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Acceptance of Artificial Intelligence (ChatGPT) in Education: Trust, Innovativeness and Psychological Need of Students

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Abstract
Since students are key stakeholders and reliable sources of information, their acceptance or rejection of artificial intelligence (AI) tools like ChatGPT can influence the general student population's uptake of AI in education. In this study, we investigated the acceptability of AI tools among students in higher education in Ghana. A cross-sectional design was used to collect data from 146 students through a self-administered online survey. Descriptive analysis and structural equation modelling were performed and a conceptual framework was developed to explore the interplay between perceived usefulness, social influence, innovation characteristics, and psychological needs of students. The findings indicated that more than half (n = 102, 69.9%) of them indicated acceptance of AI in education if available while about one-third (n = 44, 30.1%) indicated non-acceptance of AI, prompting policies to be in place for its acceptance and use in education. Additionally, the results demonstrate that the effect of perceived usefulness, social influence, innovation characteristics, and psychological needs of students on AI acceptance in education is positively significant. Concerns about lack of awareness (n = 33, 35.1%), privacy and consent (n = 19, 20.2%) and disruption of the traditional teacher-student relationship (n = 15, 16%) were identified as the main reasons students would decline uptake of AI tools in education. Action from authorities in higher education is needed to address students' hesitancy about AI tools and such interventions must consider the age and sex of the students.
Keywords: artificial intelligence, education, ChatGPT, innovation, trust, technology acceptance
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1. Introduction

In recent times, there has been a rapid proliferation of artificial intelligence (AI), which has permeated diverse fields in teaching and learning. Irrespective of the nature of technology or its perceived advantages, the subject of technology acceptance and utilization by stakeholders in education continues to captivate the attention of researchers and practitioners (Dwivedi *et al*., 2023). Especially, the release of ChatGPT in education has sparked considerable concern among academics, particularly regarding the preservation of academic integrity in university classrooms. Some scholars have voiced apprehensions, labelling these systems as facilitators of "high-tech plagiarism" and a means for students to evade genuine learning. Academic integrity issues persist, despite the existence of tools designed to detect generative AI-generated text. Nevertheless, dismissing the potential presented by such technologies based solely on academic integrity is a concern. These emerging technologies hold the power to fundamentally reshape the classroom experience and enhance the knowledge and skills outcomes for our students (Chen *et al*., 2023). Recognizing the incredible possibilities offered by these technologies, the acceptability from students' perspectives is essential to embrace this emerging technology. This study's focus revolves around how to recognize and foster the acceptance of innovation such as AI in teaching and learning, to maximize the associated benefits. It is important to underscore that, despite the augmented attention that AI is enjoying in education, the methods and strategies for effectively integrating these technologies into teaching and learning remain ambiguous (Popenici & Kerr, 2017; Rospigliosi 2023).

Given the nascent state of investigation in this field, the existing body of literature remains limited. AI in education, with its potential to challenge fundamental assumptions about research, including those pertaining to technology acceptance, is anticipated to have a transformative impact on teaching and learning (Rospigliosi 2023). Nonetheless, certain overarching theories regarding technology adoption offer a suitable starting point for exploration and can inform the development of a research agenda. Among these theories, the technology acceptance model (TAM) still holds significant recognition, having been introduced almost two decades ago (Lee, Kozar & Larsen, 2003). While the TAM framework is broad and applicable to various contexts of technology acceptance, customized adaptations of this theory are necessary to address specific contextual nuances in education.

Despite the long-standing presence of AI in education since the 1960s, its actual potential and ability to create substantial commercial impact have remained considerably constrained until recent times, primarily due to limitations in computational capabilities (Venkatesh, Raman & Cruz-Jesus, 2023). However, the contemporary computing landscape, characterized by the availability of vast quantities of diverse data, has rendered the

realization of AI's potential as a viable and practical engine for innovation. Nevertheless, it is crucial to acknowledge that AI is not without its skeptics and challenges. Researchers seeking further insights into these issues are encouraged to refer to Dwivedi *et al*. (2023) for an in-depth exploration of some of the challenges and prospects associated with AI in education. Assuming these concerns are adequately addressed, the inquiry into how AI can effectively synergize with other emerging technologies remains an open question warranting further examination in education.

Within the realm of AI tools, a selected number of scholarly articles have emerged that shed light on potential avenues for future research. For instance, Chen *et al*. (2023) present a pioneering study that introduces an innovative AI instructor along with an integrated strategy for evaluating students' acceptance and utilization of this technology. The research explored the factors influencing acceptance by drawing upon two well-established theoretical frameworks: the Technology Acceptance Model and the Task-Technology Fit Theory. The identified factors of acceptance encompass robot usage anxiety, perceived usefulness, perceived ease of use, and robot instructional task difficulty.

Moreover, these overarching dimensions have been further nuanced by incorporating concerns specifically associated with AI, such as the model's psychological needs of users (Ryan & Deci, 2013). Expanding upon this foundational concept, our focus centres on exploring technology acceptance as a pivotal factor and presents an agenda that endeavours to identify the determinants that hold relevance within the context of AI education. Investigating technology characteristics, or more specifically, technology attributes, as a central focal point for facilitating the adoption of technologies has garnered considerable attention from researchers across diverse domains. However, the use of TAM or its variations remains somewhat limited within the existing body of literature on the acceptability of AI systems in education (Zhou, Xue, & Li, 2022).

