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RESEARCH

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# Exploring socio-cultural influences on generative AI engagement in Nigerian higher education: an activity theory analysis

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## Abstract

This study explores how socio-cultural dynamics influence student engagement with Generative AI technology in Nigerian higher education, using activity theory as theoretical underpinning. By examining the roles of community norms, technological accessibility, and educational objectives, the research identifies critical factors that impact the adoption and utilisation of GenAI. We employ quantitative analysis to analyse 899 survey responses from students across seventeen (17) Nigerian universities to derive interesting insights. Findings reveal that the ease of use of GenAI tools and their alignment with educational goals enhance student engagement. Conversely, regular need for technical support negatively affect engagement, suggesting underlying technological issues. These insights provide actionable recommendations for educators, administrators, and policymakers, emphasising the importance of user-friendly GenAI tools, comprehensive training programs, and robust support systems. This study contributes to the understanding of technology adoption in culturally diverse educational settings and offers strategies to improve educational practices and outcomes both in Nigerian higher education and also potentially in other African (developing countries), where similar socio-cultural dynamics might influence technology integration and educational advancements.

**Keywords:** Generative AI, Socio-cultural dynamics, Higher education, Technology adoption, Activity theory

## Introduction

The rapid advancement of GenAI technology is transforming numerous fields, including higher education, by introducing innovative teaching and learning methodologies. The deployment of GenAI transforms educational settings by introducing innovative pedagogical methods, considerably enhancing learning outcomes (Bearman et al., 2023; Essien et al., 2024; Shahzad et al., 2024; Tlili et al., 2023). This evolution in technology opens opportunities to reimagine teaching and learning methods. In the context of Nigerian higher education (HE), the awareness of GenAI is increasing, as it promises to address various educational challenges and improve instructional methodologies (Yusuf et al., 2024). However, unique socio-cultural factors in developing countries, such

as Nigeria, impact the adoption and utilisation of technology. Therefore, it is crucial to understand these dynamics for effective utilisation of GenAI technology (Elkefi et al., 2024; Shahzad et al., 2024).

Within HE, student engagement is a critical determinant of educational success, profoundly impacting academic achievement, persistence in studies, and eventual graduation rates (Gao et al., 2024). Within this context, student engagement refers to the way students are involved with learning processes, typically encompassing behavioural, emotional, and cognitive dimensions (Fredricks et al., 2004). In the context of this study, we focus primarily on behavioural engagement, which we define as the observable actions of students as they interact with GenAI tools—ranging from their participation in technology-driven tasks to their proactive involvement in GenAI-enhanced learning environments. This definition draws on the Serrano et al., (2019) framework, which suggests that behavioural engagement is vital to exploiting the educational potential of technological innovations. To understand how the engagement dynamics interact with the socio-cultural and technological facets of HE, it is useful to employ a robust analytical framework. Activity theory offers a powerful lens for this analysis, elucidating the roles that tools, community norms, and the division of labour play in shaping the technology adoption process. This approach enables a deeper examination of how GenAI can be integrated to enhance student engagement effectively, considering the complex interplay of socio-cultural factors.

Research indicates that socio-cultural factors, such as community norms, technological accessibility, and educational objectives influence technology adoption (Shahzad et al., 2024). Aljeeran (2016) highlighted that socio-cultural acceptance is crucial for the adoption of educational technologies among faculty members. Similarly, Bandyopadhyay et al., (2021) demonstrated how leveraging community norms and technological accessibility can help bridge educational divides through social technologies. McCance et al., (2023) identified that success in academic teams hinges on (*object*), an engaging environment (*community*), and clear *division of labour*. Furthermore, Jones and Shao (2011) emphasised the importance of adopting a socio-culturally inclusive approach to integrate technology in higher education. These insights stress the critical role of understanding socio-cultural dynamics, particularly in enhancing GenAI usage in Nigerian higher education, where empirical evidence remains scant. Addressing this gap is vital to effectively merging theoretical insights with practical GenAI applications.

Activity theory provides a robust framework for analysing the socio-cultural aspects of technology integration in education (Engeström, 2014; Vygotsky & Cole, 1978). This theory emphasises the interplay between *individuals*, *community norms*, *tools*, and *objectives* in shaping activity systems. Empirical studies using activity theory have demonstrated its utility in understanding technology adoption in various educational settings (Kahu, 2013; McCance et al., 2023). Additionally, research on GenAI in education suggests that these technologies can positively enhance learning outcomes if appropriately integrated (Abbas et al., 2024; Essien et al., 2024; Nguyen et al., 2024). However, the successful implementation of GenAI hinges on aligning technological tools with socio-cultural contexts, which remains underexplored especially within Nigerian HE.

Nigeria's diverse cultural landscape presents both opportunities and challenges for technology integration. Varying community norms, technological infrastructure, and

educational objectives across regions require a distinctive examination to understand how students perceive and use GenAI (Yusuf et al., 2024). This is essential as it can reveal underlying mechanisms that either facilitate or hinder the effective adoption of GenAI. This study aims to fill this gap by providing empirical evidence on the socio-cultural dynamics influencing GenAI engagement in Nigerian universities. By doing so, our study contributes to the field by highlighting the intersection of culture and technology in educational contexts.

