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Generative Artificial Intelligence as Digital Capital: Unequal Access, Academic Engagement, and Critical Thinking among University Students in Pakistan

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ABSTRACT

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Generative artificial intelligence (GenAI) is fundamentally changing the landscape of higher education, impacting how students learn, engage, and acquire knowledge. The pedagogical value of GenAI, however, cannot be achieved equally for all learners due to the inequality that can result from differences in technological access, AI literacy, and their ability to use AI to achieve learning goals. The study explores the role of generative artificial intelligence in digital capital and its relationship with unequal access, academic engagement, and critical thinking of the students at the university level in Pakistan. The study adopts Digital Capital Theory and Digital Divide Theory to frame the concept of AI digital capital in three aspects: AI access capital, AI knowledge capital, and AI application capital. The design of the study was a quantitative research design, which was followed by a cross-sectional survey method, and data was collected from 325 university students of Pakistan. The study investigates the relationship between students' AI competencies and their interaction with generative AI and the impact of AI use on academic and cognitive performance. The study builds on previous digital capital literature as it takes the perspectives of digital capital into the digital age of artificial intelligence and illustrates the impact of AI-related capabilities on educational opportunities. The study has significant implications for universities and policymakers in the realms of AI literacy building, access to AI tools, and responsible adoption of GenAI in higher education.

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1.0 Introduction

1.1 Background: Generative AI in Higher Education

Generative artificial intelligence (GenAI) has rapidly gained speed and power to change the face of higher education, affecting how students' access and interact with information, how they create academic content, and how they engage with learning activities. Recent developments of large language model (LLM) technology, notably the launch of ChatGPT, are reshaping the future of AI in higher education, where it can facilitate the writing of academic papers, coding and creation of explanations, and tailoring of learning experiences for students (Kasneci et al., 2023). While most teaching innovations in the past focused on disseminating information, GenAI empowers educators and students to actively generate knowledge and solve educational problems, leading to new opportunities in teaching and learning.

With the trajectory of sustained development and growth in GenAI technology, students are becoming more comfortable using these tools to brainstorm ideas, paraphrase material, enhance communication, create assignments, and get instant feedback (Tlili et al., 2023). It found that students' successful integration of GenAI depends on their understanding of usefulness, ease of use, social influence, and the expected positive impact on their academic success (Ivanov et al., 2024). Moreover, how AI tools enable collaboration and diverse learning environments has become a key topic of interest for universities looking to improve accessibility and engagement (Alyoussef et al., 2025). The use of the GenAI, however, also has implications for academic integrity, misinformation, relying too heavily on the content it produces, and a loss of independent thinking (Cotton et al., 2024). Thus, to gain a better understanding of GenAI, it is important to go beyond adoption trends to understand how students access, use, and benefit from these technologies. It is essential also to consider ethical, pedagogical, and equity issues to ensure responsible AI incorporation in education (Holmes & Miao, 2023).

With the expansion of the use of GenAI, a new layer of digital inequality—the AI divide—has emerged. While recent research in the digital divide has concentrated on the unequal access to the internet, ownership of technology devices, and unequal access to the technological infrastructure, the modern digital divide also extends to the polarization of digital skills, confidence in digital technologies, and the lack of knowledge on how to apply digital technologies into meaningful outcomes (Van Dijk, 2020). Students may also vary in being able to access AI tools, in their familiarity with and experience with AI literacy, in the development of effective AI prompts, and in whether they can critically review AI-generated information in the context of GenAI. Therefore, it is not sufficient to simply have access to AI technologies to ensure the same level of educational benefits. Students with a higher level of technological skills and institutional support are more likely to benefit from GenAI when compared to students lacking both these two abilities. Students with a higher level of technological skills and institutional support are more likely to use GenAI resources as academic gains than are students low on both. (Ivanov et al., 2024) These emphasize the significance of recognizing GenAI as a digital asset that encompasses knowledge, skills, and practices necessary to receive benefits from digital resources.

The deployment of GenAI as digital capital is crucial in Pakistan because it is undergoing digitalization at an unprecedented pace and is still grappling with digital inequities in access to technology and educational tools. While Pakistan universities have embraced the use of digital and online learning, there is a gap in both the preparedness of faculty members and students' access to advanced technology as well as institutional infrastructure. Economically low-income students may not have the same opportunities to harness the benefits of GenAI because they might lack access to stable internet connections, high-end smart devices, and subscriptions for AI services and receive less training in technology. However, for disadvantaged students, there can be affordability, connectivity, and digital exposure issues. However, it would be not only the technologies that would be necessary to enable effective use of GenAI solutions, but also an understanding of AI tools and literacies (Holmes & Miao, 2023), responsible application, and a capacity to critically evaluate the outputs of AI.

Although some research in the field of GenAI in the higher educational sector has been done so far, it has been mainly about technology acceptance, perception, intention of adoption, educational benefits, and ethical issues. Previous research provides valuable information on the prevalence of AI and learning outcomes (Ivanov et al., 2024; Alyoussef et al., 2025), but little has been done to understand the differential access to resources and differential ability to access them and the differential outcomes for those who do. Additionally, research addressing GenAI as a digital asset has long overlooked the role of this technology as a source of capital while being limited to discussions about its impact on EES in developed countries. Moreover, there is a lack of literature that evaluates the role of GenAI as a digital asset, especially in the context of higher education systems in developing nations like Pakistan. In this study, authors come up with several key points to close this gap: How digital capital based on AI affects generative AI use, academic engagement, and critical thinking among university students.