In summary, students play a crucial role as key stakeholders and reliable sources of information. Their acceptance or rejection of AI can significantly influence the overall uptake of AI in education among the student population. Practitioners and policymakers heavily rely on students' input to guide decisions regarding the implementation of new technologies in education. For example, Raabe *et al*. (2019) identified a widening gender gap in STEM subject preferences influenced by how students adjust their preferences based on peer influence. Given this context, this study aims to assess and identify the factors influencing AI acceptability in education among university students in Ghana. Analyzing the acceptance of AI will: (i) empower students, educators, and researchers to develop effective interventions to address resistance towards AI (Generative Pre-trained Transformer - ChatGPT) in education, and (ii) highlight the potential for professionals (e.g., educators, students, developers) to utilize AI in both beneficial and detrimental ways.

2. Literature Review and Conceptual Model

2.1 Acceptance of AI Tools in Education

Since its launch in November 2022, ChatGPT has garnered considerable attention and sparked discussions about large language models (LLMs), especially with the release of GPT-4 in mid-March 2023. LLMs are AI tools that leverage multilayer recurrent neural networks trained on extensive data to generate text that closely resembles human language. Among the range of LLMs available, ChatGPT has achieved global recognition because it utilizes a transformer-based model, enabling efficient parallel processing of vast amounts of data, resulting in impressive capabilities in understanding and generating natural language (Zhang *et al*., 2021). Also, ChatGPT differentiates itself by providing free access and a user-friendly interface to individual users, shifting the primary user base of LLMs for the general public good. The widespread adoption of ChatGPT serves as a testament to the tremendous potential that LLMs possess.

AI, inspired by the functioning of the human neural system, aims to mimic human intelligence in understanding, learning, and research. It operates on the assumption that intelligence can be sufficiently described to be simulated by a machine (Chassignol et al., 2018). In its advanced state, AI possesses skills akin to human abilities (Montemayor et al. 2022), such as learning, recognizing situations, problem-solving, and communicating in natural language. What sets AI apart from other computer programs is its ability to self-learn, however, AI is still in its early stages of development and utilization across various fields (Nikitas et al. 2020).

Education is a significant domain where AI finds application. It has emerged as a fundamental pillar in science, technology, engineering and mathematics (STEM) education, supporting students in research and learning. Notably, AI systems can provide individualized instruction tailored to each student's unique interests, allowing for personalized learning experiences (Tapalova & Zhiyenbayeva, 2022). This versatility enables AI to rapidly detect whether a student requires further assistance as with gamified systems or when they have mastered a concept and can move on to more difficult material (Ofosu-Ampong, 2020).

Chatbots, AI-based programs capable of recognizing and understanding speech, have also become important tools in education (Adam, Wessel, & Benlian, 2021). They provide personalized learning support through various devices like computers, mobile devices, and speakers. Prominent examples of AI-powered chatbots include ChatGPT, Google Home and BARD. The interaction between chatbots and students in the classroom has the

potential to shape a new educational paradigm across scientific disciplines (Topal et al., 2021; Wu & Yu, 2023).

However, due to a lack of understanding, ethical issues and data and privacy concerns (Dwivedi et al., 2023), the use of AI in education is questionable and may affect its acceptance in higher education. This study, therefore, examines the acceptance of AI from the end-users (i.e. students') perspective. Students are a reliable source of information on educational topics to their peers; therefore, their acceptance or rejection of educational initiatives may influence the adoption and uptake of AI among the student population. Just as healthcare workers are trusted sources of information for patients, students can serve as reliable sources of educational guidance and support. The acceptance or endorsement of AI-powered educational tools and technologies by students can greatly influence the adoption and effectiveness of these tools among the student community. Furthermore, students who share their positive experiences with AI-based educational platforms and tools can inspire their peers to explore and utilize these resources, contributing to the overall improvement of the educational experience.

2.1.1 So, What is ChatGPT and What Might Happen if Used in Education?

Generative Pre-trained Transformer 3 (GPT-3) represents an autoregressive language model that employs deep learning techniques to produce textual content with a human-like quality, thereby mirroring natural speech patterns (Dale, 2021). Its inception dates back to the year 2020. ChatGPT, developed by OpenAI, is an example of an AI language model. With its deep learning algorithm, it can generate human-like responses to user queries, making it a potentially useful tool in a variety of applications. Within a relatively brief period, numerous endeavours have emerged, highlighting a wide range of real-life applications and showcasing the utility of ChatGPT. These applications span various domains, such as academia and education, and business (Enholm *et al*., 2022). ChatGPT and generative AI tools are hailed as the ultimate productivity hack, capable of drafting articles, emails, social media posts, and summaries for various types of text, leaving no conceivable example unexplored.

However, following the inadvertent disclosure of trade secrets by Samsung employees who employed ChatGPT for code-checking purposes, the company has imposed a ban on the utilization of ChatGPT and issued warnings of disciplinary consequences for non-compliance with the newly implemented restrictions. Also, due to strict financial regulations about third-party messaging, Bank of America and JPMorgan have restricted the use of ChatGPT in work activities. The temptation to cut mundane traditional assessment, learning and research, and school work into seconds seems to overshadow the purpose of teaching and learning. Thus, policies and guidelines may streamline ChatGPT in education properly. As AI is at the nascent stages of development, the study's contribution lies in augmenting the perspective through which we can analyze the acceptance and determinants of AI and other emerging technologies in education, benefiting both research and practical applications. The next section discusses the conceptual determinants of AI acceptance in education.