The main contribution of this study is a comprehensive analysis of how socio-cultural factors affect students' engagement with GenAI in Nigerian HE. Using activity theory as conceptual framework, we examine the relationships between community norms, technological tools, and educational objectives in shaping students' engagement with GenAI (Engeström, 2014). The findings advance the understanding of technology adoption in culturally diverse educational settings and inform strategies for promoting effective GenAI integration. This research challenges existing assumptions and provides new insights into the socio-cultural dynamics of technology adoption in Nigerian HE.

The outcomes of this study can enable the development of practical strategies for overcoming socio-cultural barriers to technology integration and enhancing educational practices in Nigerian HE. By uncovering the specific socio-cultural factors that influence GenAI engagement, the study provides actionable recommendations for educators and policymakers. Additionally, the research contributes to theory development by integrating activity theory with empirical findings from the Nigerian context, offering a comprehensive understanding of technology adoption in education (McCance et al., 2023; Yusuf et al., 2024).

## **Theoretical background**

### **Activity theory**

Activity theory (Vygotsky & Cole, 1978) is a prominent framework for examining human interactions with technology and their surrounding environments (Engeström, 2014). Activity theory emphasises the importance of cultural and social contexts in shaping human behaviour and learning, which can provide a comprehensive framework for understanding the dynamics of integrating technology (i.e., GenAI) within HE settings.

In educational research, activity theory has been used to explore how technological tools mediate learning and teaching processes. For example, Guo et al., (2020) found that the application of digital tools in an intercultural education context can create a complex network of interactions and contradictions. Furthermore, learning analytics are significantly enhanced by a theory-driven shared language, facilitating the sense-making of educational data (Poquet, 2024). This necessitates a comprehensive and critical understanding of how technology impacts learning, particularly through a model that systematically decodes these interactions.

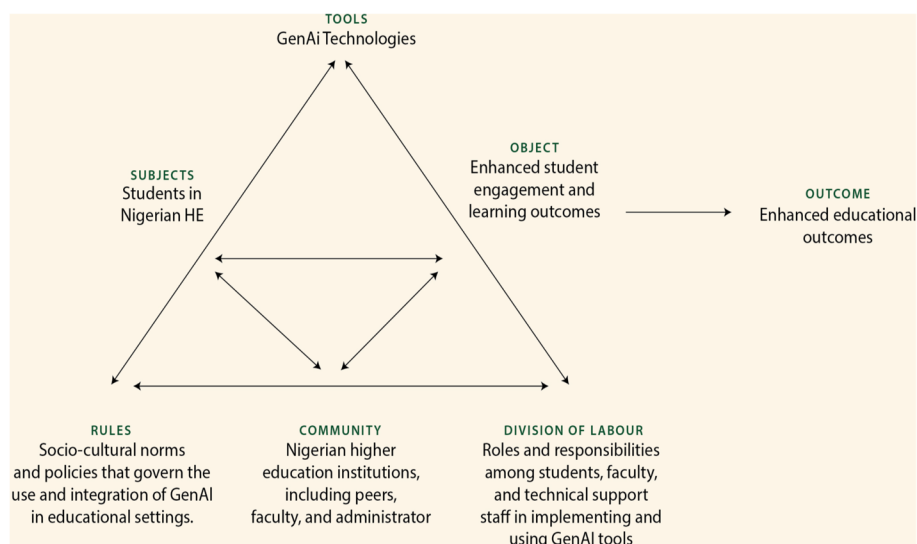
In recent literature, technology has been highlighted as a mediating artifact that both influences and is influenced by the educational practices of a community (Toprani et al., 2023). This highlights the bidirectional impact between educational practices and technological tools, showing that effective technology integration must align well with educational goals and community norms. Activity theory has been shown to uncover the

socio-cultural factors that influence technology adoption and use in educational settings (McCance et al., 2023; Poquet, 2024).

Figure 1 shows the research model of the dynamic interactions between various components in the integration of GenAI technology in Nigerian HE, adapted from activity theory. The **subjects** are the students in Nigerian HE who engage with the **tools**, which are the GenAI technologies, aiming towards the **object** of enhanced student engagement and learning outcomes. The **community** encompasses Nigerian HE institutions, including peers, faculty, and administrators who support and influence the use of GenAI. **Rules** refer to the socio-cultural norms and policies governing the use and integration of GenAI in educational settings. The **division of labour** indicates the roles and responsibilities among students, faculty, and technical support staff in implementing and using GenAI tools. The ultimate **outcome** is improved educational practices and policies.