1.2 Research Objectives

1. Examine generative AI as a form of digital capital within higher education.
2. Explore inequalities in students' access to and ability to use AI technologies.
3. Analyze the relationship between GenAI use and academic engagement.

   Investigate how GenAI influences students' critical-thinking practices.

2.0 Literature Review

2.1 Generative Artificial Intelligence in Higher Education

Generative artificial intelligence (GenAI) has ushered in a new era of technological transformation in higher education that has spurred its rapid growth. At the same time, GenAI technology offers a far greater opportunity to create content, facilitate problem-solving, and engage in conversational learning as compared to traditional educational technologies whose primary role is simply to provide access to digital resources. In light of these new studies, the promises of GenAI to revolutionize education—and in particular personalized learning, assessment, and teaching—have a lot to offer for thinking about the ways AI can reimagine academic support and learning processes and how knowledge can be conveyed to learners more

effectively and timely. As tools like ChatGPT become more ubiquitous, universities are looking to rethink their approach to adopting AI without compromising on educational quality or ethical standards. With the advent of new AI innovations, such as ChatGPT, educators have had to think about how AI can be used more successfully within education without any impact to the quality of education or ethical lessons.

Personalized learning is one of the key advantages of GenAI in education. AI systems can offer personalized explanations, make adaptive responses to suit the requirements of a pupil, and support pupils who need further learning help and guidance. In the field of education, Romero et al. (2024) propose that the applications of GenAI could help shape learning spaces that are more flexible and learner-centered, which would allow students to interact with an intelligent system based on their learning needs. On a similar note, if institutions have appropriate policies and guidance, then and only then can AI-supported education enhance access to education and opportunities for inclusive learning, also as described by Holmes and Miao (2023).

Academic support is another crucial area of contribution by GenAI. Academic support is also a critical area of contribution that GenAI can make. AI has become a game-changer for university students, helping them to summarize information, brainstorm ideas, explain complex subjects, and enhance their academic writing. The research findings show that ChatGPT is useful as a learning assistant for students, as they receive quick and instant feedback and can assist them with independent learning activities (Ngo 2023). In addition, Almulla (2024) revealed that AI tools must be both useful and easily used; otherwise, students will become frustrated with the AI-supported learning environments. The insights show that GenAI is beginning to be used as more than just a technological tool for student learning.

Academic writing and knowledge exploration have also been revolutionized by the advent of GenAI. Students utilize the capabilities of AI to enhance the quality of language, structure their arguments, initiate research ideas, and delve into new topics. Tlili et al. (2023) assert that by enabling the dialogic learning process, conversational AI systems can contribute to knowledge construction. The authors also caution that there is a need for proper guidance in order to make educational use of AI, noting that students need to learn for a critical evaluation of the type of response given by AI and not take what it says on board blindly.

However, there are some challenges to integrating GenAI into products or services. Academic integrity is one of the issues that worries. With AI systems able to produce essays, reports, and assignments, plagiarism, attribution, and the validity of assessing their work have been raised (Cotton et al., 2024). Such a rethinking of assessment strategies and a focus on learning are needed at the university level if they aren't already happening at the departmental level. It is time for a rethinking of assessment strategies at the university level, if it has not already occurred at the departmental level, such that learning is encouraged instead of content production. Another challenge is the students' heavy dependence on AI systems. Kasneci et al. (2023), point out that over-dependence on AI-generated solutions could diminish the chances for independent thought and substantial cognitive task-involving considerations. Moreover, AI systems can generate incorrect or distorted information, requiring students to possess the critical thinking ability to

assess information. Additionally, AI systems can provide false or manipulated data, which is why it is important for students to learn how to evaluate information. AI ethics are also a key issue in the deployment of GenAI. Data privacy, transparency, fairness, and responsible use are issues that need to be considered in educational institutions (Holmes & Miao, 2023).

2.2 Digital Capital Theory and Artificial Intelligence

In generating knowledge from A.I. technologies, digital capital serves as a crucial theoretical lens to shed light on the inequities of this future. Digital capital is this future's lens through which to understand unequal benefits gained through generative artificial intelligence. Earlier the subject of digital inequalities was mostly addressed with regard to the differences in access to computers, internet connection, and technological infrastructure. According to Van Dijk (2020), digital inequality is a multidimensional concept that is not only a physical issue but also a difference in skills and how and what technology is used to create outcomes. This is particularly relevant in the era of GenAI, as access to AI does not necessarily equate to the opportunity for learning benefits.

2.2.1 AI Access Capital

Firstly, access is a fundamental part of AI digital capital. The number of tools, capabilities, and information that students have available to use with GenAI systems. These resources include access to AI platforms, reliable internet connectivity, appropriate digital devices, and digital infrastructure within the institution. While various AI tools are now widely accessible to the public, the question remains about how well students will be able to access enhanced tools, premium services, and other technologies that can support them.