2.1.2 Risk of ChatGPT on Higher Education

Several concerns have been raised by scholars regarding the use of ChatGPT in educational settings. The reliability and precision of ChatGPT are under scrutiny due to potential biases and inaccuracies resulting from its training on a large dataset. The inclusion of studies primarily conducted in high-income nations and controversial books may contribute to bias. Additionally, ChatGPT lacks up-to-date information beyond 2021, which may lead to imprecise or unreliable comments, particularly on specific topics and current events (Prunkl *et al.,* 2021). These inaccuracies not only disrupt the learning process but also undermine the integrity and credibility of the educational experience, eroding the essential trust between educators and students.

A significant issue related to AI-generated content, including ChatGPT, is the increased prevalence of students passing off such content as their original work. Investigations have revealed that ChatGPT can bypass traditional plagiarism detection tools like 'TurnitIn' by generating seemingly unique information (Geerling *et al*., 2023). Literature suggests that students who utilize ChatGPT are more likely to engage in plagiarism compared to those who do not, posing a serious challenge to academic credibility and the fair assessment of student learning. Even in cases where ChatGPT usage is permitted in assessments, learners who use it gain an unfair advantage over those who do not, while teachers face difficulties in accurately assessing student performance and monitoring learning issues.

2.2 Conceptual Model

To understand the acceptance of AI ChatGPT by students, this study adopts two factors from the technology acceptance model and unified theory of acceptance and use of technology, and another two factors from the innovation diffusion theory and self-determination theory, respectively. By combining theories and models from technology acceptance, education, and psychology, a comprehensive conceptual framework can be created to elucidate the acceptance of artificial intelligence (AI) in education. These theoretical dimensions have been demonstrated to influence technology acceptance in different ways and contexts. Specifically, in an education context, students tend to prioritise and are mostly driven by their needs and personal attributes. This framework highlights four key constructs that are pertinent to understanding AI acceptance/use:

Perceived Usefulness: This construct draws from the Technology Acceptance Model (TAM) and emphasizes the significance of educators' and students' perceptions regarding the usefulness and ease of use (Davis 1989;

Glikson & Woolley, 2020) of AI-based tools in education. These perceptions play a crucial role in shaping the acceptance of AI in educational contexts.

Social Influence Factors: By incorporating elements of the Unified Theory of Acceptance and Use of Technology (UTAUT) and Social Cognitive Theory (SCT), this construct underscores the impact of social factors, observational learning, and self-efficacy on AI acceptance in education (Sahu, Padhy & Dhir, 2020). This study recognizes the influence of peers, mentors, and the social environment on individuals' acceptance behaviours.

Innovation Characteristics: Derived from the Innovation Diffusion Theory (IDT) (Wani & Ali, 2015), this construct accentuates the characteristics of the AI innovation itself (Rogers 2003), communication channels, adopter categories, and the role of opinion leaders and social networks in the diffusion and acceptance of AI in education (Ofosu-Ampong 2021). It considers factors that affect the spread and adoption of AI within the educational ecosystem.

Psychological Needs: Integrating aspects of Self-Determination Theory (SDT), this construct highlights individuals' intrinsic motivation, autonomy, and competence in the acceptance of AI in education (Ryan & Deci, 2013; Berkowitz *et al*., 2017). It acknowledges the importance of supporting educators' and students' psychological needs for autonomy, relatedness, and competence to foster acceptance.

By incorporating these four constructs into the conceptual framework, this study seeks to explore the interplay between perceived usefulness, social influence, innovation characteristics, and the psychological needs of students. This holistic approach offers a comprehensive understanding of the multifaceted factors that influence the acceptance of artificial intelligence in educational settings.

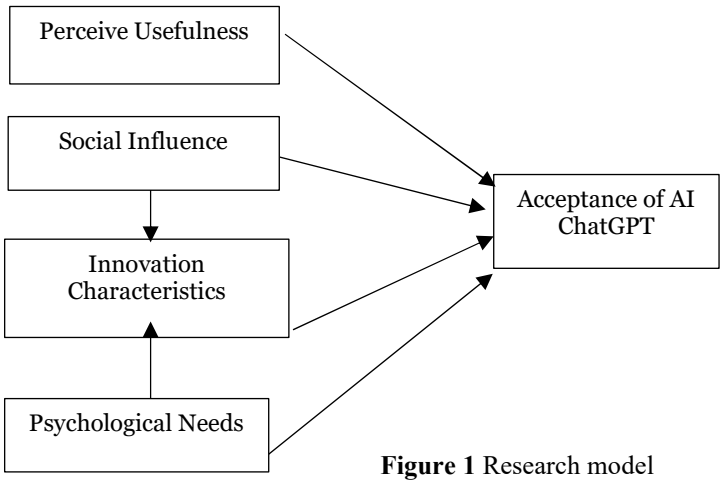

Figure 1 Research model

As shown in Fig. 1 the adapted model consists of four main constructs, namely perceived usefulness, social influence, innovation characteristics and psychological need, which affect the acceptance of AI in education.

3. Research Method

This survey is a cross-sectional study undertaken among students in higher education (HE) in Ghana, employing a convenient sampling technique. The study utilized a Google Form to construct an online self-administered questionnaire, which was subsequently disseminated through WhatsApp across various student platforms. Participation in the study was strictly voluntary, with measures in place to ensure the preservation of anonymity. To be included in the study, the participant must be a university student in a public university in Ghana and be willing to participate in the research. The data collection period spanned from August 16th, 2022 to October 15th, 2022. Throughout the study, meticulous adherence to ethical guidelines governing the collection of data from human subjects was observed.