The model in Figure 1 can be used to conceptualise the interplay between the socio-cultural context and technological adoption, highlighting how community norms, policies, and educational objectives shape the integration and effectiveness of GenAI technologies. Understanding these interactions can help identify the factors that facilitate or hinder the successful adoption of GenAI in Nigerian HE, providing valuable insights for educators, administrators, and policymakers to enhance educational outcomes through strategic technology integration. Adapting activity theory to the Nigerian HE landscape is particularly interesting due to the unique challenges and opportunities present within the Nigerian educational system. For example, varying levels of technological infrastructure, diverse socio-economic backgrounds of students, and differing institutional capabilities, which impact the adoption of GenAI technologies (Eli-Chukwu et al., 2023; Okolie et al., 2021; Okotie & Agir, 2024).

Besides, our study sheds light on the importance of localised educational policies and practices that resonate with the socio-cultural realities of Nigerian HE. It highlights the need for comprehensive training programs for faculty and technical staff to effectively



**Figure 1** Theoretical Model (adapted from Vygotsky and Cole, 1978)

utilise GenAI tools, ensuring that both educators and students can maximise the benefits of these technologies. Finally, our research model highlights emergent themes in the early stages of adoption of GenAI adoption, recommending that supportive policies and clear guidelines are essential for fostering innovation in education.

### **Socio-cultural dynamics and technology adoption**

Technology adoption in education is profoundly influenced by socio-cultural dynamics (Barrett & Pack, 2023; Bearman et al., 2023). These dynamics collectively shape the engagement with and effectiveness of new technologies (Bandyopadhyay et al., 2021). In the context of Nigerian HE, understanding these socio-cultural factors is vital for successful technology integration (Yusuf et al., 2024).

Community norms refer to the shared expectations and behaviours within a community that influence how technology is perceived and used. These norms can either facilitate or hinder the adoption of new technologies depending on their alignment with cultural values and practices. For example, socio-cultural acceptance positively affects the adoption of educational technologies among faculty members (Aljeeran, 2016), bridges educational divides by leveraging community norms and technological accessibility (Bandyopadhyay et al., 2021; Shahzad et al., 2024; Walter, 2024), and promotes collaborative learning environments through culturally responsive teaching methods (Abbas et al., 2024; Shadiev et al., 2015). Understanding these norms is essential for designing interventions that resonate with the target community.

Technological accessibility, or the availability and usability of technological tools, is another critical factor. McCance et al., (2023) identified that shared goals, environment, and clear division of labour are essential for the success of academic teams using technology. The infrastructure and support systems in place considerably impact how readily students and educators can adopt new technologies (Delcker et al., 2024; Ding et al., 2023). Additionally, educational objectives—the goals and purposes of educational activities—also play a pivotal role in technology adoption. Clear and shared objectives help align the use of technology with educational goals, enhancing its effectiveness. Jones and Shao (2011) emphasise the need for a socio-culturally inclusive approach to technology integration, highlighting the importance of aligning technological tools with educational objectives. When educational objectives are clearly defined and widely understood, they can drive the effective use of technology to achieve desired learning outcomes.

### **GenAI and educational technology**

GenAI offers new possibilities for personalised learning, automated content creation, and enhanced educational experiences (Nguyen et al., 2024). The integration of GenAI in education has been shown to improve learning outcomes by providing tailored educational resources and facilitating interactive learning environments (Crawford et al., 2024; Tlili et al., 2023). Furthermore, GenAI can assist in real-time language translation, making education more accessible to non-native speakers (Ding et al., 2023; Tan et al., 2022). It also supports teachers by automating administrative tasks, freeing up more time for instruction and student interaction (Delcker et al., 2024; Essien et al., 2024). Additionally, GenAI enhances collaborative learning by facilitating group projects and

peer-to-peer tutoring through intelligent virtual assistants (Barrett and Pack, 2023; Nguyen et al., 2024).

Recent studies have explored the potential of GenAI in various educational contexts. For instance, Nguyen et al., (2024) show its impact in enhancing student engagement and learning outcomes when integrated into the curriculum. Essien et al., (2024) found its impact on developing critical thinking skills in postgraduate students. These technologies enable the creation of adaptive learning systems that respond to the individual needs of students, providing personalised feedback and support (Abbas et al., 2024; Chan and Zhou, 2023; Lee et al., 2024). In addition, GenAI has been used to analyse student data to predict learning outcomes and tailor educational content accordingly (Yunusa & Umar, 2021). It also facilitates collaboration among students through AI-driven group projects and peer tutoring systems. Furthermore, GenAI has proven effective in enhancing remote learning environments by offering interactive and engaging digital content (Neupane et al., 2024).

