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The Effect of Generative AI-Supported Learning on Students' Epistemic Confidence: Examining the Role of Critical Thinking Disposition

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ABSTRACT

The increasing use of Generative Artificial Intelligence (AI) in higher education has created new opportunities for academic learning while raising questions about students' confidence in evaluating and understanding knowledge. This study examines the effect of Generative AI-supported learning on students' epistemic confidence and investigates the moderating role of critical thinking disposition among university students in Pakistan. A quantitative, cross-sectional research design was employed, and primary data were obtained from 335 undergraduate and postgraduate students with experience of using Generative AI tools, including ChatGPT, Google Gemini, and Microsoft Copilot, for academic purposes. Data were collected through a structured, self-administered questionnaire distributed using Google Forms and a convenience sampling technique. The collected responses were analyzed using descriptive statistics, Cronbach's Alpha, Pearson correlation, multiple linear regression, and Hayes' PROCESS Macro Model 1 with 5,000 bootstrap samples. The proposed results indicate a positive and significant relationship between Generative AI-supported learning and students' epistemic confidence ($r = 0.624$, $p < 0.01$). Multiple regression analysis suggests that Generative AI-supported learning ($\beta = 0.421$, $p < 0.001$) and critical thinking disposition ($\beta = 0.341$, $p < 0.001$) jointly explain 47.7% of the variance in students' epistemic confidence ($R^2 = 0.477$). Furthermore, moderation analysis indicates a positive interaction between Generative AI-supported learning and critical thinking disposition ($B = 0.158$, $p < 0.001$), suggesting that critical thinking disposition strengthens the relationship between AI-supported learning and epistemic confidence. The study highlights the importance of integrating Generative AI tools with critical thinking practices to promote informed academic judgments, responsible technology use, and meaningful learning experiences in higher education. It further emphasizes that students should evaluate and verify AI-generated information rather than accept it without critical examination. The findings may guide educators and universities in developing effective AI literacy strategies that support independent thinking and evidence-based learning. This research also contributes to educational psychology by extending understanding of how students' critical thinking disposition may shape their confidence in academic knowledge when using emerging AI technologies.

Introduction

Generative AI-Supported Learning and Its Role in Higher Education

The use of Generative Artificial Intelligence (Generative AI) has been rapidly becoming a major feature of higher education, impacting the way students find information, digest academic ideas, accomplish learning tasks, and interact with academics. Students have the opportunity to engage with AI-generated explanations through generative AI tools, get instant feedback, learn about complicated topics and get customized academic assistance from ChatGPT, Google Gemini and Microsoft Copilot. Generative AI is not just another digital learning tool, but can generate context specific answers in response to student questions in an interactive manner, which enables students to ask questions and learn in new ways and understand different points of view on academic subjects. These capabilities have opened new opportunities to enhance students' learning experiences, knowledge building and independent learning (Öncü et al., 2026). This has led to Generative AI-supported learning becoming an area of significant research in education and its impact on students' cognitive learning and understanding.

Generative AI learning is the concept of learning using AI tools to assist in acquiring knowledge, solving academic problems, exploring information and making decisions about learning. These technologies enable students to get a simplified explanation, to create examples, to compare theoretical explanations, and to get some help to understand hard academic content. This is because from a constructivist learning point of view, these interactions can help construct knowledge, as the learners are encouraged to link the new information they have learned with their existing knowledge and experiences. The educational impact of Generative AI depends on how students relate to the AI-generated information, how they assess its accuracy, and how they incorporate it into their learning journey. Research indicates that generative AI can offer valuable support for education, but factors such as the potential for misinformation, dependency, and decreased independent thinking should be addressed (Dwivedi et al., 2023). Thus, the study of learning with Generative AI also needs to focus on the cognitive–psychological mechanisms of how students build their academic knowledge.

The increasing adoption of Generative AI in the classroom also underscores the need to be aware of how Generative AI affects students' self-assurance in their knowledge and academic decisions. In the learning and studying of new topics, in assignments and in the comparison of the different solutions, students are increasingly using the explanations and recommendations produced by the AI. These interactions could enhance their knowledge by offering easily accessible explanations and opportunities for repeated learning. However, relying on AI-generated answers without proper scrutiny could lead to an incomplete knowledge and understanding. The correlation between the use of Generative AI in learning and students' epistemic confidence, therefore, requires special attention, as students need to be able to discern between information that seems convincing and one that is adequately backed up by evidence. The responsible use of AI in education, critical engagement, and human judgement have all been highlighted in previous studies (Bender et al., 2024). These considerations lay the groundwork for exploring the role of generative AI-aided learning in fostering students' epistemic confidence and the potential impact of specific cognitive traits on this connection.