3.1 Data Collection and Analysis

Survey online questionnaires were used to collect data from the student population. The questionnaire briefly collected socio-demographic data, and social trust data on AI acceptability and focused extensively on the four factors that influence the acceptance of AI in education. The question used a 5-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

The data were analysed using STATA v15 and SmartPLs v3 for structural equation modelling (SEM) – partial least squares (PLS). Descriptive statistics were employed to describe the sociodemographic attributes of the students while the SEM was used to assess the measurement model to evaluate the reliability and validity and correlation between the constructs and their indicators. Also, the structural model assessment was used to identify the path coefficients of the constructs. The perceived usefulness constructs were adapted from Davis (1989), social influence, innovation characteristics from Rogers (2003) and psychological needs constructs from Ofosu-Ampong

et al. (2021) and Ryan and Deci (2013).

4. Results

The analysis of the results is twofold. The initial analysis examines the demographic characteristics of the participant's acceptance of AI, while the subsequent analysis employs a structural equation model to assess the acceptability of AI based on the four primary constructs.

4.1 Analysis I: Demographic Analysis of AI Acceptability

4.1.1 Sample Characteristics. There were a total of 146 students who completed the online survey. Of the 146 students, more than half (n = 81, 55.5%) were aged 18-26 years. The majority of the student participants were males (n = 77, 52.7%), studying for the award of a diploma or first degree (n = 79, 54.1%), and living on-campus (n = 114, 78.1%). A higher proportion of males (n = 58, 75.3%) significantly indicated acceptance of AI tools in education compared to females (n = 44, 63.7%). Regarding employment status, the highest proportion (n = 78, 53.4%) of students were not employed and a higher proportion of students (n= 129, 88.4%) have heard and used AI tools like ChatGPT. Also, the majority (n = 79, 54.1%) of students have had positive results in using AI tools like ChatGPT. In terms of using AI tools again, 74% were certain of using it while 19.2% were not sure of its usage in future (Table 1).

4.1.2 Acceptance of AI in Education. Out of the 146 students who participated in this study, more than half (n = 102, 69.9%) of them indicated acceptance of AI in education if available while about one-third (n = 44, 30.1%) indicated non-acceptance of AI, prompting policies to be in place for its acceptance and use in education.

Table 1. Demographic profile of respondents

Profile	Category	n (%)	Acceptance of AI		p-value
			No *n* (%)	Yes *n* (%)	
Sex	Female	69 (47.3)	25 (36.2)	44 (63.7)	
	Male	77 (52.7)	19 (24.7)	58 (75.3)	0.217
Age	18-26	81 (55.5)	20 (24.7)	61 (75.3)	
	27-34	37 (25.3)	15 (40.5)	22 (59.5)	
	35 and above	28 (19.2)	9 (32.1)	19 (67.9)	0.015**
Employment status	Employed	68 (46.6)	21 (30.9)	47 (69.1)	
	Not employed	78 (53.4)	33 (42.3)	45 (57.7)	0.237
Place of residence	On-Campus	114 (78.1)	23 (20.2)	91 (79.8)	
	Off-Campus	32 (21.9)	4 (12.5)	28 (87.5)	0.047**
Level of education	Diploma/First degree	79 (54.1)	19 (24.1)	60 (75.9)	0.028**
	Postgraduate	67 (45.9)	8 (11.9)	59 (88.1)	
Heard and use AI tools e.g. ChatGPT	Yes	129 (88.4)	30 (23.3)	99 (76.7)	
	No	17 (11.6)	4 (23.5)	13 (76.5)	0.815
Results of using AI tools e.g. ChatGPT	Positive	79 (54.1)	11 (13.9)	68 (86.1)	
	Not sure	19 (13.0)	7 (36.8)	12 (63.2)	0.138
	Negative	48 (32.8)	27 (56.3)	21 (43.7)	
Chance of using AI tool again	Yes	108 (74.0)	21 (19.4)	87 (80.6)	
	Not sure	28 (19.2)	9 (32.1)	19 (67.9)	0.282
	No	10 (6.8)	5 (50.0)	5 (50.0)	

$p < 1^{*}$, $p < 0.05^{**}$, $p < 0.01^{***}$

Of the students who experienced positive results of using ChatGPT in learning, 75% think it is an effective alternative to attending class, while 90% of them revealed that the search results and assignments were correct. The positive results from these students may disrupt the traditional teacher-student relationship and class attendance (see Figure 2).

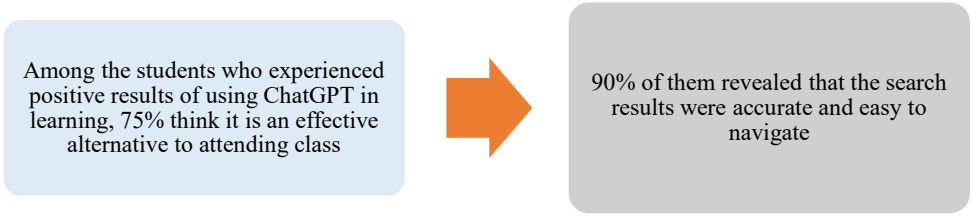

Figure 2

4.2 Trust and Acceptance of AI in Education

The study results indicate that approximately 45.2% of students trust in the value and expected benefits associated with the utilization of AI systems in education. Moreover, more than half (59.6%) of the students exhibited trust in the accessibility and user-friendliness of the AI systems. Additionally, a majority of the students (n = 96, 65.8%), placed their trust in the AI system and its decision-making capabilities. Similarly, 45.7% of students expressed trust in the transparency and explainability of AI systems.

