledgeable than some of their 'immigrant' teachers. These assertions by teachers corroborate prior study (Wang and Zhao 2023). These align with Prensky's claim of 'native' students being more comfortable with digital tools and have implications for practice: 'native' students may drive demands for technology enabled and instructional approaches. Nonetheless, these findings contrast with previous research conducted by Tou et al. (2020) where older teacher's attitudes towards technology recorded higher scores than students. These differences could possibly have been the result of the existence of government regulated ICT policies that supported the professional development of teachers in public schools in previous contexts. Thus, Prensky's assertion may be overgeneralized as context and not just age, may be much more of a stronger determinant of digital competence.

Teachers categorized their students as 'natives' based on the technical support and assistance they received from them. Findings revealed that students were very quick at learning to use gadgets and even though teachers were trained in technology usage, the students seemed to learn faster, adapt and help their teachers in the use of the gadgets. These support the findings of Mogapi et al. (2023) and Modeme & Onwuegbuna (2023). In the current study, Teachers identified reasons for this: They believed students had a lot more time than their teachers who were preoccupied with other adult life engagements and therefore had less time to spend online; this also supports prior study (Kesharwani, 2020). When students consistently exhibit ease of use of digital tools, it could be interpreted as aligning with Prensky's assertions of 'digital natives'. However, teachers need for technical support may not be a good measure for classifying students as having 'native'-like digital capabilities. It could more often be indicative of the differences in exposure and access or familiarity with specific tools. Practice implications are that specific technical areas where teachers require support should be identified and professional development should be geared towards pedagogy for technology integration and not just accessing and usage of digital devices.

Interestingly, findings from the current study revealed that teachers believed students were social media 'natives' and not particularly 'digital natives'. This distinction echoes Prensky's core ideas but introduces some nuance. Teachers

suggested that students' strengths did not lie in formal educational or digital technologies but rather in the use of social and online communication tools. This is indicative of gaps between everyday digital fluency and digital literacy for the classroom. This has implications for designing digital literacy and education curricula that integrate informal digital competencies with digital tasks required in the classroom. That is designing assignments that would enable students transfer skills from social media to academic work.

Further, the study revealed that context was key in determining the disposition of teachers towards the use of digital technology. Within the private schools, teachers had an enabling educational environment, available information technology infrastructure, well trained teachers, and digital usage policies that enabled students thrive within the digital space thereby supporting their development of digital skills. On the other hand, within the public schools, conditions were not enabling as a result of lack of infrastructure, low technical expertise of teachers and lack of policy on usage of digital gadgets in schools. These findings corroborate that of Adayi et al. (2021) and Masoumi & Noroozi (2023) who attributed teachers' lack of competencies to limited resources and institutional support. The 'native' 'immigrant' distinction becomes insufficient in view of the environment. Though Prensky (2001) claims their generation classifications should put them in the category of 'digital natives', teachers in better resourced environments may develop higher order digital skills faster than teachers in poorly resourced setting. As regards policy, there is the need to ensure equitable access for teachers across schools particularly public basic schools.

Narratives on implications of teaching students in an era marked by digitization and technological transformation revealed that there was a need for a paradigm shift from traditional methods of teaching and learning to new and innovative approaches. Scholars including Ulla & Perales, (2021), Yates et al. (2021), Tashtoush et al. (2023) support these findings. Teachers' advocacy for innovation aligns with the need to leverage technology-rich student- centered strategies that Prensky (2001) identifies with 'native'-like use of digital tools in education. Effective innovation implies the alignment of technology, pedagogy and content and more attention given to digital literacies, equity and assessment. Policy directions should focus on creation of guidelines for monitoring and evaluation of innovative practices.

Our Findings suggest that teachers, schools and institutions should fully embrace the digital adoption mindset. These are supported by related research by Dakhi et al. (2020) and Liesa-Oruse et al. (2020) whose recommendations suggest same. Fully embracing the digital adoption mindset entails being adaptable, learning continuously, and having a learner-centred orientation, which extends beyond the 'native/immigrant' dichotomy. This calls for the extended support of government and regulating institutions to develop clear expectations of what a digital mindset is in the practice. It also beckons the need for schools to implement and report on digital mindset initiatives.

Limitations and Direction for Future Research

The study was conducted in two public and two private schools using a qualitative interview with few research participants and thus limiting its generalizability. Findings may be context specific and therefore cannot be extended to larger populations. We suggest future research on a quantitative basis involving a much

larger spread of population and schools to test the themes that emerged qualitatively. For example, testing the proposition that teachers' interpretations of students' digital identities inform their instructional choices and classroom management. Furthermore, future studies could test whether contextual factors influence the relationship between teachers' perceptions and implications for teaching.

