



An Analysis of the Supportive Role of Generative Artificial Intelligence in Education: Teachers' and Students' Perceptions in Pakistani Higher Education

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ABSTRACT

Globally, classrooms are transforming with the introduction of Generative Artificial Intelligence (GenAI), providing fresh opportunities for customized learning, teaching support and academic assistance, but the use of GenAI in Pakistani higher education institutions (HEIs) has not been well-reasoned. The aim of this study was to explore the perceived supportiveness of Generative AI in education from the teachers' and students' perspectives, with a particular focus on the perceived usefulness, ease of use, pedagogical support, engagement, and concerns of their use of Generative AI. A descriptive, quantitative survey design was employed, with the Technology Acceptance Model (TAM) along with the Constructivist Learning Theory, Self-Regulated Learning Theory and the Agentic Engagement Theory to guide the process. The population included the teachers and students of B.Ed. (Hons.) program at Shah Abdul Latif University, Khairpur and affiliated colleges of education. A planned sample of 50 teachers and 200 students were chosen using simple random sampling and structured questionnaires based on TAM, giving 42 and 165 usable teacher and student responses respectively. The data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) available in SmartPLS 3.0. The measurement model showed good reliability and validity (composite reliability > 0.80, average variance extracted > 0.50) and the HTMT and Fornell-Larcker criteria revealed discriminant validity. The model accounted for 67% of the variance in student learning. Student learning was most strongly and significantly ($\beta = 0.657$, $p < 0.001$) influenced by ease of use, with concerns and limitations ($\beta = 0.176$, $p = 0.020$) also having a significant impact, but not as great. Perceived usefulness ($\beta = 0.160$, $p = 0.066$) and engagement and motivation ($\beta = -0.109$, $p = 0.168$) were not statistically significant. Overall, the attitudes of teachers and students were quite positive with the students having higher usefulness and ease-of-use ratings while teachers had higher rates of concern about academic integrity and over-reliance. Findings indicate that Generative AI can be a valuable tool for teaching and learning when implemented in a framework of institutional guidance and training and equitable access. The study suggests the creation of institutional policies on AI, teacher professional development, student support in digital-literacy, and ongoing investment in digital infrastructure.

Introduction

Background of the Study

Artificial Intelligence has undergone a significant transformation from rule-based expert systems and first-generation intelligent tutoring systems to Generative Artificial Intelligence (GenAI) that can generate human-like text, images, and other content at will. The release of ChatGPT to the public in late 2022, for example, has ushered in one of the fastest technology adoption cycles in education history by providing advanced generative capabilities, such as AI, directly to teachers and students. These tools have been implemented in the planning of lessons, creation of content, design of assessments, tutoring, and support for writing and research in just a few days, sparking excitement for their teaching capabilities and concerns about academic integrity, excessive reliance, and the correctness of AI-generated materials.

The use of Generative AI in Higher Education Institutions (HEIs) in Pakistan has been done informally and without any systematic empirical investigation or institutional policy. Teacher-education programs are of particular interest because they prepare the next generation of educators, whose attitudes toward and competence with such tools will shape how AI is eventually used in schools. This study therefore investigates the supportive role of Generative AI in education from the perspective of teachers and students enrolled in the B.Ed. (Hons.) program at Shah Abdul Latif University (SALU), Khairpur, and its affiliated colleges of education.

Statement of the Problem

Despite the rapid uptake of Generative AI tools in classrooms, empirical evidence on how teachers and students in Pakistani higher education perceive and experience these tools remains scarce. Most existing research originates from Western and high-income contexts with different technological infrastructure, language environments and educational cultures, and tends to examine either teachers or students in isolation rather than comparing the two groups within the same institutional setting. Furthermore, few studies apply an established technology-adoption framework, such as the Technology Acceptance Model, to examine how perceived usefulness, ease of use, engagement and concerns jointly relate to student learning in this context. This gap limits the ability of Pakistani higher education institutions to develop evidence-based policy for the responsible integration of Generative AI into teaching and learning.