On the other hand, a notable proportion of students, around 37.6%, experienced trust issues concerning the privacy and data security measures implemented for the use of AI systems. In contrast, a higher percentage of students (n = 89, 60.9%), acknowledged having a positive prior experience with the use of AI systems. Furthermore, approximately 39.7% (n = 53) trust their institution's (authorities) ability to establish criteria for the ethically acceptable use of AI, while 31.2% trust in the social and ethical implications associated with the use of AI systems in education (refer to Table 2).

Table 2. Trust and acceptance of AI education (ChatGPT)

Profile	Category	*n* (%)	Acceptance of AI		p-value
			Yes *n* (%)	No *n* (%)	
I trust in the value, accuracy and benefit expected from the use of AI systems in education					
	Disagree	24 (16.4)	8 (33.3)	16 (66.7)	
	Neutral	56 (38.4)	24 (42.9)	32 (57.1)	0.007**
	Agree	66 (45.2)	19 (28.8)	47 (71.2)	
I trust in the accessibility and user-friendliness of AI systems					
	Disagree	14 (9.6)	9 (64.3)	5 (35.7)	
	Neutral	45 (30.8)	15 (33.3)	30 (66.7)	0.075*
	Agree	87 (59.6)	18 (20.7)	59 (79.3)	
I trust AI technology and its decision-making capabilities					
	Disagree	20 (13.7)	10 (50.0)	10 (50.0)	
	Neutral	30 (20.5)	7 (23.3)	23 (76.7)	0.031**
	Agree	96 (65.8)	18 (18.8)	78 (81.2)	
I trust in the transparency and explainability of AI systems e.g. ChatGPT					
	Disagree	15 (10.3)	9 (60.0)	6 (40.0)	
	Neutral	30 (20.5)	11 (36.7)	19 (63.3)	0.079*
	Agree	101 (69.2)	29 (28.7)	72 (71.3)	
I trust in the privacy and data security measures in place for the use of AI system					
	Disagree	55 (37.6)	31 (56.4)	24 (43.6)	
	Neutral	69 (47.3)	39 (56.5)	30 (43.5)	0.011**
	Agree	22 (15.1)	5 (22.7)	17 (77.3)	
I have a previous positive experience with the use of AI system					
	Disagree	9 (6.2)	4 (44.4)	5 (55.6)	
	Neutral	48 (32.9)	26 (54.2)	22 (45.8)	0.801
	Agree	89 (60.9)	26 (23.6)	63 (76.4)	
I trust in the social and ethical implications of the use of AI systems in education					
	Disagree	39 (26.7)	18 (46.2)	21 (53.8)	
	Neutral	60 (41.1)	25 (41.7)	35 (58.3)	0.218
	Agree	47 (31.2)	19 (40.4)	28 (59.6)	
I trust my institution (authorities) to put in place criteria for the ethically acceptable use of AI					
	Disagree	67 (45.9)	29 (43.3)	38 (56.7)	
	Neutral	21 (14.4)	6 (28.6)	15 (71.4)	0.620
	Agree	58 (39.7)	13 (22.4)	45 (77.6)	

$p < 1^{*}$, $p < 0.05^{**}$, $p < 0.01^{***}$

4.3 Reasons for not accepting AI tools

The majority (35.1%) of the respondents were unwilling to accept AI tools in education due to concerns about a lack of awareness and engagement with new AI tools. Further, about 20.2% and 16% of them were unwilling to accept due to ethical concerns such as student privacy, consent and accountability and its disruption of the traditional teacher-student relationship, respectively (see Table 3). Other concerns were technical limitations and a lack of understanding of AI tools. In general, AI tool like ChatGPT is incredibly limited and can create misleading quality data in education (Ofosu-Ampong *et al*. 2020). As a progressive innovation, there is more room to develop its robustness and truthfulness for use in teaching and learning.

Table 3. Reasons for not accepting AI tools in education (n=94)

Reasons for not accepting AI tools	*n* (%)
Lack of awareness and engagement with new AI tools	33 (35.1)
Ethical concerns such as student privacy, consent and accountability	19 (20.2)
Disrupt the traditional teacher-student relationship and promotes cheating	15 (16.0)
Technical limitations and challenges e.g. right prompt to use/understand context	10 (10.6)
Lack of understanding of AI tools and knowing where to start	9 (9.6)
Data privacy and security concerns	8 (8.5)

Some students also harbour fear when it comes to AI tools and this makes them hesitant to learn and use technology. From the data collection stage, we observed that most students do *not know who to talk to concerning ChatGPT i.e. they lack technical mentors*. Universities should deliberately address these concerns for a smooth AI uptake in education.

4.4 Analysis II: Structural Equation Modelling of AI Acceptability

This section introduces two primary analyses aimed at comprehending the factors influencing the acceptance of AI in education. The first analysis focuses on evaluating the measurement model, while the second analysis centres on assessing the structural model.

4.4.1 Measurement Model Assessment: To determine the factors that influence the acceptance of AI, the reliability and validity tests of each construct were assessed. As shown in Table 5, the composite reliability (CR) and Cronbach Alpha (CrA) values were all above the 0.7 recommended minimum threshold, ranging from 0.876 to 0.953. This implies a good internal consistency between the measurement items in each construct. Additionally, Table 4 provides an average individual mean score of students on all constructs, ranging from 0.311 to 0.417.