Van Dijk (2020) notes that access to digital information can be a reflection of social inequalities, with those who are not as well-served technologically as others not being able to take part as much as they might in digital space. In higher education settings, where students from privileged families might have greater access to sophisticated devices, high-speed internet, and paid-for AI services, this is a very important argument to offer in the context of gaps among technologies in the education sector. This argument is especially salient in higher education domains, where students from economically secure backgrounds would likely have entry to superior gadgets, excessive-speed web connections, and hired, AI-based solutions. Access to AI, therefore, could be the first bridge to learning gap creep.

2.2.2 AI Knowledge Capital

The second dimension is AI knowledge capital, which is related to students' cognition of the systems and interactions with AI. While it's true that access to AI tools will yield academic benefits, many students will require knowledge about how such technologies work, the design of AI prompts, and evaluating the quality of AI-generated information.

AI literacy is now recognized as an essential component of the successful use of AI in the field of education, with recent research focusing on its importance. Psychologists recognize that the rise of digital competencies and skills in AI has become the integral part of current education structures, as the students need to comprehend the potential and boundaries of AI (as cited in Svoboda, 2024). They also identified that students' attitudes to GenAI are influenced by their perception, knowledge, and confidence in AI technologies, similar to Ivanov et al., 2024.

2.2.3 AI Application Capital

The third is the application of artificial intelligence—students' skills in developing and using GenAI in the learning process. This includes using AI to brainstorm and enhance understanding, to research, to evaluate content, and to strengthen learning experiences. High-AI application capital students don't just use AI to complete their academic work; instead, they use it as a learning aid.

Where students and institutions have the capabilities to effectively utilize AI in learning, AI can support inclusive learning, as argued by Alyoussef et al. (2025). Likewise, Stojanov et al. (2024) show that students have various levels of dependence on ChatGPT, meaning that there is a degree of variation in AI use among learners. Some pupils may rely on AI as an aid to their learning; others may rely on AI too heavily and never gain any greater understanding.

2.3 Generative AI and Academic Engagement

Another critical educational outcome that can create a lens on the influence of GenAI on learning is academic engagement. Engagement is about student involvement, effort, motivation, and psychological investment in learning activities. There have been three components of engagement (behavioral, cognitive, and emotional) in the higher education literature.

Behavioral engagement is the engagement of students in their academic-related behavior, which includes attending school, submitting assignments, and doing activities related to learning. GenAI may aid in enhancing the students' engagement by providing timely support and reducing the "obstacles" faced by the students to participate effectively. For instance, AI can be utilized by students for clarifying concepts, structuring assignments, and providing further explanations beyond the classroom setting (Ngo, 2023).

Cognitive engagement is related to the intellectual involvement of students in learning, their problem-solving and analysis, and the production of knowledge. GenAI can boost cognitive engagement by promoting exploration and facilitating more advanced learning processes. For learners to engage in critical processing of generated information and not simply copy the material, AI systems act as learning partners, as suggested by Kasneci et al. (2023).

Again, the relationship between GenAI and cognitive engagement is dependent on students' engagement with the technologies. Relying too heavily on AI might lead students to relying on AI responses and potentially hamper developing their own cognitive skills (Cotton et al., 2024).

Emotional engagement motivation, confidence, and interest in learning. Personalized support and feedback can boost student confidence, potentially addressing academic challenges with the assistance of artificial intelligence. AI feedback and personalized support can enhance student confidence through addressing academic challenges with personalized support. Almulla (2024) posits that the higher students' satisfaction with the AI-assisted learning environments, the greater their perception of usefulness and learning support in these settings. With enough digital capital, GenAI can help enhance engagement if they have access to such tools.

2.4 Generative AI and Critical Thinking

In our increasingly information- or knowledge-heavy world, one of the foremost questions on GenAI integration in higher education circles is, "What exactly is critical thinking? In this

information- or knowledge-driven world, one of the most widely discussed topics is "What is critical thinking?" As many universities emphasize developing analytical thinking, logistical reasoning, and independent decision-making in their students, they have raised some doubts concerning the impact of AI on these skills, either promoting or obstructing them.

The positive side of GenAI is that it can help students think differently, think creatively, think about complex issues, and think about different perspectives. The ability to generate alternative explanations, explore those assumptions, and even help students investigate new concepts and ideas. While current opportunities for such learning are scarce, conversational AI systems can be designed that offer opportunities for interactive learning for the learner by responding to the AI system in a critical manner, Tlili et al. (2023) argue.

Similarly, GenAI can help in reflective learning by allowing students to reflect on their answers and thoughts against the AI-generated response. If utilized appropriately, AI feedback can inspire students to make revisions to their text, improve the text, and consider alternative points of view (Kasneci et al., 2023).

However, there's a worry about the potential negative effects of AI dependence on critical thinking skills development. If students just copy the AI-generated answers without thinking through their own, they might not be able to express their ideas and engage in independent thinking and analysis as well. As mentioned by Cotton et al. (2024), the application of AI to generate content has raised concerns about students' ability to demonstrate their understanding.