Students’ Epistemic Confidence and Critical Thinking Disposition

Epistemic confidence is a person's self-assessed confidence in their knowledge, information and judgements regarding the reliability of the knowledge claims. In educational settings, students' epistemic confidence is where their confidence in their ability to access academic information, assess explanations, identify reliable knowledge from less certain claims, and draw informed judgments. It's a crucial psychological and cognitive component of learning, as learners often find themselves exposed to information from various sources, such as academic papers, textbooks, online resources, and AI-generated answers. Epistemic beliefs are tightly linked to epistemic confidence, which involves people's beliefs about how knowledge is created, how sure they are of it and how justified it is. Studies of personal epistemology have shown that students have varying beliefs about what can be known, how knowledge claims are to be evaluated, the nature of evidence and whether evidence can be considered reliable (Lai et al., 2026). Hence, it is especially important to understand how an epistemic confidence will develop in the current educational context where the student is expected to evaluate the ever-growing amount of information on his own.

In higher education, epistemic confidence can affect students’ willingness to engage in academic discourse, to voice their opinion, undertake challenging learning tasks, and argue their points and conclusions with adequate evidence. An epistemic confidence is well calibrated when students are able to identify what they know and what they don't know and when they need more information. But a student's confidence does not necessarily mean that the student knows the information, as they might have a strong opinion without having enough evidence or critically evaluating it. When incorporating Generative AI tools, this will be particularly relevant because the AI-generated responses may seem authoritative but are not necessarily correct or complete. Studies on epistemic cognition indicate that learners need to reflect on the credibility of information sources, the quality of supporting evidence, and the

justification for claims of knowledge to make an effective evaluation of knowledge (Kartal et al., 2024). Epistemic confidence should therefore be viewed as related to students' powers of assessing knowledge, not solely with regard to their subjective certainty in what they know.

Critical thinking disposition is a person's persistent willingness and inclination to think critically, reasoning, and substantiating their beliefs with evidence when processing information and making decisions. This is about being intellectually curious, open-minded, analytical, seeking truth, having a systematic way of thinking, and revisiting the thinking of one's own beliefs when they are challenged with convincing evidence. While critical thinking skills involve cognitive abilities that are necessary to analyze and evaluate information, critical thinking disposition is about the desire and readiness to use the critical thinking skills in a variety of contexts. In general, students with higher levels of critical thinking dispositions tend to be more critical of assumptions, more inclined to consider alternative explanations, to look for inconsistencies, and to search for evidence to support or refute information. Mansouri et al., (2023) pointed out the significant dimensions of critical thinking such as interpretation, analysis, evaluation, inference, explanation, and self-regulation, and Tarchi et al (2025) emphasized the importance intellectual engagement and willingness to think critically. In the same way, Solodikhina (2025) pointed out the importance of cognitive abilities and a disposition to use them effectively when critical thinking is required. This attitude can be crucial in the context of Generative AI facilitated learning, enabling students to interact with AI generated content in a responsible manner.

Relationship Between Generative AI-Supported Learning, Critical Thinking Disposition, and Epistemic Confidence

With the power of generative AI, students might experience epistemological changes in their learning, such as having easy access to academic explanations, learning opportunities through interaction, and answers to questions regarding knowledge. As students apply AI technologies to discover new ideas, to compare explanations of a topic, to understand how to resolve misunderstandings, they may gain a deeper understanding of academic material and be more confident in their learning. The use of AI-powered learning tools could also foster self-directed learning and help students seek out more information and explanations as they learn. Not all situations, however, are positive between the use of Generative AI for learning and the epistemic confidence. Relying too heavily on AI-generated answers can foster superficial learning and lead to higher confidence ratings in answers without a deeper understanding. To this end, the educational value of Generative AI is reliant on students' active engagement with the information generated, not simply taking it on faith without verifying it. Educational opportunities and cognitive challenges that arise with AI tools for generative writing have been emphasized in previous studies (Yan et al., 2025), and the need for the meaningful engagement in learning activities and the independent evaluation of knowledge is evident. Therefore, the study of this correlation can offer valuable insights into the impact of using AI in learning experiences on students' confidence in learning content.