Table 4. Descriptive Statistics, Construct Reliability and Validity

Construct	Items	Mean	CrA	Rho_A	CR	AVE
Innovation characteristics	IC1	0.403	0.901	0.915	0.938	0.834
	IC2	0.311				
	IC3	0.381				
Perceive usefulness	PU1	0.359	0.928	0.930	0.954	0.875
	PU2	0.343				
	PU3	0.369				
Social influence	SI1	0.383	0.876	0.876	0.924	0.801
	SI2	0.379				
	SI3	0.360				
Psychological need	PN1	0.417	0.909	0.923	0.942	0.845
	PN2	0.336				
	PN3	0.336				
Acceptance of AI	AA1	0.363	0.926	0.927	0.953	0.872
	AA2	0.357				
	AA3	0.351				

The average variance extracted (AVE) and Fornell-Larcker criterion was used to measure the convergent and discriminant validities of the constructs. From Table 5, the AVE values are all higher than the recommended minimum value of 0.5, implying a good relationship among the measured constructs. Also, as shown in Table 5, there is a strong relationship between similar constructs which implies good discriminant validities.

Table 5. Discriminant Validity - Fornell-Larcker Analysis

	AE	CU	HA	HM	SE
IC	**0.913**				
AA	0.927	**0.934**			
PU	0.657	0.713	**0.935**		
SI	0.684	0.659	0.811	**0.895**	
PN	0.722	0.771	0.586	0.525	**0.919**

Further, the average scores of the students on each construct were estimated to assess their views on AI acceptance. As shown in Table 4, the sample mean score of participants was average on all constructs but relatively high for innovation characteristics (0.742) towards acceptance of AI. Also, psychological need recorded a high mean score (0.509) towards innovation characteristics indicating a good influence on students' acceptance of AI in education.

4.4.2 Structural Model Assessment

The next after providing evidence of internal reliability and discriminant validity of the scales is to assess the structural model using the significance of the path coefficient (p-value) and coefficient of determination (R^2) obtained through a bootstrapping technique of 500 resamples. Table 6 shows the results of the PLS-SEM analysis. For the approximate fit indices, the SRMR and NFI, which were direct outcomes of the PLS-SEM model estimation, were used. The criteria values for SRMR and NFI are 0.077 and 0.91, respectively. Based on these criteria values, the PLS model estimate indicates an acceptable fit, meeting the required thresholds (SRMR < 0.08 and NFI > 0.90). Additionally, the variance inflation factor (VIF) was estimated to assess the issue of multicollinearity. As shown in Table 5, the VIF values ranged from 1.381 to 3.347, all below the recommended threshold of 5, indicating no multicollinearity issue in this study. The results presented in Table 6 indicate that all six hypotheses were fully supported, suggesting a significant relationship.

Table 6. Structural model

	Path Coefficient	Sample Mean	SD	F2	VIF	T statistics	P Value
IC →AI acceptance	0.78	0.742	0.088	1.821	2.872	8.371	0.000
PU → AI acceptance	0.224	0.221	0.109	0.148	3.271	2.057	0.040
SI → IC	0.421	0.425	0.124	0.367	1.381	3.392	0.001
SI → AI acceptance	0.216	0.211	0.085	0.139	2.347	2.018	0.005
PN → IC	0.501	0.509	0.134	0.519	1.381	3.728	0.000
PN → AI acceptance	0.167	0.157	0.084	0.122	2.215	1.986	0.048

Table 7. R square

	R Square	R Square Adjusted
Innovation of AI acceptance	0.650	0.638
AI acceptance	0.896	0.889

Aside from the evaluation of the structural model, an estimation was conducted to know how well the model predicts the latent factors by assessing the explained variance values (R^2). PU, SI, IC and PN jointly explained 88.9% of the variance for acceptance of AI. SI and PN explained 63.8% of students' innovation characteristics. In summary, it should be noted that studies in the adoption and acceptance of technology consider R^2 values of 50% as high. Thus, the R^2 values (*see* Table 7) in this study indicate the model's good predictive power.

Table 8. Mediation Analysis Results

Indirect path	β	T Statistics	Results
Social influence → Innovation → AI acceptance	0.311	2.881	Full Mediation
Psychological need → Innovation → AI acceptance	0.370	3.507	Full Mediation

5. Discussion

This study investigates the factors that influence the acceptance of AI by students. Using two validated constructs of the UTAUT2 and two other significant behavioural factors, this study investigated the student's AI acceptance using five constructs: perceived usefulness (PU), social influence (SI), innovation characteristics (IC), psychological need (PN) and acceptance of AI (AA).

The first empirical result regarding the determinant of students' acceptance of AI is that social influence significantly influences AI acceptance. The uniqueness of this result means that students benefit from their peers when making decisions with technologies in education. In other words, students would accept AI tools based on recommendations from peers. The second empirical result indicates a positive relationship between Perceived usefulness and students' acceptance of AI. This finding is consistent with several studies, thus if students perceive

AI tools to be useful, their acceptance and likelihood to use is enhanced (Chen et al., 2023).

The third result indicates that innovation highly explains the students' acceptance of AI tools in learning. Among the four independent variables, innovation characteristics had the strongest influence on acceptance. This means that the integration of AI tools learning fosters deep learning experiences that aid acceptance.