2.5 Educational Inequality and AI Access

While GenAI's integration into the higher education landscape offers new opportunities for learning, it can also contribute to exacerbating existing educational inequities. Even as AI technologies increasingly become available, students are not afforded such access to AI to the same extent. Economic backgrounds or resource availability in terms of schools, areas, and technologies can impact how well students can maximize the benefits of GenAI (Van Dijk, 2020).

Another key factor is institutional inequality. Each university has distinct resources related to AI training, technical capability, and ethical issues on responsible use of AI. While some of those institutions with higher digital capacity could offer the opportunity to provide a higher level of artificial intelligence (AI) knowledge to the student, institutions with lower digital capability might find it difficult to offer the opportunity to provide higher levels of AI knowledge to the student (Ghnemat et al., 2022).

2.6 Theoretical Framework

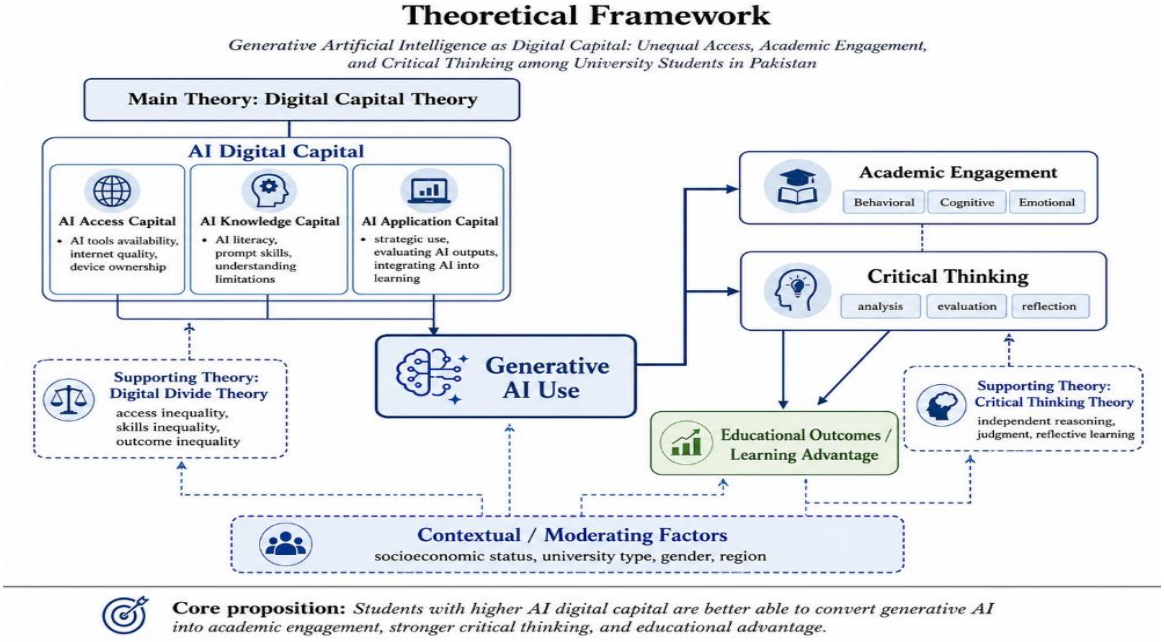
In this research, a theoretical framework is presented mainly based on Digital Capital Theory along with the uses of Digital Divide Theory and Critical Thinking Theory to account for the new possibility of generative AI (GenAI) leading to an inequitable academic opportunity for university students. The core hypothesis of this framework is that GenAI is not a technology but an educational asset that needs to be accessed, known, and utilized to induce educational outcomes.

Digital Capital Theory: This is the concept that everyone is not equally adept at creating something out of these digital resources. The advantages that students gain from GenAI will vary not just based on the availability of technologies but also based on how AI-literate and confident

the students are to use these technologies strategically. Modern studies during the last years highlight the necessity of digital skills, knowledge of the constraints of AI, and its ability to be used in the learning process for successful implementation of AI in higher education (Svoboda, 2024; Ivanov et al., 2024). The concept is used as the basis of this study, in which there are three types of AI digital capital: AI access capital (AI tools, Internet connectivity, device), AI knowledge capital (AI literacy, prompt skills, knowledge of AI capability), AI application capital (ability to apply AI, ability to evaluate AI results, ability to integrate AI into academic activity), etc.

It is supported by the notion of Digital Divide Theory, which refers to non-physical aspects of the digital divide, including disparities in skills and results from using technology (Van Dijk, 2020). For GenAI, this perspective implies students who have more resources and competencies pertaining to AI may have increased academic benefits.

Additionally, CTT can be used to analyze how learners' reasoning processes are affected by GenAI. The danger of relying too heavily on AI tools and the subsequent loss of independent critical thinking and engagement (Kasneci et al., 2023; Cotton et al., 2024). In this framework, this seems to be the way students are using AI digital capital and GenAI to enhance their academic participation and thinking skills.