However, the successful adoption of GenAI in education requires addressing several challenges. These include issues related to data privacy, technological infrastructure, and the importance of aligning AI tools with pedagogical goals (Nguyen et al., 2024; Shahzad et al., 2024; Walter, 2024). Addressing these challenges is crucial for leveraging the full potential of GenAI in educational settings. Aligning AI tools with educational objectives ensures that these technologies enhance rather than replace traditional teaching methods, fostering a balanced and effective learning environment (Yusuf et al., 2024). By overcoming these obstacles, educators can harness the full potential of GenAI, creating more engaging, efficient, and personalised educational experiences. Table 1 summarises the factors influencing the adoption and

**Table 1** Key factors impacting GenAI adoption and use in higher education

Factor	Key contributions	Relevant studies	Impact on GenAI adoption
Community norms	Influences perceptions and usage of technology. Can facilitate or hinder technology adoption.	Aljeeran, 2016; Bandyopadhyay et al., 2021	Critical in shaping the acceptance and integration of GenAI in educational contexts.
Technological accessibility	Availability and usability of tools. Essential for successful technology adoption.	McCance et al., 2023	Directly affects the practical implementation and effectiveness of GenAI tools.
Educational objectives	Alignment with pedagogical goals enhances the effectiveness of technology in education.	Jones and Shao, 2011	Ensures that GenAI tools are used to achieve desired educational outcomes.
GenAI in learning	Enhances personalised learning, automates content creation, and supports interactive learning.	Adamu and Benachour, 2020; Nguyen et al., 2024	Improves learning outcomes and engagement.
Challenges in GenAI adoption	Includes data privacy, infrastructure needs, and alignment with pedagogical goals.	Nguyen et al., 2024	Must be addressed to fully leverage GenAI benefits in education.
GenAI in Nigerian HE	Influenced by variability in infrastructure, access to resources, and cultural attitudes.	Yusuf et al., 2024; Elkefi et al., 2024	Poses unique challenges and opportunities for integrating GenAI effectively.



effectiveness of GenAI in educational settings, highlighting socio-cultural dynamics, technological accessibility, and educational objectives as pivotal elements.

### **GenAI in the Nigerian HE landscape**

The integration of GenAI in Nigerian HE presents unique opportunities and challenges shaped by the diverse socio-cultural landscape in Nigeria. The Nigerian HE system is characterised by variability in technological infrastructure, access to educational resources, and community norms, which collectively influence the adoption of new technologies (Yusuf et al., 2024). Community norms in Nigerian HE can either facilitate or hinder the adoption of GenAI. The acceptance and use of new technologies are often influenced by cultural attitudes towards technology and innovation, including community support and positive attitudes towards technology (Elkefi et al., 2024).

Technological infrastructure is another critical factor in the Nigerian context (Adeniyi et al., 2024). The availability of reliable internet access, sufficient hardware, and technical support are essential for the successful integration of GenAI. Disparities in infrastructure across different regions and institutions also pose important challenges (Yusuf et al., 2024). Aligning GenAI tools with the educational goals of institutions and ensuring that these tools address the specific needs of Nigerian students is vital for effective integration. This alignment requires a thorough understanding of the local educational context and a commitment to addressing the unique challenges faced by Nigerian HE institutions (Neupane et al., 2024; Yusuf et al., 2024).

### **Purpose, research questions and hypotheses**

From the foregoing, the purpose of this study is to investigate the socio-cultural dynamics influencing the adoption and utilisation of GenAI technology in Nigerian HE. We argue that this is essential for providing actionable insights into how GenAI can be effectively integrated into educational practices and policies. This integration has the potential to enhance learning outcomes and technological engagement among students and educators, thereby addressing existing educational challenges.

To address these aspects, our study is guided by the following research questions and hypotheses:

**RQ1: *How do community norms, technological tools, and the object of activity influence students' engagement with GenAI in Nigerian higher education?*** To answer this question, we make three hypotheses:

*H1a Community norms positively influence students' engagement with GenAI technology.* This hypothesis is supported by Aljeeran (2016), who found that socio-cultural acceptance positively impacts technology adoption.

*H1b The availability and usability of technological tools positively influence students' engagement with GenAI technology.* McCance et al., (2023) demonstrated that accessible and user-friendly tools are crucial for effective engagement.



*H1c* The educational objectives (object of activity) positively influence students' engagement with GenAI technology. Jones and Shao (2011) emphasised the importance of aligning technology with educational objectives to enhance its effectiveness.

**RQ2: What are the potential contributions of the socio-cultural dynamics of technology integration to educational practices and policies in Nigerian higher education?**

*H2a* Positive socio-cultural dynamics of technology integration contribute to improved educational practices. Bandyopadhyay et al., (2021) highlighted that culturally responsive technology integration can enhance educational practices.

*H2b* Positive socio-cultural dynamics of technology integration inform effective educational policies. Yusuf et al., (2024) suggested that understanding socio-cultural factors is vital for developing policies that support equitable and effective technology use in education.

## **Methodology**

### **3.1 Research instrument**

This study used a survey<sup>1</sup> to investigate how socio-cultural dynamics influence student engagement with GenAI technology in Nigerian higher education. The survey included questions on a 5-point Likert scale, from “Strongly disagree” to “Strongly agree.” The instrument was rigorously evaluated to ensure both validity and reliability. To ensure content validity, a panel of three senior academics—each with over a decade of experience in HE technologies—evaluated the questionnaire. Following their feedback, minor modifications were applied to the survey. Subsequently, the revised questionnaire was pilot tested with 41 educators in HE to evaluate its readability and appropriateness, with no major concerns reported.