The final finding indicates that the psychological need of students has a significant direct effect on AI acceptance. The result of this finding suggests that the intrinsic motivation and inner satisfaction of an individual during learning is paramount to the kind of technology to use. Largely, the results contend that the acceptance of AI tools is highly driven by students' psychological need as a means to fulfill their autonomy, competence and social relatedness. Thus, students with high psychological needs in education are more likely to have a greater acceptance of AI than students with low psychological needs. The results also reveal that the relationship between psychological need and innovation is strong among students who have a high acceptance of AI tools.

5.1 Mediation effects of innovation characteristics

From the mediation analysis results in Table 6, students' psychological need indirectly affects AI acceptance through the full mediation effect of innovation, such that psychological need positively impacts innovation which in turn positively influences acceptance of AI. Therefore, it can be inferred that students who have a high psychological need for AI systems may be more prone to the inherent nature of innovation of AI in education and therefore have favourable evaluation and purpose to accept AI tools.

Furthermore, the empirical results revealed that social influence amongst peers can affect the acceptance of AI through the mediating role of innovation. Consequently, if students develop a high social influence through the innovation of AI systems, the tendency to accept the system will be high for students.

6. Implications for Theory and Practice

6.1 Theoretical Implication

This study contributes to the theoretical enhancement of recent discourse on AI integration and use in HE in threefold. First, by empirically testing the role of perceived usefulness, social influence, innovation characteristics, and psychological need along with their relationship with acceptance of AI, this study explains 89.5% of the variance of student's acceptance of AI tools and 63.8% of their innovation characteristics with AI acceptance in education. Thus, this research affirms the robustness of the technology acceptance theory in recent studies and emphasizes the need to integrate other important variables in current issues.

Second, the relationship between innovation, social influence and psychological needs in education has not been considerably studied especially with the advancement of AI. Consequently, the results of this study enrich existing knowledge on AI integration and acceptance in education by confirming the need to advance existing AI policies to transient the nature of student interests and goals.

Third, the present study provides a deeper understanding of the mediating role of innovation in education by conducting a mediation analysis via the PLS-SEM approach. This empirical study provides insight into (1) how social influence indirectly affects AI acceptance through innovation characteristics towards AI tools in learning, and (2) how the psychological needs of students indirectly affect acceptance of AI through innovation (Ofosu-Ampong *et al*. 2021).

6.2 Practical Implication

Practically, this study emphasizes the importance of AI in education and learning environments. The main takeaway is that AI is being used extensively nowadays in various contexts, and HE has a choice in how they approach its acceptance, integration and use. This research suggests two options: either letting AI engineers, scientists or big tech companies determine the course of AI in education, or actively participating in productive discourse. This research urges HE authorities and educators to decide whether to passively accept what is given to them or to take a critical stance. By adopting a critical perspective, HE can contribute to ensuring that AI in education reaches its full potential and ethically benefits everyone involved.

6.3 Limitations and Future Research

Notwithstanding the theoretical and practical contributions to research on social trust and acceptance of AI, it is not exempt from limitations. First, the sample size of the participants limits the study's generalisation. The participants were only students from one university in Ghana, hence limiting the results to an extent. Future studies should broaden the population size of students and possibly compare results from other developing and developed country contexts. Additionally, there is a need for future research to examine the demographic characteristics (e.g. age, gender, familiarity with AI) as these variables may reflect different levels of impacting the role of independent factors (e.g. perceived usefulness, social influence, innovation, psychological needs) AI acceptance. Consideration of the technology-organisation-environment model can provide an effective and collaborative way of building information modelling for AI education (Ofosu-Ampong & Acheampong, 2022).

7. Conclusion

In order to enhance the acceptance and utilization of AI among students in higher education, this study emphasizes the significance of considering their demographic characteristics, perceived usefulness, social influence, innovation, psychological needs, and social trust. The study suggests that higher education institutions (HEIs) should take these factors into account when implementing measures to promote AI acceptance and usage, thereby achieving the desired outcomes. Higher education institutions seeking to integrate AI for students' benefit may adopt these suggestions

- *set up an AI working expert (i.e. tech savvy + HEI policy) group to draft guidelines and regulations on AI use*
- *train faculty and staff on how to adapt AI pedagogical practices and*
- *revise curriculum to prepare students for the AI-driven market, highlighting the ethical implications*

The future of AI in education will continuously reward experimentation and the creative power of society to determine its integration for good. We hope that HEIs exercise caution when using AI tools, as these models have the potential to spread *misinformation* and *cyberattacks* within the field of education. Future studies may also focus on the intersection between gamification or game-based design elements and artificial intelligence-based tools in education (Ofosu-Ampong 2020). However, the most important discussion especially for developing countries would focus on: the Regulation of AI. How AI is regulated will dictate what it means to educational institutions in Africa. The question on regulations of AI education is: *whose interest would any new AI regulation in education be crafted?* We hope this paper has set the tone for further discussion and elaboration on AI acceptance in education in a developing country context.

Reference

Adam, M., Wessel, M., & Benlian, A. (2021), "AI-based chatbots in customer service and their effects on user compliance", *Electronic Markets*, **31**(2), 427-445.

Berkowitz, M. W., Bier, M. C., & McCauley, B. (2017), "Toward a science of character education", *Journal of Character Education*, **13**(1), 33-51.

Chassignol, M., Khoroshavin, A., Klimova, A., & Bilyatdinova, A. (2018), "Artificial Intelligence trends in education: a narrative overview", *Procedia Computer Science*, **136**, 16-24.

Chen, S., Qiu, S., Li, H., Zhang, J., Wu, X., Zeng, W., & Huang, F. (2023), "An integrated model for predicting pupils' acceptance of artificially intelligent robots as teachers", *Education and Information Technologies*, 1-24.