3.0 Methodology

3.1 Research Design

The study is designed as a quantitative research approach through cross-sectional survey design and was used to evaluate the generative artificial intelligence (GenAI) as digital capital, academic engagement, and critical thinking skill of university students in Pakistan. Since the study is essentially concerned with testing relationships between theoretically developed constructs using quantitative analysis, a quantitative approach was chosen. In particular, the study focuses on the relationship between students' AI digital assets (AI access, AI knowledge, and the capabilities

of using AI applications) and GenAI usage and educational outcomes.

Eligibility for use of GenAI is assumed, as this approach is unlikely to be equally beneficial to all. Rather, the worth of AI lies in students' access to, comprehension of, and successful use of those technologies. In higher education with the application of artificial intelligence in education, studies (Alyoussef et al., 2025; Ivanov et al., 2024; Ngo, 2023) have used quantitative methods in the fields of adoption of artificial intelligence, students' perceptions, satisfaction in learning, and education experiences.

3.2 Population and Sample

The study population is the Pakistani students studying in higher education institutions of Pakistan. The students enrolled were chosen because they are key users whose learning activities are currently undergoing the transformation by GenAI in a search for information, in writing academic texts, as a support in research, and as a help in learning.

Convenience sampling was used for the sampling method, as participants were easily accessible, and GenAI in the education context is a relatively new practice. Students from various academic disciplines and the various types of universities were included to enhance diversity. Gender, age, academic discipline, study level, and type of academy were asked for to ensure one's understanding of differences in the ways in which students experience AI.

3.3 Data Collection Procedure

Data was gathered using a semi-structured questionnaire designed based on earlier studies on the subject of the use of AI, digital skills, student involvement in studies, and the ability to think critically. A survey-based questionnaire was shared electronically with the students of the university in Pakistan. The research purpose, voluntary participation, confidentiality, and academic use of the information to be gathered were explained to participants.

There were two sections to the questionnaire. The two sections were one about demographics and the other about the main constructs AI digital capital, the usage of GenAI and academic engagement, and critical-thinking practices. A 5-point Likert paradigm scale was used for all items, in which 1 represented strongly disagree and 5 represented strongly agree.

3.4 Measurement of Constructs

AI digital capital was designed as a multi-dimensional phenomenon comprising three different capital elements: AI access capital, AI knowledge capital, and AI application capital. Access capital is the availability of access to AI for students; this includes access to platforms and the internet as well as access to digital devices. AI knowledge capacity is a combination of AI literacy and skills with prompts and AI awareness of abilities and limitations, whereas AI application capacity is the students' ability to effectively apply AI tools in academic tasks. AI knowledge capital: AI knowledge/capacity, understanding of how to use prompts, and knowledge of the capability and limitation of AI tools; AI application capital: competence of packing AI tools strategically in academic tasks.

All this conceptualization coincides with a digital inequality perspective, which seeks to understand that the benefits of technology need to be realized if it is accessed and used by the users (Van Dijk, 2020). Studies also highlight the significance of acquiring by the educator AI literacy

and digital skills for the successful incorporation of AI into education (Svoboda, 2024; Ivanov et al., 2024).

The use of generative AI was operationalized as a mediator, which represents the extent of students' academic use of generative AI for writing assistance, information exploration, idea generation, and learning support. The previous studies emphasized the growing use of AI systems by students in academic activities, where the effectiveness of use is tailored to responsible and critical use (Kasneci et al. 2023; Tlili et al. 2023).

Academic engagement was assessed in both behavioral, cognitive, and emotional aspects and represents involvement, in-depth learning, motivation, and confidence in academic performance. Given the ability of GenAI to either enhance or undermine higher-order thinking, the assessment of critical-thinking practices involved an analytical evaluation, student reflection, and independent thinking (Kasneci et al. 2023; Cotton et al. 2024).

3.5 Data Analysis

The collected data were analyzed descriptively through Pearson correlation analysis and the use of regression analysis in order to explore the relationships between main constructs. The data from the respondents were summarized using descriptive statistics, and their relationships between AI digital capital, AI digital usage, academic engagement, and critical behavior were tested using correlation analysis. To understand the predicting relationships between the main variables, regression analysis was performed. In order to explore the proposed theoretical relationships between the latent constructs in a more in-depth way, another research method, namely Structural Equation Modeling (SEM), was regarded.

3.6 Ethical Considerations

Research conducted in an ethically proper manner. The purpose of the data collection was for academic research only; confidentiality and anonymity of the collected data were maintained, and participation was voluntary.

4.0 Findings and Results

4.1 Respondents' Demographic Profile

There were 325 responses analyzed. The respondents were presented with the demographic characteristics of the respondents in Table 1.

Table 4.1 Demographic Characteristics of Respondents (N = 325)

Variable	Category	Frequency	Percentage
Gender	Male	173	53.2%
	Female	152	46.8%
Age	Below 20 years	86	26.5%
	20–25 years	80	24.5%
	26–30 years	73	22.5%
	Above 30 years	86	26.5%
Study Level	Undergraduate	117	36.0%
	Master's	96	29.5%
	PhD	112	34.5%

The demographic profile of the respondents is given in Table 1. Display is shown for both public and private universities: a sample of 48.6% from public universities and 51.4% from private universities. As far as gender is concerned, the male students made up 53.2% of the sample, while the female students made up 46.8% of the sample. There was also a variation across the respondents in academic level (undergraduate, master's, and doctoral level), which offered diversity in students' experience of generative AI technology.