Conclusions and Recommendations

The study sought to investigate teachers' experiences with digital technology usage by finding out their perceptions on students' identities, the challenges they faced in using technology in the classroom and the implications of teaching 'digital natives' in a digital era. Prensky's (2001) theory on "digital natives' and 'digital immigrants" served as the framework and significantly shaped the conclusions. The study's findings partly confirmed the 'digital native' and 'digital immigrant' assertion by suggesting differences in familiarity with and access to technology.

The study also highlighted significant limitations of the theory. Rather than adhering to a strict age-based categorization, the study found that the 'digital native' 'digital immigrant' label was assigned based on contextual exposure such as school environment, assistance and frequency of usage. This suggests that the theory's age-based distinction may not be universally applicable, particularly in contexts where access to technology is limited. In the Ghanaian context, disparities in access to technology were found to drive teachers' classifications rather than age. This finding underscores the need to consider contextual factors when applying Prensky's theory. Furthermore, the study revealed physical, institutional and structural limitations that can hinder technology adoption, regardless of age or digital inclination. These limitations highlight the importance of access and training in facilitating digital adoption.

The study's findings also suggest that infrastructure, access and capacity building are crucial factors of digital adoption, rather than just age or 'native' 'immigrant' status. This challenges the simplistic rendering of Prensky's theory, which suggests that 'digital natives' will naturally possess technological savviness. Instead, the study shows that those labelled 'natives' may not effectively leverage digital technology without adequate access and training,

Moreover, the study found that teachers' readiness to integrate technology indicates a shared belief in technology enhanced learning, which transcends the 'digital native/immigrant' dichotomy. This finding suggests that educators are willing to move beyond traditional paradigms and adopt more innovative approaches to teaching and learning. Overall, the study's findings suggest that Prensky's theory should be extended to account for contextual factors, access and training. Rather than relying solely on age or generational differences, the theory should be nuanced to reflect the complex realities of digital adoption in diverse contexts. By acknowledging the importance of infrastructure, access and capacity building, educators and policy makers can work to create more inclusive and effective technology-enhanced learning environments.

We recommend:

1. Government prioritizes the use of digital technologies in basic schools through the development and implementation of curricula that are technology- driven.
2. The creation of policies that allow the use of digital tools in schools and offer teachers the flexibility and confidence of teaching with digital technology.
3. Educational institutions should collaborate with management of basic schools to organize regular training and engage all-inclusive interventions to develop teachers' capacity (young and old) in digital teaching.
4. The promotion of digital literacy through its incorporation in syllabuses, teaching pedagogy and daily teaching tasks in schools coupled with the implementation of professional development programmes and training workshops.
5. As additional interventions in schools, the creation of mentorship programmes where tech-savvy students could be paired with their teachers and for the exchange information and strategies

Teachers' competencies and skills are critical to teaching in a technologically revolving world. It is necessary therefore, to place priority in developing their digital skillsets to enhance a fuller learning experience for students and to enable teachers confidently play their role in co-constructing knowledge with their 'digital native' students. To engage 'digital natives' effectively, teachers should speak their language and therefore should be prepared with the requisite skills that will enable them effectively meet the needs of the 21st century learner.

References

Abedi, E. A. (2023). Tensions between technology integration practices of teachers and ICT ineducation policy expectations: implications for change in teacher knowledge, beliefs and teaching practices. *Journal of Computers in Education, 11*(4)1215-1234. https://doi.org/10.1007/s40692-023-002966

Adarkwah, M.A. (2021). I'm not against online teaching, but what about us: ICT in Ghana post Covid-19*. Education and Information Technologies, 26*, 1665-1685. https://doi.org/10.1007/s10639-020-10331-z

Adayi, O. I., Dtse, I. L., Idoko, T. D., & Onah, C. J. (2021). Service paradox in contemporary Nigerian academic libraries-Finding a meeting ground between "Digital Natives" and "Digital Natives". *International Journal of Public Administration and Management Research, 6*, 61-70. https://doi.org/10.1007/s10639-020-10331-z

Agormedah, E.K., Henaku, E.A., Ayite, D.M.K., & Ansah, E. A. (2020). Online learning in higher education during Covid-19 pandemic: A case of Ghana. *Journal of Educational Technology & Online Learning 3*,3, 183-210. https://dergipark.org.tr/en/pub/jetol

Akram, H., Abdelrady, A. H., Al-Adwan, A. S., & Ramzan, M. (2022). Teachers' perceptions of technology integration in teaching-learning practices: A systematic review. Frontiers in psychology, 13, 920317. https://doi.org/10.3389/fpsyg.2022.920317.

Ananga, P., & Sakyi, Y. O. (2023). Connecting Classrooms through Social Media Instruction in Educational Institutions. *International Journal of Technology in Education and Science*, *7*(4), 500-513. https://doi.org/10.46328/ijtes.502.