The relationship between Generative AI-supported learning and students' epistemic confidence could be attributed to their critical thinking disposition. Students with intellectual curiosity, open-mindedness, and analytical skills can engage in more reflective use of Generative AI tools, challenging, comparing, and verifying information they get from these tools with information from other sources and identifying potential inaccuracies. This type of engagement could contribute to students understanding their knowledge as reliable (from evidence) and non-reliable (not from evidence) and build more realistic and evidence-based confidence in their academic knowledge. However, students with less critical thinking dispositions may be more apt to accept AI-generated answers without rigorous scrutiny, and establish a level of confidence on information that has not been thoroughly vetted. Studies of critical thinking and digital information assessment indicate that critical thinking and digital information assessment require reflective judgment and source evaluation. (Hochman et al., 2026). Because of this, critical thinking disposition can serve as a moderator that can strengthen or weaken the relationship between Generative AI-supported learning and epistemic confidence.

The relationship between Generative AI-aided learning, disposition of critical thinking and students' epistemic confidence is an interesting area of focus for research in Educational Psychology and the use of technology in education. While Generative AI has the potential to support students' learning in real-time and afford them the chance to explore knowledge unique to them, its pedagogical effects could be shaped by how students critically engage with and evaluate the information they are provided. Learners who seek out alternative explanations, challenge the AI's answers, and check the facts may be better equipped to gain a more robust understanding of and trust in what they're learning and what they're thinking. In contrast, AI-generated information, when not critically interpreted, can result in a lack of knowledge justifications and lead to overconfidence. While the academic debate on the use of Generative AI in education has been undergoing an increasing discussion, there is still a need for more empirical study for better understanding of the relationship between the use of AI supported learning and epistemic confidence of the students especially in university learning environment, and how students' critical thinking dispositions influence this relationship (Helal et al., 2025). While the relationship between the two is already well established in the existing literature on AI-supported education and the existing literature on epistemic cognition, the relationships are highly specific and needs further investigations. Thus, the present study takes a look at the impact of Generative AI-supported learning on students' epistemic confidence, and explores the

moderating effect of critical thinking disposition. The study seeks to make a contribution to educational research by clarifying the mechanisms behind how students' cognitive dispositions foster their confidence in gaining knowledge and evaluating it in higher education settings where AI is increasingly playing a central role.

Research Objectives

- To examine the relationship between Generative AI-supported learning and students' epistemic confidence.
- To investigate the impact of Generative AI-supported learning on students' epistemic confidence.
- To examine the moderating role of critical thinking disposition in the relationship between Generative AI-supported learning and students' epistemic confidence.

Research Questions

Q1: What is the relationship between Generative AI-supported learning and students' epistemic confidence?

Q2: What is the impact of Generative AI-supported learning on students' epistemic confidence?

Q3: Does critical thinking disposition moderate the relationship between Generative AI-supported learning and students' epistemic confidence?

Problem Statement

Generative Artificial Intelligence (AI) has revolutionized the way students learn and are solving problems in class, and studying independently. Generative Artificial Intelligence (AI) has changed the way students are learning, solving class problems, and studying independently. While Generative AI tools can offer instant explanations, tailored academic support, and the ability to delve into complex ideas, there are questions about the capacity of students to assess AI-generated information and form trustworthy academic understanding. Students may over rely on AI-generated responses without critically evaluating the accuracy, credibility and supporting evidence and may build confidence in what they are responding to that is misplaced. In addition, when developing knowledge and making academic decisions, students' epistemic confidence, or confidence in their knowledge and academic judgments, is especially crucial in learning environments where the ability to distinguish accurate information from inaccurate information has become a difficult task (Vendrell et al., 2026). Although there is limited understanding about how critical thinking disposition might moderate the connection between Generative AI supported learning and students' epistemic confidence, the interpretation, questioning, and evaluation of AI generated information are constrained by the students' critical thinking disposition. While there are existing studies on the education opportunities and challenges that Generative AI presents for students, more empirical research is required to determine whether AI-supported education can boost students' epistemic confidence and whether the disposition toward critical thinking alters this relationship (Esmaeiligoujar et al., 2026). Based on this, the present study focuses on students' epistemic confidence and the moderating effect of their critical thinking disposition in the relationship between Generative AI-supported learning and students' epistemic confidence, thereby contributing to the field of research that has been lacking.