While the survey was designed to capture a comprehensive array of responses concerning students' engagement with GenAI technologies, it did not specifically account for individual differences in prior experience or frequency of GenAI use. These factors are recognised as potentially influential in shaping student perceptions and engagement.

### **Sampling and procedure**

The target demographic for this study included students from public and private universities in Nigeria. The study used both convenience and purposive sampling to achieve a diverse student representation. Invitations to participate in the survey were distributed through university email lists and recruitment posters placed around campuses. The study collected 899 complete responses from students across 17 public and private universities in Nigeria. Selection criteria included current/past enrolment in a Nigerian university. Ethical considerations were addressed by obtaining informed consent from all participants, ensuring anonymity, and maintaining data confidentiality. The data

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<sup>1</sup> <https://forms.office.com/e/yeehbc7r4q>

collection for this study was conducted from June to August 2024. It is important to note the timeframe as recent advances and increased adoption of GenAI tools in educational settings may influence students' familiarity and proficiency with these technologies, potentially impacting their engagement and responses.

### **Data analysis procedure**

Data analysis was done using IBM SPSS 24, including cleaning for completeness and consistency. Descriptive statistics, including means, standard deviations, and frequency distributions, were calculated to summarise demographic characteristics and response patterns of the sample. The reliability of the survey instrument was confirmed using Cronbach's alpha (Cronbach, 1951) to ensure internal consistency of the items. We obtained a Cronbach's alpha value of 0.89, which indicates a high level of reliability, suggesting that the survey items are consistently measuring the same underlying concept. This is crucial for ensuring that the findings derived from the survey are based on stable and consistent measurements. Construct validity, which assesses the accuracy with which a survey measures the theoretical construct it intends to measure, was confirmed through factor analysis, following the method outlined in Hair (2009). This verifies that the questionnaire items are appropriately grouped under their respective constructs, further affirming the validity of the survey instrument used in this study.

Multiple linear regression was employed to test the hypotheses, chosen for its robustness in examining relationships between multiple predictors and a single outcome. This approach offers clear interpretation and is more efficient for handling the sample size compared to PLS-SEM, which is often used for complex models and smaller samples (Wong, 2013). The assumptions of normality, linearity, homoscedasticity, and independence of residuals were verified through residual plots and Shapiro-Wilk tests. Regression analysis revealed that while community norms and technological tools influenced engagement, educational objectives did not yield a statistically significant effect, suggesting differential impacts of socio-cultural factors on technology adoption. The results were interpreted within the context of existing literature to provide insights and inform strategies for effective technology integration in Nigerian HE.

## **Findings and analysis**

### **Descriptive statistics**

Table 2 summarises our participant demographic, showing that respondents were mainly undergraduates ( $n=472$ , 53%) aged between 18 and 24 ( $n=243$ , 27%), with an almost evenly split gender distribution comprising 52% men ( $n=463$ ), and 428 women (48%), with the remainder identifying as others ( $n=8$ ). This diverse demographic provides a comprehensive overview of perspectives across various educational levels, disciplines, and age groups, enriching the analysis of socio-cultural dynamics in GenAI technology engagement.

### **Hypothesis testing**

Table 3 summarises the output of our analysis. H1a is supported, with the regression results indicating that community norms positively influenced student engagement with the technology, suggesting that community norms explain approximately 22.6%

**Table 2** Respondent demographics (N=899)

Variable	Man	Woman	Others	Grand Total
<i>Education level</i>				
Postgraduate research (MPhil, PhD)	57	51	1	109
Postgraduate taught (MSc, MA, etc.)	146	165	7	318
Undergraduate	260	212		472
<i>Academic discipline</i>				
Business and management	83	77	4	164
Engineering and technology	83	96	1	180
Humanities	56	65		121
Law and Education	66	58	2	126
Natural sciences	74	59		133
Social sciences	101	73	1	175
<i>Age</i>				
18–24	123	113	7	243
25–34	184	178	1	363
35–44	87	84		171
45–54	59	44		103
55 or older	10	9		19

of the variance in students' engagement with GenAI technology,  $R^2 = .226$ ,  $F(2, 896) = 178.184$ ,  $p < .001$ . Our analysis shows that peer encouragement of GenAI use influences student engagement,  $\beta = .484$ ,  $t = 15.795$ ,  $p < .001$ , with the specific aspect relating to faculty encouragement showing a non-significant influence on students' engagement,  $\beta = -.033$ ,  $t = -1.091$ ,  $p = .276$ . This emphasises the importance of peer encouragement in fostering a conducive environment for technology adoption.