Arora, A. K., & Srinivasan, R. (2020). Impact of pandemic Covid-19 on the teaching and learning process: A study of higher education teachers.

Prabandhan:Indian Journal of Management, 13(4). https://doi.org/10.17010/pijom/2020/v3i4/151825.

Attride-Stirling, J. (2001). Thematic networks: an analytic tool for qualitative research. *Qualitative research*, *1*(3), 385-405. https://doi.org/10.1177/146879410100100307.

Bennett, S., Maton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British journal of educational technology*, *39*(5), 775-786. https://doi.org/10.1111/j.1467-8535.2007.00793.x.

Braun, V., & Clarke, V. (2020). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, *18*(3),328–352. https://doi.org/10.1080/14780887.2020.1769238.

Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The psychologist*, *26*(2), 120-123.

Creighton, T. B. (2018). Digital Natives, Digital Immigrants, Digital Learners: An International Empirical Integrative Review of the Literature. *Education Leadership Review*, *19*(1), 132-140.

Dakhi, O., Jama, J., & Irfan, D. (2020). Blended learning: a 21st century learning model at college. *International Journal Of Multi Science*, *1*(08), 50-65.

Demeshkant, N., Trusz, S., & Potyrala, K. (2022). Interrelationship between levels of digital competences and Technological Pedagogical and Content Knowledge (TPACK): A preliminary study with Polish academic teachers. *Technology, Pedagogy and Education, 31*(5), 579-595. https://doi.org/10.1080/1475939X.2022.2092547.

Gallardo-Echenique, E. E., Marqués-Molías, L., Bullen, M., & Strijbos, J. W. (2015). Let's talk about digital learners in the digital era. *International Review of Research in Open and Distributed Learning*, *16*(3), 156-187. *https://doi.org/10.19173/irrodl.v16i3.2196*.

Hargittai, E. (2010). Digital Na(t)ives? Variation in internet skills and uses among members of the"Net Generation". *Sociological Inquiry*, 80(1), 9-113. https://doi.org/10.1111/j.1475-682X.2009.00317.x.

Ilori, M.O., & Ajagunna, I. (2020). Re-imagining the future of education in the era of the fourth Industrial revolution. *Worldwide Hospitality and Tourism Themes*, *12*(1), 3-12. https://doi.org/10.1108/WHATT-10-2019-0066

Jain, S., Lall, M., & Singh, A. (2021). Teachers' voices on the impact of COVID-19 on school education: Are ed-tech companies really the panacea? *Contemporary Education Dialogue*, *18*(1), 58-89. https://doi.org/10.1177/0973184920976433.

Kesharwani, A. (2020). Do (how) digital natives adopt a new technology differently than digital Immigrants? A longitudinal study. *Information & Management, 52*(2). https://doi.org/10.1016/j.im.2019.103170

Kincl, T., & Strach, P. (2021). Born digital: Is there going to be a new culture of digital natives?*Journal of Global Scholars of Marketing Science, 31*(1), 30-48. https://doi.org/10.1080/21639159.2020.1808811.

Liesa-Orús, M., Latorre-Cosculluela, C., Vázquez-Toledo, S., & Sierra-Sánchez, V. (2020). The technological challenge facing higher education professors: Perceptions of ICT tools for developing 21st century skills. *Sustainability*, *12*(13), 5339. https://doi.org/10.3390/su12135339.

Masoumi, D., & Noroozi, O. (2023). Developing early career teachers' professional digital competence: A systematic literature review. *European journal of teacher education*, 48(3),644-666. https://doi.org/10.1080/02619768.2023.2229006.

Mensah, R. O., Quansah, C., Oteng, B., & Nii Akai Nettey, J. (2023). Assessing the effect of information and communication technology usage on high school student's academic performance in a developing country. *Cogent Education*, *10*(1),2188809. https://doi.org/10.1080/2331186X.2023.2188809

Mhlanga, D., & Moloi, T. (2020). COVID-19 and the digital transformation of education: What are we learning on 4IR in South Africa? *Education sciences, 10*(7), 180. https://doi.org/10.3390/educsci10070180

Miles, B. M., Huberman, A. M., & Saldana, J. (2014). Qualitative data analysis: A methods sourcebook. Sage Publications.

Modeme, E. R., & Onwuegbuna, I. E. (2023). Digital Divide: An empirical study of teachers' and students' application of digital technology in music classroom. *RIK International Journal of Philosophy, Art and Culture (RIK-IJPAC)*, *7*(1), 29-43.