Significance of the Study

The present study is significant because it explores how Generative AI-supported learning influences students' epistemic confidence and highlights the importance of critical thinking disposition in AI-integrated educational environments. As Generative AI tools become increasingly common in higher education, understanding their influence on students' confidence in acquiring, evaluating, and applying knowledge has become essential. The findings may help university students develop more responsible AI-supported learning practices, encourage educators to promote critical thinking and independent judgment, and assist academic institutions in developing effective guidelines for integrating Generative AI into educational activities. Furthermore, the study may contribute to educational psychology and technology-enhanced learning by providing insights into how individual thinking dispositions shape students' confidence in their academic knowledge. It may also provide a foundation for future researchers investigating the cognitive and educational implications of Generative AI in higher education.

Literature Review

Generative AI-Supported Learning and Students' Academic Development

Pesovski et al., (2024) discuss the opportunities and challenges of using large language models (LLM), and in this case, ChatGPT, in educational environments. Their research underscored the promise of generative AI to provide personalized learning support, to explain academic concepts, to support independent learning, and to give instant feedback. The authors of the document highlighted the potential of AI-driven educational aids in bridging the information gap and addressing various learning needs. But they also surfaced some issues with inaccurate information, academic honesty and overreliance on AI-generated responses. Their research indicates that the pedagogical impact of GenAI relies on students' engagement with and feedback on the content that they are exposed to in relation to these tools.

Likewise, Iqbal et al. (2025) explored the educational implications of ChatGPT and the potential uses of ChatGPT in education and learning. They found that conversational AI can aid students by providing personalized assistance and explanations, and by enhancing access to educational materials. The authors also stressed the ethical concerns, accuracy of information and responsible use of AI. They believe that using Generative AI in learning activities can positively assist students' learning process if it is used as a tool to help students learn rather than to replace their thinking. This insight offers a base to consider the potential impact of AI-enhanced learning experiences on students' academic self-assurance and knowledge acquisition.

To explore the influence of ChatGPT in the education field, Isaeva et al., (2026) carried out a literature review. It highlighted a number of learning opportunities such as personalized learning, support with writing, academic support and enhanced access to explanations. The author also raised concerns about the dissemination of misinformation, reliance on academic databases, and the shortcomings of AI-generated answers. The findings suggest the need for students to have the necessary evaluation skills when utilizing generative AI tools for academic work. The findings are applicable to the current study in that they highlight the need to consider not only availability of AI-enhanced learning, but also how AI has an impact on students' confidence in their understanding and evaluation of academic information(Ayaz Khan J, Wali Ahmed F, Shaikh N, et al. July 13, 2025).

Generative AI-Supported Learning and Epistemic Confidence

Nnenna (2026) studied the development of epistemological theories, and described how learners' beliefs about knowledge and knowing affect their learning processes. They developed that students have different ideas about the "sureness, order and grounds" of knowledge. The authors emphasized that learners' beliefs about knowledge have an impact on their meaning-making, explanation assessment, and academic work. It is worth noting that their theoretical contribution is especially significant for this research, as epistemic confidence is related to students' confidence in their knowledge and academic judgments. These beliefs can impact students' perception and acceptance of AI-generated information in a learning setting.

Michael (2026) made an attempt to examine the dimensions of epistemic cognition by combining philosophy and psychology. Their research highlighted that knowledge evaluation means to review evidence, to assess the trustworthiness of information and to grasp the justification of knowledge claims. Effective learning involves students thinking beyond accepting information, and using their reasoning and evidence to assess the logic of specific claims, the authors explained. When it comes to Generative AI powered learning, it is crucial to have this perspective because students often are given explanations that seem plausible but need further verification. Their theoretical work indicates that student's self-confidence in the knowledge should be taken into account along with the reliability of information assessment.