H1b proposed that the availability and usability of technological tools positively influence students' engagement with GenAI technology. The analysis supported the hypothesis, with the results showing that the ease of use of GenAI tools positively influenced student engagement,  $\beta = .489$ ,  $t = 17.450$ ,  $p < .001$ , while access to technical support also showed a negative influence on engagement,  $\beta = -.380$ ,  $t = -13.560$ ,  $p < .001$ . Overall, the regression model showed that the availability and usability of technological tools account for 31.8% of the variance in engagement,  $R^2 = .318$ ,  $F(2, 896) = 250.504$ ,  $p < .001$ . This highlights the critical role of accessible and user-friendly technology in enhancing student interaction with GenAI. In other words, while ease of use of the tools enhances engagement, increased access to (and use of) technical support might indicate underlying issues with the technology that require support, thereby negatively impacting overall engagement.

H1c suggested that educational objectives (*object* of activity) positively influence students' engagement with GenAI technology. Our analysis supported this hypothesis with positive relationships for GenAI enhancing learning outcomes,  $\beta = .430$ ,  $t = 9.087$ ,  $p < .001$ , and its essential role in keeping up with academic requirements,  $\beta = .251$ ,  $t = 5.882$ ,  $p < .001$ . The  $R^2$  value of .189 indicates that educational objectives account for 18.9% of the variance in engagement,  $R^2 = .189$ ,  $F(2, 896) = 148.647$ ,  $p < .001$ , demonstrating that aligning GenAI with educational goals is a pivotal factor. Both the perception that GenAI enhances learning outcomes and its necessity

**Table 3** Regression results

Hypothesis	Predictor	R	R <sup>2</sup>	$\beta$	t	p	Supported
H1a– <b>Community norms</b> positively influence students' engagement with Generative AI technology	Constant	.476	.226		7.211	<.001**	Partially
	Encouraged by peers			.484	15.795	<.001**	
	Encouraged by faculty			–.033	– 1.091	.276	
H1b–The <b>availability</b> and <b>usability</b> of technological tools positively influence students' engagement with Generative AI technology	Constant	.564	.318		15.943	<.001**	Supported
	Ease of use of GenAI tools			.489	17.450	<.001**	
	Access to technical support			–.380	– 13.560	<.001**	
H1c–The <b>educational objectives</b> (object of activity) positively influence students' engagement with Generative AI technology	Constant	.435	.189		5.801	<.001**	Supported
	GenAI enhances learning outcomes			.307	9.087	<.001**	
	GenAI is essential for keeping up with academic requirements			.199	5.882	<.001**	
H2a–Positive socio-cultural dynamics of technology integration contribute to improved <b>educational practices</b>	Constant	.715	.511		4.938	<.001**	Partially
	GenAI enhances learning outcomes			.450	14.505	<.001**	
	Encouraged by peers			.071	2.152	.032*	
	GenAI is essential for keeping up with academic requirements			.171	5.438	<.001**	
	GenAI tools available at my institution are easy to use.			.184	6.033	<.001**	
	I have access to adequate technical support for using GenAI technology.			–.001	–.056	.956	
H2b–Positive socio-cultural dynamics of technology integration inform effective <b>educational policies</b>	Constant	.692	.479		4.071	<.001**	Supported
	GenAI enhances learning outcomes			.307	9.593	<.001**	
	Encouraged by peers			.153	4.510	<.001**	
	GenAI is essential for keeping up with academic requirements			.313	9.669	<.001**	
	GenAI tools available at my institution are easy to use.			.081	2.566	.010*	
	I have access to adequate technical support for using GenAI technology.			.004	.165	.869	

\* $p < .05$ , indicates statistical significance at the 5% level. \*\* $p < .01$ , indicates statistical significance at the 1% level

for meeting academic requirements positively influence students' engagement with GenAI technology.

For H2a, the analysis showed a strong positive correlation between socio-cultural dynamics of technology integration and educational practices,  $R = .715$ . Specifically, we found that *peer encouragement* was positively correlated with GenAI enhancing *learning outcomes*,  $\beta = .450$ ,  $t = 14.505$ ,  $p < .001$ , *ease of use* of GenAI tools,  $\beta = .071$ ,  $t = 2.152$ ,  $p = .032$ , and for keeping up with *educational requirements*,  $\beta = .171$ ,  $t = 5.438$ ,  $p < .001$ . The findings suggest that these factors explain 51.1% of the variance in improved

educational practices,  $R^2 = .511$ ,  $F(2, 896) = 84.545$ ,  $p < .001$ , confirming that supportive socio-cultural contexts are instrumental in advancing educational practices through technology integration.

Finally, we hypothesised in H2b that positive *socio-cultural dynamics of technology integration* can inform effective *educational policies*. The model reported an  $R^2$  value of .479, indicating that socio-cultural factors accounted for 47.9% of the variance in effective educational policies, emphasising their critical role in shaping policies that support the integration of GenAI technology. Additionally, the model demonstrated a strong correlation with an R-value of .692,  $(2,896) = 84.914$ ,  $p < .001$ , highlighting the influence of these dynamics on policy effectiveness. Overall, the regression results revealed significant positive relationships for GenAI enhancing *learning outcomes*,  $\beta = .307$ ,  $t = 9.593$ ,  $p < .001$ , peer encouragement,  $\beta = .153$ ,  $t = 4.510$ ,  $p < .001$ , and *ease of use* of GenAI tools,  $\beta = .081$ ,  $t = 2.566$ ,  $p = .010$ . These findings indicate that positive socio-cultural factors—specifically, the enhancement of learning outcomes through GenAI, peer encouragement, and usability of GenAI tools—contribute to shaping and supporting effective educational policies. Thus, fostering a supportive socio-cultural environment is crucial for the successful integration of GenAI technology in educational settings, ensuring that such integration is both beneficial and sustainable.