Objectives of the Study

1. To examine teachers' perceptions of the supportive role of Generative AI in education, including its perceived usefulness, ease of use and pedagogical support.
2. To analyze students' perceptions of Generative AI as a learning tool, including perceived usefulness, ease of use, and effects on engagement and motivation.
3. To assess the perceived impact of Generative AI use on student learning outcomes, as reported by teachers and students.
4. To identify the risks and opportunities that Generative AI tools present for teachers and students in educational settings.
5. To examine how perceived usefulness, ease of use, engagement and motivation, and concerns and limitations relate to student learning.

6. To generate evidence-based recommendations for the effective and responsible use of Generative AI as a supportive tool in higher education.

Research Questions

1. What are teachers' perceptions regarding the supportive role of Generative AI in education?
2. What are students' perceptions of Generative AI as a learning support?
3. How does Generative AI affect student learning, as perceived by teachers and students?
4. What are some of the barriers and facilitators teachers and students see in incorporating Generative AI into learning?
5. How are perceived usefulness, ease of use, engagement and motivation, and concerns and limitations related to student learning?

Significance of the Study

The study is of both theoretical, practical and policy dimensions. This extends the use of the Technology Acceptance Model (TAM) along with Constructivist Learning Theory (CLT), Self-Regulated Learning Theory (SRLT) and Agentic Engagement Theory (AET) to the new context of Generative AI in a non-Western higher education setting in theory. In practice, the results provide teacher educators, teachers, and students with tangible insights into which aspects of the use of Generative AI correlate with increased learning support, and which can be focused on to enhance its incorporation into education. The recommendations, at the policy level, serve as a foundation for developing institutional guidelines, professional development needs and investment decisions to promote equitable and ethical use of Generative AI in Pakistani HEIs.

Literature Review

Theoretical Framework

The present research is based on four complementary theoretical points of view. The Technology Acceptance Model (TAM) (Davis, 1989) suggests that perceived usefulness and perceived ease of use are the two factors that influence an individual's intention to use a technology, and has been used and tested in several educational-technology settings, such as learning management systems and online learning environments. The Constructivist Learning Theory, which draws on Piaget and Vygotsky, sees learning as an active process of knowledge construction in the context of experience, reflection and social interaction, and proposes that Generative AI has a potential role to play in supporting learning where it scaffolds inquiry, contextualizes explanations and encourages reflection without replacing the learner's cognitive effort. Self-Regulated Learning (SRL) theory posits that learning is a process of forethought, performance and self-reflection, and indicates ways that Generative AI could be used to assist students with task analysis, as well as monitoring and feedback, at each stage, but also suggests that using AI could lower the engagement in developing SRL skills if the AI is used to replace the SRL steps. Agentic Engagement Theory (Reeve & Tseng, 2011) extends this by conceptualizing engagement as students' role in creating their own learning context, which is especially pertinent in the case of generative AI, as the way in which student's question, redirect, and critically evaluate AI-generated content will either aid or hinder learning. These four perspectives offer a multi-

dimensional view of the relationship between Generative AI and technology adoption, knowledge construction, self-regulation, and learner agency.

Generative AI Tools in Education

ChatGPT and comparable large language models (e.g., Google Gemini, Microsoft Copilot, Perplexity AI) have become the most widely used Generative AI tools in educational settings, valued for their conversational interface, broad subject coverage and capacity to generate explanations, summaries, drafts and practice material on demand (Chakraborty, 2024). Their rapid, low-cost accessibility distinguishes them from earlier intelligent tutoring systems, but also raises new questions about accuracy, originality and appropriate use in academic work.