Sui et al., (2026) examined university students' perceptions of the use of generative AI in higher education, its perceived benefits, challenges, and implications for education. Their research revealed that students identified generative AI as being useful for boosting learning efficiency, getting explanations and to assist in academic activities. There were also concerns highlighted by students that the accuracy, reliability, privacy, and dependence on AI technologies are problematic. They found that students' interactions with generative AI are educational opportunities as well as uncertainties. These results help examine if exposure to AI-backed learning helps build students' epistemic confidence and if being able to critically evaluate information generated by AI affects that confidence.

Critical Thinking Disposition as a Moderator

Under the auspices of the American Philosophical Association, Fatmawati et al., (2025) created an influential theoretical framework of critical thinking as a result of an expert consensus study. The framework defined six big cognitive skills: "interpretation, analysis, evaluation, inference, explanation, and self-regulation. The writer also stressed that the people must be able to show readiness to

use their thinking skills in the analysis of information and making judgments. In AI-enabled learning, this is especially crucial as students can get many different explanations and recommendations from a generative AI tool without always checking the validity. According to Orhan (2022) model, students who are ready to accept information, evaluate supporting evidence, and change their opinions, will be more receptive to academic materials created with the help of AI. Thus, it is crucial to have a theoretical foundation that can explain the differences in students' responses to Generative AI supported learning, which is critical thinking disposition.

Likewise, Zhao et al. (2024) studied the attitudes towards critical thinking and concluded that intellectual curiosity, open-mindedness, systematic thinking, seeking the truth, and analytical thinking are important. Their research showed that critical thinking requires not only reasoning skills but also an attitude to use reasoning skills to solve various problems. Students who possess greater critical thinking dispositions might be more apt to challenge explanations developed by AI, to compare information from different sources, and to identify inconsistencies in academic information. These traits are especially pertinent in the context of students employing AI technologies to gain knowledge of subjects they are unfamiliar with, or to construct research-based arguments. Their research gives a conceptual framework to think about how critical thinking disposition can be a factor that can affect the relationship between AI-integrated learning and students' knowledge certifications.

Gürler et al., (2023) explored how people assess online information and even developed a new strategy for it: lateral reading, reading about the information source from other sources that are independent of the source web page. They identified the need for source checking and critical appraisal in the digital information landscape. Likewise, explored students' skills in assessing the reliability of information found online and the importance of cultivating civic online reasoning skills. Their results showed that the credibility of the digital information, the supporting evidence, and the reliability of information must be deliberately considered when evaluating digital information. The student use of Generative AI in class demands students to assess AI-generated responses instead of taking them as truth. These contributions are relevant to the current study as students will need to evaluate what is generated by the AI, instead of accepting it as truth. Therefore, critical thinking disposition can facilitate the link between Generative AI-assisted learning and epistemic confidence by fostering knowledge evaluation based on evidence and careful consideration.

Relationship Between Generative AI-Supported Learning and Epistemic Confidence

Epistemic confidence can be explained in terms of students' learning, seeking help and assessing information with the support of Generative AI. Zagami (2026) stated that LLM could be helpful to personalized learning by providing explanations, answering questions, and engaging students with academic contents. These opportunities can allow students to see concepts they have not been introduced to, and to increase their self-belief in their knowledge. The authors also noted that AI-generated responses need to be checked by humans as AI systems can sometimes impart inaccurate or misleading information. This could mean that the correlation between AI-enabled learning and epistemic confidence can be different if students learn with AI-generated explanations and/or if they just use AI responses without building their understanding of them.

Umar (2026) performed a literature review to explore the use of AI chatbots for teaching. They reviewed 67 relevant studies and found that homework assistance, personalized learning, and skills development are key elements that provide benefits to educational chatbots. The authors also talked about the reliability and accuracy of AI technologies and their ethical application. According to their research, AI-powered educational engagement can offer learning opportunities, but students need to be cognizant of the constraints of information generated by AI. The results of this research lend weight to the idea that Generative AI-supported learning could lead to students' increased confidence in their grasp of academic concepts, especially when paired with students' independent learning and checking the reliability of the information they obtain.

Isaeva et al., (2026) studied applications of ChatGPT in teaching and learning to explore the educational affordances and challenges of ChatGPT. They discussed the potential and constraints of using generative AI in the educational context, as well as its ability to assist in educational activities. The authors underlined the need for proper pedagogical practices to bring in AI technologies instead of it being a source to acquire knowledge. The researchers' results align with the importance of comprehending and gaining trust in the judgments that students make while learning. The present study builds on these results to investigate if there is a correlation between students' engagement with Generative AI-supported learning and increases in epistemic confidence.