4.2 Descriptive Statistics of Research Constructs

Table 4.2 Descriptive Statistics of Main Constructs

Construct	Mean	Standard Deviation
AI Access Capital	3.56	1.08
AI Knowledge Capital	3.61	1.05
AI Application Capital	3.63	1.06
Generative AI Usage	3.59	1.04
Academic Engagement	3.58	1.07
Critical Thinking Practices	3.60	1.06
Educational Inequality Perception	3.60	1.07

The descriptive statistics reveal that the respondents, as a group, had a moderate to high level of consensus on the various aspects of generally agreeing that generative AI is a tool of relevance to academic pursuits. Overall, the mean score for AI application capital (M = 3.63) was the highest among the four measured dimensions of AI digital capital, indicating that students believed they were relatively good at using AI tools to enhance learning in their education. Similarly, the mean value for AI knowledge capital was relatively high (M = 3.61), suggesting that students' awareness of the predispositions and uses of AI were relatively high.

The average score for generative AI usage was 3.59, representing a moderate usage level among students. In terms of academic engagement and critical thinking, the overall mean scores were comparable, indicating that the use of GenAI can enhance the learning experience for students.

4.3 Correlation Analysis

Pearson correlation analysis was used to study the relationship between various major constructs of the study. AI Digital Capital, Generative AI Usage, Academic Engagement, and Critical Thinking Practices were included in the analysis.

Table 4.3 Pearson Correlation Matrix of Main Research Variables (N = 325)

Variables	1	2	3	4
1. AI Digital Capital	1			
2. Generative AI Usage	0.017	1		
3. Academic Engagement	-0.023	-0.088	1	
4. Critical Thinking Practices	0.052	0.072	-0.086	1

Note: Pearson correlation coefficients are reported.

Correlation analysis was performed to explore the questions concerning the relations

between variables used in developing the research model. The Pearson correlation coefficient indicates that AI Digital Capital has a weak positive correlation with Generative AI Usage (r = 0.017). Within this data set, there was very little association between the students' reported use of AI and aspects of AI access, knowledge, and AI capabilities. Academic engagement had a weak negative relationship with generative AI usage, while a weak positive relationship was observed with critical thinking practices (r = 0.072). Academic engagement and critical thinking practices were associated negatively, but weakly, with each other (r = -0.086).

The overall correlation results show that all the constructs are not correlated. The theoretical basis suggests that greater relationships would be expected because AI digital capital has been hypothesized to improve effective use of AI, which in turn would have an impact on educational outcomes.

4.4 Regression Analysis

A regression analysis was performed to analyze the relationships between the key variables in the proposed research model.

Model 1: AI Digital Capital Predicting Generative AI Usage

To determine if AI Digital Capital predicts generative AI usage, a simple linear regression analysis was conducted.

Table 4.4 Regression Results for AI Digital Capital Predicting Generative AI Usage

Predictor	B	Beta (β)	t-value	p-value
Constant	3.513		13.222	<0.001
AI Digital Capital	0.023	0.017	0.309	0.758

Table 4.5 Model Summary

R	R^2	Adjusted R^2
0.017	0.000	-0.003

The regression analyses indicate that for this sample, AI-Digital Capital was not a significant predictor of Generative AI Usage (β = 0.017, p = 0.758). The overall model explained approximately 0.03% of the variance in the "Generative AI use (R^2 = 0.0003).

The relationship was positive, but not significantly different between the groups. This implies that differences in AI use within this dataset cannot be attributed to the presence or absence of AI access and/or knowledge and application capabilities.

Model 2: Generative AI Usage Predicting Academic Engagement

The next regression model tested the relationship between academic engagement and generative AI usage.

Table 4.6 Regression Results for Generative AI Usage Predicting Academic Engagement

Predictor	B	Beta (β)	t-value	p-value
Constant	3.827		24.874	<0.001
Generative AI Usage	-0.067	-0.088	-1.581	0.115

Table 4.7 Model Summary

R	R^2	Adjusted R^2
0.088	0.008	0.005

The findings suggest that the variance in academic engagement was accounted for by 0.8% of the variance in the model. On the contrary, there was a negative and slight correlation, which was not statistically significant ($\beta = -0.088$, $p = 0.115$).

The results indicate that this may not be another good trend in relation to academic engagement if used solely for frequency of using AI. The educational value of GenAI might rely on students' strategic, critical, and learning-support skills of using AI.

Model 3: Generative AI Usage Predicting Critical Thinking Practices

The third regression model was whether critical thinking practices were predicted by the interaction between generative AI usage and addictiveness.

Table 4.8 Regression Results for Generative AI Usage Predicting Critical Thinking Practices

Predictor	B	Beta (β)	t-value	p-value
Constant	3.355		17.396	<0.001
Generative AI Usage	0.069	0.072	1.289	0.198

Table 4.9 Model Summary

R	R^2	Adjusted R^2
0.072	0.005	0.002

The regression analysis results indicate that generative AI usage positively predicted critical thinking practices, but not statistically. ($\beta = 0.072$, $p = 0.198$) The model accounted for ~0.5% variance in the CT practices model.