Chen, Y., Jensen, S., Albert, L. J., Gupta, S., & Lee, T. (2023), "Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success", *Information Systems Frontiers*, **25**(1), 161-182.

Dale, R. (2021), "GPT-3: What's it good for?" *Natural Language Engineering*, **27**(1), 113-118.

Davis, F. D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, 319-340.

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., ... & Wright, R. (2023), "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.

Enholm, I. M., Papagiannidis, E., Mikalef, P., & Krogstie, J. (2022), "Artificial intelligence and business value: A literature review", *Information Systems Frontiers*, **24**(5), 1709-1734.

Geerling, W., Mateer, G. D., Wooten, J., & Damodaran, N. (2023), "Is ChatGPT Smarter than a Student in Principles of Economics?" *Available at SSRN 4356034*.

Glikson, E., & Woolley, A. W. (2020), "Human trust in artificial intelligence: Review of empirical research", *Academy of Management Annals*, **14**(2), 627-660.

Lee, Y., Kozar, K. A., & Larsen, K. R. (2003), "The technology acceptance model: Past, present, and future", *Communications of the Association for information systems*, **12**(1), 50.

Montemayor, C., Halpern, J., & Fairweather, A. (2022), "In principle obstacles for empathic AI: why we can't replace human empathy in healthcare", *AI & Society*, **37**(4), 1353-1359.

Nikitas, A., Michalakopoulou, K., Njoya, E. T., & Karampatzakis, D. (2020), "Artificial intelligence, transport and the smart city: Definitions and dimensions of a new mobility era", *Sustainability*, **12**(7), 2789.

Ofosu-Ampong, K., & Acheampong, B. (2022), "Adoption of contactless technologies for remote work in Ghana post-Covid-19: Insights from technology-organisation-environment framework", *Digital Business*, **2**(2), 100023.

Ofosu-Ampong, K. (2020), "The shift to gamification in education: A review on dominant issues", *Journal of Educational Technology Systems*, **49**(1), 113-137.

Ofosu-Ampong, K., Boateng, R., Kolog, E. A., & Anning-Dorson, T. (2020), "Examining Information Quality

and Perceived Learning Performance in a Gamified Environment", In *2020 IEEE 22nd Conference on Business Informatics (CBI)* **2**, 1-9. IEEE.

Ofosu-Ampong, K., Boateng, R., Kolong, E. A., & Anning-Dorson, T. (2021), "Motivation in gamified social media learning: a psychological need perspective", *Journal of Information Systems Education*, **32**(3), 199-212.

Ofosu-Ampong, K. (2021), "Determinants, barriers and strategies of digital transformation adoption in a developing country Covid-19 era", *Journal of Digital Science*, **3**(2), 67-83.

Popenici, S. A., & Kerr, S. (2017), "Exploring the impact of artificial intelligence on teaching and learning in higher education", *Research and Practice in Technology Enhanced Learning*, **12**(1), 1-13.

Prunkl, C. E., Ashurst, C., Anderljung, M., Webb, H., Leike, J., & Dafoe, A. (2021), "Institutionalizing ethics in AI through broader impact requirements", *Nature Machine Intelligence*, **3**(2), 104-110.

Raabe, I. J., Boda, Z., & Stadtfeld, C. (2019), "The social pipeline: How friend influence and peer exposure widen the STEM gender gap", *Sociology of Education*, **92**(2), 105-123.

Rogers, E. M. (2003), *Diffusion of innovations* (5th ed.). New York, US: Free Press

Rospigliosi, P. A. (2023), "Artificial intelligence in teaching and learning: what questions should we ask of ChatGPT?" *Interactive Learning Environments*, **31**(1), 1-3.

Ryan, R. M., & Deci, E. L. (2013), "Toward a Social Psychology of Assimilation: Self-Determination Theory in Cognitive", *Self-regulation and autonomy: Social and developmental dimensions of human conduct*, **40,** 191

Sahu, A. K., Padhy, R. K., & Dhir, A. (2020), "Envisioning the future of behavioural decision-making: A systematic literature review of behavioural reasoning theory", *Australasian Marketing Journal*, **28**(4), 145-159.

Tapalova, O., & Zhiyenbayeva, N. (2022), "Artificial Intelligence in Education: AIEd for Personalised Learning Pathways", *Electronic Journal of e-Learning*, **20**(5), 639-653.

Topal, A. D., Dilek Eren, C., & Kolburan Geçer, A. (2021), "Chatbot application in a 5th grade science course", *Education and Information Technologies*, **26**(5), 6241-6265.

Venkatesh, V., Raman, R., & Cruz-Jesus, F. (2023), "AI and emerging technology adoption: a research agenda for operations management", *International Journal of Production Research*, 1-11.

Wu, R., & Yu, Z. (2023), "Do AI chatbots improve students learning outcomes? Evidence from a meta-analysis", *British Journal of Educational Technology*. DOI: 10.1111/bjet.13334

Wani, T. A., & Ali, S. W. (2015), "Innovation diffusion theory", *Journal of General Management Research*, **3**(2), 101-118.

Zhang, R., Guo, J., Chen, L., Fan, Y., & Cheng, X. (2021), "A review on question generation from natural language text", *ACM Transactions on Information Systems (TOIS)*, **40**(1), 1-43.

Zhou, L., Xue, S., & Li, R. (2022), "Extending the Technology Acceptance Model to explore students' intention to use an online education platform at a University in China", *Sage Open*, **12**(1), 21582440221085259.