Research Gap

While some prior studies have looked at the educational implications of Generative AI, its impact on students' learning experiences, and the need for critical thinking in digital environments, little empirical research has focused on examining how Generative AI-supported learning affects students' epistemic confidence. Pedrosa (2025) discussed the educational potentials and challenges of generative AI, whereas Christopoulos et al., (2026) analysed the perception of educational potentials and constraints of generative AI among university students. Likewise, Prroni et al. (2026) stressed the need for critically assessing evidence and making claims

of knowledge. This study, however, is still lacking in the study of generative AI-supported learning combined with students' epistemic confidence, especially at various critical thinking disposition levels. Previous studies have investigated the relationship between critical thinking and use of AI as well as the relationship between critical thinking and epistemic confidence; more research is required to determine whether critical thinking disposition enhances or undermines the relationship between AI-supported learning and epistemic confidence. So the present study is intended to fill the gap by exploring the relationship between Generative AI-supported learning with students' epistemic confidence, and examining the role of critical thinking disposition as a moderator among the university students.

Research Hypotheses

H1: Generative AI-supported learning is significantly and positively associated with students' epistemic confidence.

H2: Generative AI-supported learning and critical thinking disposition significantly predict students' epistemic confidence.

H3: Critical thinking disposition significantly moderates the relationship between Generative AI-supported learning and students' epistemic confidence.

Conceptual Framework

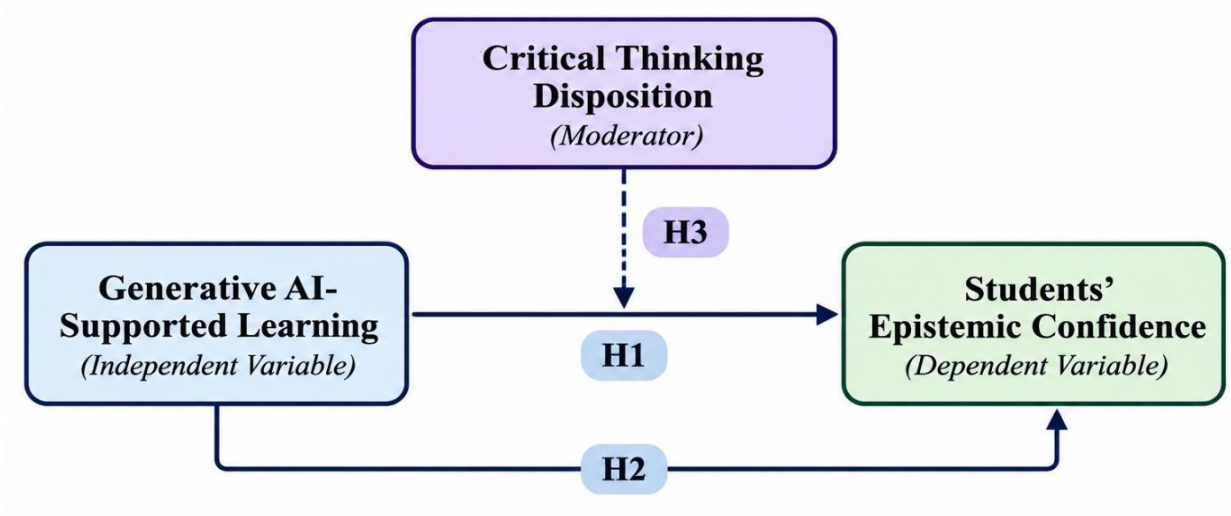


Fig 1: Conceptual Framework

Methodology

Research Design

This research was conducted with quantitative research approach and cross-sectional survey design, which aims at investigating the effect of Generative AI supported learning and to see the moderating role of critical thinking disposition on students' epistemic confidence. Primary data was collected from the university students of Pakistan by using structured questionnaire. Actually, the study involved examining relationships, predictive effects, and moderation among the variables of the study, thus the quantitative approach was chosen. Data were gathered at one time and statistical analysis was performed with SPSS software to check the hypotheses under investigation.