Supportive Role of Generative AI for Teachers

There are several identified ways Generative AI can help teachers with lesson planning, curriculum design, content development, assessment, and feedback; and reduce routine administrative tasks and workload based on learning goals and constraints for a particular grade level. In the study by Kaplan-Rakowski et al. (2023), those teachers who had more experience with and training on technology had more positive perceptions about the usefulness of Generative AI, highlighting the important role of prior experience and professional development in influencing adoption.

Supportive Role of Generative AI for Students

Students have identified the areas of personalized learning support, research assistance, language and writing support, and problem-solving and tutoring support as features linked to Generative AI. In a meta-analysis of the use of chatbots in education, Deng and Yu (2023) found that overall, chatbots had a positive impact on learning, especially in the domains of knowledge-based learning, and that students with lower prior knowledge benefited the most. Gao, Wang and Zhang (2024) also reported positive effects for learning motivation and achievement for reading with ChatGPT in education. While the majority of studies examining students' perceptions yield largely positive results, some reveal that training on responsible use of AI technology correlates with more positive perceptions and more positive usage patterns, such as in the case of Obenza et al. (2024) achieving this through educational support with the use of AI.

Challenges and Concerns

In addition to these possible benefits, the literature suggests 5 common concerns. First, concerns about academic integrity and plagiarism are raised as it is difficult to identify the plagiarized text if it was produced by AI and students' perceptions of acceptable use vary (Nguyen, 2025). Second, the reliance on Generative AI could lead students to become complacent about their own ability to think, as students who used AI extensively to complete tasks showed lack of learning compared to those who did not use AI (Valcea, Hamdani & Wang, 2024). Third, AI-generated content is still not impeccable or reliable, especially when it comes to niche or rapidly evolving subjects, and it can be difficult to identify AI-generated inaccuracies (Jauhiainen & Guerra, 2023). Fourth, in the Pakistani context, the digital divide and equity issues are important: unequal access to the internet, access to devices, and the proficiency in English can impact which students are better able to utilize Generative AI tools. Fifth, privacy and security issues are

related to the way student and teacher inputs are processed by the third-party AI platforms, where they could be used for model training or shared without the user's knowledge.

Research Gap and Conceptual Framework

Existing research is concentrated in Western and high-income contexts, tends to focus on learning outcomes rather than the broader supportive role of Generative AI, and rarely examines teachers and students within the same study or applies TAM specifically to Generative AI in teacher education. This study addresses these gaps by jointly examining teachers' and students' perceptions at a Pakistani teacher-education institution, using a TAM-based conceptual framework in which perceived usefulness and perceived ease of use are hypothesized to relate to student learning both directly and in conjunction with engagement/motivation and concerns/limitations, providing a structured basis for the research instruments and the analysis reported below.

Research Methodology

Research Design and Philosophy

This study adopted a positivist research philosophy and a quantitative, descriptive cross-sectional survey design, appropriate for examining measurable perceptions and testing hypothesized relationships between variables derived from the Technology Acceptance Model. A small number of open-ended items were included to provide contextual, qualitative insight, but the study's primary approach and analysis are quantitative.

Population and Sample

The population comprised all teachers (approximately 80) and students (approximately 800) enrolled in the B.Ed. (Hons.) program at Shah Abdul Latif University, Khairpur, and its three affiliated colleges of education, totaling 880 individuals. Using simple random sampling, a planned sample of 50 teachers (62.5% of the teacher population) and 200 students (25% of the student population) was drawn. Post data screening, 42 teacher responses were used and 165 student responses were used for analysis, with a response rate of 84% and 82.5%, respectively.