These findings collectively affirm the hypotheses and highlight the impact of socio-cultural dynamics, technological accessibility, and educational objectives on the adoption and effectiveness of GenAI technology in Nigerian higher education. Our analysis provides robust evidence for the critical role of community norms, user-friendly technological tools, and aligned educational objectives in fostering engagement with GenAI, thereby enhancing educational practices and informing effective policies. The detailed results offer valuable insights into the key factors driving technology integration in educational settings (see Table 3).

## Discussion and implications

The aim of this study was to explore the influence of socio-cultural factors on students' engagement with GenAI technology in Nigerian higher education, using activity theory as the conceptual framework. The findings offer several important theoretical implications.

### Theoretical implications

First, our findings affirm the pivotal role that socio-cultural dynamics play in technology adoption within educational settings, echoing the insights of Engeström (2014) and Kahu (2013). Specifically, the positive influence of GenAI's ease of use on student engagement (H1b) highlights the importance of the *tools* dimension in activity theory, aligning with Vygotsky's (1978) emphasis on the mediating role of *tools* in shaping human *activity*. Additionally, the impact of educational objectives (H1c) illustrates the criticality of well-defined educational goals, reinforcing the notion that aligning technological adoption with pedagogical aims is pivotal for effective integration (Bearman et al., 2023).

The non-significant impact of faculty encouragement on student engagement with GenAI (H1a) challenges the prevailing assumptions in the literature, which have traditionally emphasised the critical role of faculty support in technology adoption (Jones &

Shao, 2011; Oyetade et al., 2020). Our findings suggest that student engagement with GenAI is influenced more by the usability of the tools than by faculty attitudes. In Nigerian HE, unique socio-cultural factors—e.g., varying technological infrastructure, differing community norms, and distinct educational objectives— influence GenAI adoption (Elkefi et al., 2024; Yusuf et al., 2024). Furthermore, Nigeria's diverse cultural landscape offers important opportunities and poses challenges for effective technology integration (Adeniyi et al., 2024). Strong communal ties and a culture of collaborative learning may encourage the adoption of user-friendly technologies, even in the face of less supportive faculty attitudes (Okai-Ugbaje et al., 2022). Understanding these dynamics is crucial for integrating GenAI in Nigerian HE.

### **Practical implications**

The findings of this study hold strong implications for educators and administrators within Nigerian HE. The observed positive impact of the user-friendliness of GenAI tools on student engagement highlights the need for institutions to prioritise the selection and deployment of accessible GenAI technologies (Crawford et al., 2024). To further boost engagement, it is crucial to implement comprehensive training programs that enhance students' proficiency with these tools. Workshops, tutorials, and practical sessions should be designed to enhance students' ability at using GenAI technologies, thereby improving their overall educational experience.

Incorporating GenAI tools into the curriculum to align with academic goals has shown to elevate student engagement. Educators are encouraged to design learning activities and assignments that explicitly integrate GenAI tools, facilitating increased engagement and a deeper appreciation of the practical applications of GenAI in both academic and professional settings (Lo et al., 2024). For example, using GenAI in research projects, presentations, and group work can make learning experiences more interactive and aligned with real-world demands.

Despite minimal direct effects of faculty encouragement on student engagement, fostering a supportive attitude toward GenAI remains crucial. Developing faculty training programs to highlight GenAI benefits and integration into teaching is essential. Additionally, the negative impact of technical support on engagement necessitates reevaluating support frameworks. Institutions should enhance GenAI tool reliability and usability, reducing reliance on technical support through regular maintenance, software updates, and streamlined support systems. Implementing a centralised support system and providing comprehensive online resources can empower students to independently resolve minor issues, thereby improving the learning environment. Investing in high-quality, intuitive GenAI tools and ensuring they are readily accessible, coupled with consistent training sessions, will substantially strengthen both student and faculty engagement with GenAI technologies in Nigerian higher education.

### **Policy implications**

From a policy perspective, the findings of this study offer several recommendations for HE policymakers. The influence of tool usability in student engagement highlights the need for policies that prioritise the availability and integration of high-quality, user-friendly GenAI technologies (Punar Özçelik & Yangın Ekşi, 2024). Policymakers should

establish guidelines and standards for evaluating the usability and effectiveness of these tools before their adoption at educational institutions. This can ensure that only the most suitable technologies are integrated into the educational environment, thereby maximising their impact on student engagement and learning outcomes (Al Murshidi et al., 2024; Tlili et al., 2023). Specifically, there should be an emphasis on developing GenAI technologies that are tailored to the Nigerian context, such as those incorporating local languages and cultural nuances. This could involve collaboration with local tech developers to create GenAI tools that address specific educational needs within Nigeria.