This suggests that the use of AI could be a helpful tool in enabling critical thinking, but whether it can do so effectively depends on how students engage with the information created by AI. With that being said, it is important to evaluate and reflect strategically to enable meaningful contributions to higher-order thinking using GenAI.

Table 4.10 Summary of Regression Findings

Hypothesis Relationship	β	p-value	Result
AI Digital Capital → Generative AI Usage	0.017	0.758	Not Significant
Generative AI Usage → Academic Engagement	-0.088	0.115	Not Significant
Generative AI Usage → Critical Thinking	0.072	0.198	Not Significant

The relationship of the major constructs of the study with respect to one another was considered in the regression analysis. The results show that the two factors, namely AI Digital Capital ($r = 0.017$, $p = 0.758$), were not found to be statistically significant predictors for the Generative AI Usage. For this dataset, it appears no statistical relationships were observed between students' access to AI and knowledge and/or use with respect to the level of GenAI use. Likewise, the academic engagement ($\beta = -0.088$, $p = 0.115$) was not significantly affected by generative AI usage. The results showed that the correlation between AI usage and academic involvement was negative but not statistically significant, which suggests that using AI does not necessarily improve students' academic engagement and learning involvement. Moreover, there was a positive yet insignificant correlation between generative AI usage and critical thinking practices ($\beta = 0.072$, $p = 0.198$). This implies that AI tools could enhance critical thinking skills in the future, contingent on the ways in which students process and assess information created by AI.

5.0 Discussion and Conclusion

Based on the aforesaid findings, this study gives insights on the role of generative artificial intelligence (GenAI) within higher education as a source of digital capital. This study was designed to investigate the impact of students' assets, knowledge, and application skills of AI on their involvement with generative AI and the correlation between their involvement with generative AI and academic engagement and critical thinking of students at the university level in Pakistan. The results add to the burgeoning discussion that GenAI should not be viewed as a technology innovation but understood as an education tool whose benefits will critically rely on students' access, understanding, and strategic application of the capabilities of AI technologies.

Digital Capital Theory provided the foundation for this study, suggesting that people can have varying capacities to convert digital resources into their digital capital. However, using AI tools in education does not automatically equate to educational benefits. Pupils need to be equipped with further skills such as AI literacy, the capacity to develop prompts, critical evaluation skills, and knowledge of how to apply them in a strategic way. This argument builds on the current debates on the digital divide, with interventions that show emerging inequalities linked to the use

of AI tools and algorithms are not only about access at the level of technology but also regarding the capacity for the benefits of these resources to accrue to students. (Van Dijk, 2020). The results therefore imply that the integration of GenAI has added an additional layer to digital inequality in higher education, with those who are more capable with skills in using AI more likely to actually translate AI technologies into academic gains.

Moreover, these findings underscore the need to grasp GenAI adoption not just in terms of its usage rate, but also by analyzing some of the key thoughts and concerns within it. AI has also been found to be used to assist with academic writing, exploring information, generating ideas, and supporting learning by students in increasing numbers (Kasneci et al., 2023; Tlili et al., 2023). The benefits that AI brings to education, however, rely on the quality and intent of use. While some students might benefit from enhanced comprehension and engagement with the material when using AI as their learning companion, others might see only minimal cognitive benefits if they rely exclusively on AI to do academic work. The results thus demonstrate, on the one hand, the need for AI readiness and responsible use in academic settings and, on the other hand, underscore the necessity of AI literacy.

This study's contribution to the academic engagement—and generative AI relationship—is another key aspect. By offering people immediate feedback, customized explanations, and further learning supports, GenAI can improve behavioral, cognitive, and emotional aspects of engagement. Various studies have shown that students view AI tools as beneficial due to their ability to offer easily accessible or academic support and in helping with independent learning (Ngo, 2023; Almulla, 2024). But the results also indicate that there is no direct linkage between the availability of AI and academic commitment. The effects of GenAI will rely on the ability of students to engage in meaningful learning with AI. It is imperative that universities more widely aim to offer students access to AI as well as the ability to effectively utilize its various technologies.

The critical thinking under the lens of GenAI holds a particularly promising relationship since critical thinking is one of the main objectives of higher education. AI tools can aid in critical thinking by prompting students to consider various viewpoints, compare sources of information, and think through different interpretations. AI response generation can be supportive tools for critical thinking and intellectual growth when students critically analyze these responses (Kasneci et al., 2023). But there is still a problem with tools being too reliant on AI content. Cotton et al. (2024) highlight that overuse of AI can negatively impact critical thinking and, with it, the concept of academic honesty. So, the educational benefits of GenAI will hinge on how students use AI capabilities, either as an aid to cognition or instead of it.

These results are also applicable to the Pakistani HE landscape, which is an important context of digital inequalities. While the use of digital learning technologies has been increasing in school and university settings in Pakistan, the availability of these resources may differ between schools and universities, as well as between socio-economic environments and different schools/universities, which could have a differential impact on the opportunities and benefits of GenAI. Students may have access to AI platforms, training, and technical support that is more easily available than it is for students at disadvantaged institutions, leading to digital inequities and

the lack of participation in AI-enhanced learning environments for students at disadvantaged institutions. The context emphasizes inclusiveness in building AI strategies, both in terms of technology and competency building (Holmes & Miao, 2023).