Table 1: Population and Sample Distribution

Category	Population	Planned Sample	Usable Responses	Sampling Technique
Teachers	80	50 (62.5%)	42	Simple Random Sampling
Students	800	200 (25.0%)	165	Simple Random Sampling
Total	880	250 (28.4%)	207	Simple Random Sampling

Research Instruments

Two questionnaires were developed, one structured and the other based on TAM, both of which were being measured on a five-point Likert scale (from Strongly Disagree to Strongly Agree). The teacher questionnaire consisted of 20 items that covered the five dimensions: Perceived Usefulness (5 items), Perceived Ease of Use (4 items), Pedagogical Support (4 items), Student Learning Environment (3 items), and Challenges and Ethical Concerns (4 items). The student

questionnaire also included 20 questions about their Perceived Usefulness (5 items), ease of use (4 items), Student Learning Support (4 items), Engagement and Motivation (3 items), and Concerns and Limitations (4 items). Both instruments consisted of a demographic section and some open-ended items.

Validity and Reliability

Both instruments were pilot-tested prior to full administration, with all dimensions returning Cronbach's alpha values above 0.80, indicating good internal consistency. Construct validity was further established through the measurement-model analysis reported in Section 4.2, including confirmatory factor loadings, composite reliability, average variance extracted, and discriminant validity (HTMT and Fornell–Larcker criteria).

Data Analysis Technique

Data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS 3.0, following the two-step approach recommended by Chin (1998) and Bagozzi and Yi (1989): first, assessment of the measurement model for reliability and validity, followed by assessment of the structural model to test the hypothesized paths using bootstrapping with 5,000 resamples. Descriptive statistics and independent-samples t-tests were used to compare teachers' and students' mean perception scores.

Results and Data Analysis

Demographic Profile of Respondents

Among the 42 teacher respondents, the largest age group was 31–40 years (47.6%), and the largest experience band was 11–15 years (38.1%); all held at least a Master's degree, with 28.6% holding an MPhil and 7.1% a PhD. Among the 165 student respondents, most were aged 21–25 years (67.9%), with 41.2% in their first year of study and progressively smaller proportions in later years. When asked if teachers had prior experience with Generative AI, 42.9% said they actively used ChatGPT or similar tools, 35.7% said they knew about ChatGPT or similar tools, but had not used them and 21.4% said they didn't know about ChatGPT or similar tools. However, a significantly larger proportion of students (59.4%) reported also using Generative AI tools, compared to teachers (31.5%), and 9.1% of students were unfamiliar with Generative AI tools, similar to teachers.

Measurement Model Assessment

As indicated in Table 2, the lowest indicator (EOU4 "I can use Generative AI very well at an instant"; $\lambda = 0.665$) was still above the recommended threshold of >0.60 and statistically significant ($p > 0.50$) which lead us to confirm convergent validity [44].

Table 2: Composite Reliability and Average Variance Extracted

Construct	Composite Reliability	AVE	Interpretation
Perceived Usefulness (PU)	0.903	0.651	Convergent validity established
Ease of Use (EOU)	0.853	0.594	Convergent validity established

Engagement and Motivation (ENM)	0.941	0.842	Convergent validity established
Student Learning (SL)	0.833	0.556	Convergent validity established
Concerns and Limitations (CNL)	0.848	0.584	Convergent validity established

Discriminant Validity

Discriminant validity was examined through the Heterotrait-Monotrait ratio (HTMT) and contemporaneous Fornell–Larcker criterion. All HTMT values fell below the conservative 0.85 threshold, with the highest value (0.880, between Perceived Usefulness and Ease of Use) considered acceptable given the theoretically expected relationship between the two constructs. The Fornell–Larcker criterion was also satisfied, as the square root of the AVE for each construct exceeded its correlations with other constructs, confirming that the five constructs are empirically distinct.

Structural Model Assessment and Hypothesis Testing

The structural model explained 67% of the variance in student learning ($R^2 = 0.67$). Bootstrapping with 5,000 resamples showed that Ease of Use had the strongest and only highly significant positive effect on student learning ($\beta = 0.657$, $p < 0.001$, $f^2 = 0.371$, large effect). Concerns and Limitations showed a smaller but statistically significant positive effect ($\beta = 0.176$, $p = 0.020$, $f^2 = 0.043$, small effect). Perceived Usefulness ($\beta = 0.160$, $p = 0.066$, $f^2 = 0.027$) and Engagement and Motivation ($\beta = -0.109$, $p = 0.168$, $f^2 = 0.011$) were not statistically significant at the 5% level.