Mogapi, M., Kagiso, B., & Gabajesane, I. (2023). Examining the learner-teacher digital divide: implications for learning in basic education classes-insights from teachers in Botswana. *Journal of Education, Society and Behavioural Science*, *36*(8), 61-80. https://hal.science/hal-05144439

Nettey, N.A. J., Osei Mensah, R., Asafo-Adjei, R., & Adiza Babah, P. (2024). Analyzing the challenges basic school teachers face in integrating Information and Communication Technology into teaching and learning activities in a developing country. *Cogent Education*, *11*(1), 2364544. https://doi.org/10.1080/2331186X.2024.2364544.

Nkengbeza, D., Mbuzi, D., & Chainda, A. M. (2022). Challenges faced by primary school English teachers in integrating media technology in the teaching and learning of English. *Creative Education*, *13*(4), 1139-1153. https://doi.org/10.4236/ce.2022.134071.

Opoku, M. P., Cuskelly, M., Pedersen, S. J., & Rayner, C. S. (2021). Attitudes and self-efficacy as significant predictors of intention of secondary school teachers towards the implementation of inclusive education in Ghana. *European Journal of Psychology of Education*, *36*(3), 673-691. https://doi.org/10.1007/s10212-020-00490-5

Prensky, M. (2001). Digital natives digital immigrants part 2: Do they really think differently? *On the Horizon*, 9(6), 3-16. https://doi.org/10.1108/1074812011042484.

Reimers, F. & Schleicher, A. (2020). *Schooling disrupted, schooling rethought. How the Covid-19 pandemic is changing education*. OECD, Better Policies for Better Lives.

Selwyn, N. (2009). The digital native – myth and reality. Aslib Proceedings: *New InformationPerspectives*, 61(4), 364–379. https://doi:10.1108/00012530910973776

Sikhakhane, M., Govender, S., & Maphalala, M. C. (2020). Investigating pedagogical paradigm shift in the 21st century teaching and learning in South African secondary schools. *International Journal of Education and Practice, 8*(4), 705-719. https://doi.org/10.18488/journal61.2020.84705719.

Singh, M. N. (2021). Inroad of digital technology in education: Age of digital classroom. *Higher Education for the Future*, *8*(1), 20-30. https://doi.org/10.1177/2347631120980272.

Spiteri, M., & Chang Rundgren, S. N. (2020). Literature review on the factors affecting primary teachers' use of digital technology. *Technology, Knowledge and Learning*, *25*(1), 115-128.https://doi.org/10.1007/s10758-018-9376-x.

Takyi, B., Korankye, S., & Akolbila, V. (2025). innovating within constraints: basic school teachers'experiences with pedagogical reform in Ghana. *International Journal of Teaching and Learning, 2*(12), 1448-1436.

Tashtoush, M., AlAli, R., Wardat, Y., AL-Shraifin, N., & Toubat, H. (2023). The Impact of Information and Communication Technologies (ICT)-Based Education on the Mathematics Academic Enthusiasm. *Journal of Educational and Social Research, 13(3), 284-293*. https://doi.org/10.36941/jesr-20230077.

Tou, N. X., Kee, Y. H., Koh, K. T., Camire, M., & Chow, J. Y. (2020). Singapore teachers' attitudes towards the use of information and communication technologies in physical education. *European Physical Education Review*, *26*(2), 481-494. https://doi.org/10.1177/1356336X19869734.

Tjoa, A. M., & Tjoa, S. (2016, September). The role of ICT to achieve the UN Sustainable Development Goals (SDG). In *IFIP world information technology forum* (pp. 3-13). Springer, Cham.

Trainor,L.R., & Bundon, A. (2021). Developing the craft: Reflexive accounts of doing reflexive thematic analysis. Qualitative research in sport, exercise and health, 13(5), 706-762. https://doi.org/10.1080/2159676X.2020.1840423

Ulla, M. B., & Perales, W. F. (2021). Facebook as an integrated online learning support application during the COVID19 pandemic: Thai university students' experiences and perspectives. *Heliyon*, *7*(11). https://doi.org/10.1016/j.heliyon.2021.e08317.

Uluyol, C. & Sahin, S. (2016). Elementary school teachers' ICT use and their motivations for using ICT. *British Journal of Educational Technology*, 47(1), 65-75. https://doi.org/10.1111/bjet.12220.

Wang, Q., & Zhao, G. (2023). Exploring the influence of technostress creators on in-service teachers' attitudes toward ICT and ICT adoption intentions. *British Journal of Educational Technology*, *54*(6), 1771-1789. https://doi.org/10.1111/bjet.13315.

Watson, J. R. (2013). Digital natives or digital tribes? Universal Journal of Educational Research, 1(2), 104-112. https://doi.org/10.13189/ujer.2013.010210.

Yates, A., Starkey, L., Egerton, B., & Flueggen, F. (2021). High school students' experience of online learning during Covid-19: the influence of technology and pedagogy. *Technology, Pedagogy and education*, *30*(1), 59-73. https://doi.org/10.1080/1475939X.2020.1854337.

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