To conclude, this research was part of an increasing trend in the field of GenAI, which was mostly directed at advancing the debate from GenAI as just a technology for learning toward the status of a digital asset. There is a strong need to build the competencies and resources that enable and ultimately empower students to leverage AI in their education in order to shape the future of AI-enhanced higher education. This research combines Digital Capital Theory with insights into how AI technologies are being adopted and educational disparities to offer a more holistic perspective on the potential of GenAI to bridge gaps and generate new opportunities for learning.

5.1 Recommendations

Accordingly, a few recommendations on higher education institutions, policy makers, and students may be forwarded in light of the results of the research. It is time for universities to create structured AI literacy initiatives, enabling students to grasp its proper, ethical, and critical implementation. It is not a prerequisite assumption that students have built-in AI skills; institutions should equip students with an understanding of developing prompts, assessing AI-generated content, its responsible usage, and academic integrity. These efforts can contribute to narrowing the gap in students' AI knowledge assets across the background spectrum.

However, a key priority for higher education institutions should be to minimize unequal access to AI resources. Universities that have limited technological infrastructure ought to be supported to deliver students with any reliable digital resources and internet facilities along with AI-aided learning environments. Developing institutional guidelines for AI usability and faculty education programs can also further facilitate responsible and educationally appropriate use of AI.

AI inequality can be regarded as a new education challenge that policymakers have to consider. AI accessibility, building AI literacy, and supporting disadvantaged students are critical elements of national plans supporting digital education. How to minimise the inequalities between public and private institutions and between urban and rural areas will also be essential for GenAI to become an enabler for educational inclusion (as opposed to increased inequalities) in the Pakistani context.

Pupils should also be taught a balanced attitude to the use of AI. Instead of thinking of generative AI as a replacement for independent thinking, it's important to consider it not as a replacement for thinking but as a partner to it that can help with understanding, creativity, and reflection. Creating critical AI literacy will help students assess the information generated by artificial intelligence and leverage these tools to support their learning better.

5.2 Conclusion

The research sheds light on generative artificial intelligence as a new form of digital capital in higher education. While access to AI technologies is an essential component, the benefits of GenAI extend beyond mere access, requiring students to have knowledge of and skills around how to strategically use these tools. In the higher education landscape in Pakistan, inequitable access to AI and disparities in AI literacy can result in emerging forms of educational inequity. Thus,

universities have to go beyond just adopting AI and create inclusive AI ecosystems that have access to technology as well as human capabilities as well. Higher education institutions can benefit from maximizing the potential in higher education with respect to GenAI technology while avoiding the risk of exacerbating inequalities already seen in the education system through AI competence acquisition.

Contribution

Muhammad Ali Zia: Problem Identification and Theoretical Framework
Salma Bibi: Data Analysis, Supervision and Drafting
Faiza Qureshi: Methodology and Revision

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References

Romero, M., Reyes, J., & Kostakos, P. (2024). Generative artificial intelligence in higher education. In *Creative applications of artificial intelligence in education* (pp. 129-143). Cham: Springer Nature Switzerland.

Ngo, T. T. A. (2023). The perception by university students of the use of ChatGPT in education. *International Journal of Emerging Technologies in Learning (iJET)*, *18*(17), 4-19.

Almulla, M. A. (2024). Investigating influencing factors of learning satisfaction in AI ChatGPT for research: University students perspective. *Heliyon*, *10*(11).

Stojanov, A., Liu, Q., & Koh, J. H. L. (2024). University students' self-reported reliance on ChatGPT for learning: A latent profile analysis. *Computers and Education: Artificial Intelligence*, *6*, 100243.

Svoboda, P. (2024). Digital Competencies and Artificial Intelligence for Education: Transformation of the Education System: P. Svoboda. *International Advances in Economic Research*, *30*(2), 227-230.

Ghnemat, R., Shaout, A., & Abrar, M. (2022). Higher Education Transformation for Artificial Intelligence Revolution: Transformation Framework. *Int. J. Emerg. Technol. Learn.*, *17*(19), 224-241.

Alyoussef, I. Y., Drwish, A. M., Albakheet, F. A., Alhajhoj, R. H., & Al-Mousa, A. A. (2025). AI adoption for collaboration: Factors influencing inclusive learning adoption in higher education. *IEEE Access*, *13*, 81690-81713.

Ivanov, S., Soliman, M., Tuomi, A., Alkathiri, N. A., & Al-Alawi, A. N. (2024). Drivers of generative AI adoption in higher education through the lens of the Theory of Planned Behaviour. *Technology in Society*, *77*, 102521.

Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., ... & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and individual differences*, *103*, 102274.

Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart learning environments*, *10*(1), 15.

Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2024). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in education and teaching international*, *61*(2), 228-239.

Van Dijk, J. (2020). *The digital divide*. John Wiley & Sons.

Holmes, W., & Miao, F. (2023). *Guidance for generative AI in education and research*. Unesco Publishing.