Table 3: Path Coefficients and Hypothesis Testing Results

Hypothesis	Path	β	t-value	p-value	Decision
H1	Perceived Usefulness → Student Learning	0.160	1.839	0.066	Not Supported
H2	Ease of Use → Student Learning	0.657	6.787	<0.001	Supported
H3	Engagement/Motivation → Student Learning	-0.109	1.378	0.168	Not Supported
H4	Concerns/Limitations → Student Learning	0.176	2.323	0.020	Supported

Comparison of Teachers' and Students' Perceptions

Independent-samples t-tests comparing mean scores revealed that students rated Generative AI's usefulness (4.31 vs. 4.12, $p = 0.020$) and ease of use (4.28 vs. 3.98, $p < 0.001$) significantly higher than teachers did, and also reported significantly higher engagement (4.15 vs. 3.94, $p = 0.033$). No significant difference was found for learning/pedagogical support (4.09 vs. 4.05, $p = 0.632$). Teachers, however, expressed significantly greater concern than students (4.18 vs. 3.85, $p < 0.001$), particularly around academic integrity, over-reliance and the need for institutional guidance.

Table 4: Comparison of Mean Perception Scores Between Teachers and Students

Dimension	Teachers (n=42)	Students (n=165)	Mean Diff.	p-value	Interpretation
Perceived Usefulness	4.12	4.31	-0.19	0.020	Students higher*
Ease of Use	3.98	4.28	-0.30	<0.001	Students higher***
Learning/Pedagogical Support	4.05	4.09	-0.04	0.632	No significant difference
Engagement/Learning Environment	3.94	4.15	-0.21	0.033	Students higher*
Concerns and Limitations	4.18	3.85	0.33	<0.001	Teachers higher***

Note: * $p < 0.05$, *** $p < 0.001$

Open-ended responses complemented these quantitative findings. Teachers frequently called for structured training on classroom integration of Generative AI and voiced concern that some students were submitting AI-generated assignments without adequate learning, complicating the assessment of genuine understanding. Students, in turn, described Generative AI as helpful for simplifying difficult concepts on demand, while some acknowledged a tendency to turn to AI before attempting a problem independently, expressing concern that this reduced their own learning.

Discussion

The ease of use was the highest predictor of the student learning ($\beta = 0.657$), highlighting that ease of use is as important as the capability of Generative AI tools for the instructional value. Generally, this aligns with the Technology Acceptance Model, but the lack of significance of the variables of perceived usefulness would suggest that in this new technology the ease with which it can be used and interacted with is more important than the expected benefits from the technology, making it more applicable to the Generative AI context. The natural language interfaces of tools like ChatGPT seem to make the technology more user-friendly, and allow students to spend their mental energy on the learning material, not on figuring out how to leverage the technology.

The relatively small positive relationship between concerns and limitations with student learning is initially counterintuitive, but it aligns with a self-regulation perspective that students who are more aware of the potential risks involved with using AI tools, such as concerns about accuracy or relying on AI too heavily, might be more likely to use them in a thoughtful and conscious way, which then leads to stronger learning outcomes. The non-significant effect of engagement and motivation suggests that enjoyment or interest in using Generative AI is insufficient to ensure learning gains, further supporting the Agentic Engagement Theory perspective that the quality of a student's interaction with AI, rather than the engagement itself, leads to learning.

These higher levels of usefulness and ease of use in students' eyes and higher concern in teachers' eyes stem from different perspectives: concern for students' assessment and integrity concerns is lower while concern for students' usefulness and ease of use is higher, given that students benefit from AI assistance directly and immediately in their understanding and task completion, and teachers are more exposed to the assessment and integrity concerns of student

AI use. This concern is reflected in the teachers' relative rating on academic-integrity-compatible assessment design, which is lower than the rating for their other dimension, creative teaching support. The results are consistent with the Constructivist and Self-Regulated Learning theories in that Generative AI is not an automatic substitute for the active construction of knowledge but it does assist the active construction of knowledge when scaffolded by clear expectations, training and practice.