The impact of clearly defined educational objectives on engagement highlights the need for policy frameworks that promote the integration of technology with pedagogical goals. Policymakers should advocate for curricula that ethically/responsibly incorporate GenAI tools to enhance learning outcomes. For instance, policies could require that every new curriculum include elements on using GenAI tools to meet specific learning objectives or assessments (Perkins et al., 2024). Furthermore, these policies should promote the development of customised GenAI applications tailored to the unique demands of various academic disciplines, ensuring purposeful and effective technology integration. Additionally, professional development programs focused on effective integration strategies and incentives for innovative teaching could support this alignment.

Training faculty to understand and integrate GenAI into teaching is crucial for policymakers. Professional development programs should equip faculty with the skills to use and effectively incorporate GenAI tools within teaching and learning. These programs can also foster sharing best practices and innovative strategies. It would be important to establish clear guidelines for evaluating and adopting GenAI technologies, emphasising user-friendliness, reliability, and alignment with educational objectives. Setting high standards ensures that the tools benefit both students and faculty. These standards should include metrics for continuous evaluation and improvement. Encouraging collaboration between educational institutions, technology developers, and policymakers can further enhance GenAI integration. Partnerships with tech companies can develop GenAI tools tailored to the Nigerian educational context, meeting the unique needs of students and educators and enhancing the overall educational experience.

### **Conclusion and future works**

The incorporation of Generative AI (GenAI) technology in Nigerian HE is shaped by socio-cultural dynamics. This study has provided interesting insights into how factors such as community norms, technological tools, and educational objectives influence students' engagement with GenAI. These findings hold crucial implications for educators, administrators, and policymakers striving to enhance the adoption and effective use of GenAI in educational settings.

We highlight the importance of user-friendly GenAI tools in fostering student engagement. The ease of use of these tools was found to be a critical factor, suggesting that investments in intuitive and accessible GenAI technologies are vital. Furthermore, the alignment of GenAI tools with educational objectives has been shown to enhance student engagement, highlighting the need for curricular designs that integrate AI in ways that directly support learning goals. While faculty encouragement did not impact engagement, promoting a supportive and encouraging attitude towards GenAI use can



still be beneficial, creating a positive learning environment and boosting students' confidence in using these tools.

These findings offer actionable strategies for educators, administrators, and policy-makers to optimise GenAI utilisation in educational settings. Prioritising the selection of high-quality, user-friendly GenAI tools, and providing comprehensive training programs for both students and faculty can enhance the effective use of these technologies. Institutions should also focus on developing robust IT infrastructures and support systems to ensure the reliability and usability of GenAI tools, thereby minimising disruptions and technical issues that could hinder engagement. From a policy perspective, the study emphasises the need for guidelines and standards that prioritise the usability and effectiveness of GenAI technologies.

### **Limitations and future works**

A significant limitation of the current study is the lack of data on the extent of students' previous experience with and the frequency of their use of GenAI tools. Previous research (Strzelecki, 2023) has indicated that familiarity and usage frequency can significantly affect users' perceptions and acceptance of new technologies. The absence of this data prevents a more dynamic understanding of the influences on student engagement and may limit the generalisability of our findings. Future studies are encouraged to include these factors to better predict and understand the complexities of GenAI adoption in educational settings.

Besides, while our study provides foundational insights into the socio-cultural dynamics influencing the adoption of GenAI in Nigerian higher education, it also reveals several areas for further exploration to enhance the depth and applicability of the findings. Future studies should aim to more comprehensively dissect the impact of specific socio-cultural factors on GenAI adoption across diverse educational environments. Although our focus was primarily on the Nigerian higher education system, subsequent research could broaden this scope to include comparative analyses between developed and developing countries. Such studies would offer valuable perspectives on how different socio-economic settings influence technology integration in education.

Additionally, further research could investigate the variability of socio-cultural impacts across different student demographics or institutional types within Nigeria. This approach would deepen our understanding of how the adoption of GenAI might differ based on local cultural norms, economic conditions, and educational objectives. It is crucial to examine these variations to develop more targeted educational technologies that address the specific needs of varied student groups. These future research opportunities are critical for advancing our understanding of how GenAI impacts education and ensuring its effective integration to enhance teaching and learning outcomes globally.

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### **Author contributions**

Aniekan Essien conceived of the presented idea and problematized the study. Adewale Salami and Adesina Sodiya performed the analysis literature review. Olubunmi Ajala verified the analytical methods and provided proof-reading as well as design and typesetting. Bamidele Adebisi supervised the findings of this work. Grace Essien was responsible for data collection. All authors discussed the results and contributed to the final manuscript.

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**Availability of data and materials**

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**Declarations****Competing interests**

The authors declare that they have no competing interests.

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