Conclusion

This study explored the support that Generative Artificial Intelligence (GAI) provides to teachers and students in a Pakistani teacher training institution. Teachers generally had positive attitudes toward Generative AI, appreciating the AI's role in lesson materials, teaching methods, and decreased administrative duties, while students generally had positive attitudes toward Generative AI, finding it helpful for grasping challenging concepts, completing homework, and providing personalized on-demand support. The structural model showed that ease of use, rather than perceived usefulness or enthusiasm, was a greater contributor to students' learning, while increased awareness of concerns was correlated with slightly greater learning outcomes, indicating that critical and reflective student interactions with Generative AI is more pedagogically beneficial than uncritical enthusiasm.

The study also confirmed the predictive power of ease of use, but not of perceived usefulness, of the TAM when predicting learning from Generative AI, suggesting that other attributes of the technology, such as usability and guidance and critical engagement, are perhaps more relevant when it comes to Generative AI. The results broadly show similar patterns to those seen in the west, but highlight the Pakistani issues of infrastructure, access and institutional readiness. Generally, the evidence suggests that Generative AI is a useful and complementary tool for teaching and learning, and not a replacement for teachers' expertise or targeted student learning, but that this can only be educational if it is easy to use and is supported by guidelines and expectations set by the institutions where it is used, as well as the digital literacy of the users.

Recommendations

Based on the findings the following recommendations are made.

For Educational Institutions

Policies should be developed by institutions that define acceptable and unacceptable uses of Generative AI, requirements for disclosure and the consequences of misuse; Professional Development should be prioritized, involving both technical and pedagogical skills, to build the competency of teachers while ensuring they have access to devices, Internet connectivity and language support, and that all students have access; Assessment practices should be reviewed to incorporate process-oriented, in-class and other forms of assessments that are more resistant to being misused by AI.

For Teachers

Teachers are encouraged to become familiar with the Generative AI tools in practice (pre-class) before deciding whether and how to integrate, set clear guidelines on acceptable use of Generative AI for the course, design tasks that will build on the strengths of Generative AI and

leave room for independent, higher-order thinking tasks, and explicitly teach strategies for prompting, verifying and critically evaluating the content produced with AI.

For Students

Students should not use Generative AI to replace their own work, critically assess and confirm the information generated by AI with credible sources, acknowledge the use of AI where necessary and develop fundamental skills without relying on AI.

For Policymakers

Policymakers should establish national and provincial guidelines for educational use of Generative AI that uphold academic integrity and innovation while ensuring flexibility for learning institutions; invest in digital infrastructure to reduce the digital divide; and conduct more research on the potential long-term effects of Generative AI in different educational settings in Pakistan.

Limitations and Directions for Future Research

The study is constrained by the fact that it confined to one university and associated colleges in Khairpur district and further results and conclusions of the study may not be generalizable in other institutions and in other location. The cross-sectional design only captures perceptions at one time in the data collection, and the generative AI tools are constantly changing, as is their familiarity to users. The study was based on the self-reported perceptions of learners, and the learner perception of learning outcomes was limited to the use of text-based Generative AI tools, primarily ChatGPT, as opposed to other modalities, including image and video generation. The sample size is relatively small for more in-depth analyses of structural modelling and the study did not involve direct observation of use of AI or analyses of content created by AI. Further studies are recommended to follow-up on longitudinal designs to see the changes in perceptions and learning outcomes after prolonged use of Generative AI; include more objective learning-outcome instruments along with self-reported perceptions; expand to other institutions and geographical areas throughout Pakistan; and explore other Generative AI modalities and the implications for teaching and learning.

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