Population

The target population comprised undergraduate and postgraduate students of public and private universities throughout Pakistan with experience in using Generative AI tools including ChatGPT, Google Gemini and Microsoft Copilot for academic and learning purposes. The participants were selected from various geographical regions of Pakistan such as Punjab, Sindh, Khyber Pakhtunkhwa and Islamabad Capital Territory. The possible institutional settings were University of the Punjab, Bahauddin Zakariya University, Government college university, Faisalabad, COMSATS University Islamabad, University of Karachi, University of Sindh, University of Peshawar, Abdul wali khan University Mardan, and International Islamic University Islamabad. To capture various viewpoints

on using AI as a learning partner and for the development of academic knowledge, students from varied fields of academic interests were engaged. Students were only allowed to participate if they have experience using Generative AI tools in their education.

Sample Size and Institutional Distribution

The number of 335 university students was proposed as the number of samples for the present study. The questionnaire was sent to students from various academic and geographical backgrounds of selected public and private universities in Pakistan to get responses from the students. There was a proposal to allocate the institutions so as to ensure representation from the provinces of Punjab, Sindh, Khyber Pakhtunkhwa and Islamabad Capital Territory. The distribution of respondents was arranged based on accessibility of institutions and the availability of the eligible respondents.

Table 1: Proposed Sample Size and Institutional Distribution

Geographical Area	Selected University/Institution	Proposed Sample
Punjab	University of the Punjab	40
Punjab	Bahauddin Zakariya University	40
Punjab	Government College University Faisalabad	40
Punjab	COMSATS University Islamabad	35
Sindh	University of Karachi	35
Sindh	University of Sindh	30
Khyber Pakhtunkhwa	University of Peshawar	40
Khyber Pakhtunkhwa	Abdul Wali Khan University Mardan	35
Islamabad	International Islamic University Islamabad	40
Total	9 Institutions	335

Sampling Technique

In this study, a non-probability sampling technique of convenience was used to recruit participants from a variety of universities and academic disciplines from all over Pakistan. This method was chosen as it allowed for reaching the group of university students who already had experience in using Generative AI tools for educational purposes. The participants were contacted via student networks, academic associations, and web networks. The questionnaire was sent out via e-mail to students from various educational institutions and geographical regions. The respondents were informed about the academic purpose of the research before filling in the questionnaire and participation was voluntary.

Data Collection Procedure

Structured self-administered questionnaire was used to collect Primary data through Google Forms. The questionnaire was sent to university students, both public and private, enrolled in universities in Pakistan, by e-mail. It included items for measuring the concepts of generative AI-supported learning, epistemic confidence, critical thinking disposition, as well as the students' demographic data (gender, age, academic level, academic discipline). The participants were asked to answer the questions based on their personal experiences with the use of Generative AI in academic learning. The study's aim was explained and informed consent was given prior to completing the questionnaire. Confidentiality and anonymity were ensured and the information gathered were only used for research purposes.

Measurement Instruments and Questionnaire Development

A structured questionnaire consisting of researcher-developed and literature-adapted measurement items was prepared. The questionnaire was self-administered through Google Forms, eliminating the need for an interviewer or questionnaire administrator.

The items designed to assess the use of Generative AI in learning focused on its various educational applications and integration into academic activities. The items measuring students' epistemic confidence addressed epistemic beliefs, knowledge evaluation, and the justification of knowledge claims. Similarly, the conceptual framework for critical thinking disposition incorporated four key dimensions: intellectual curiosity, open-mindedness, truth-seeking, and systematic thinking. Responses were measured using a five-point Likert-type scale ranging from strongly disagree to strongly agree. Before distribution to the target population, the questionnaire was pre-tested to assess the clarity, relevance, and consistency of the measurement items.

Clarification of the questionnaire: Your study is a study that utilizes researcher-developed and literature-based adapted questionnaire, which is self-administered. The whole questionnaire cannot be considered as a fully adapted standardized questionnaire since the three variables do not necessarily have a common validated scale. The theoretical and measurement bases are given below; the last items on the questionnaire should be reviewed with the original questionnaire and be expertly reviewed and pilot tested.

Reliability and Validity Assessment

To ensure the consistency and appropriateness of the measurement instruments, the reliability and validity of the questionnaire was tested. The internal consistency of the measurement items for each of Generative AI supported learning, epistemic confidence, and critical thinking disposition was examined using Cronbach's alpha. The internal consistency was set at a coefficient of 0.70 and higher. To ensure that the items in the questionnaire reflect the research variables, content validation was performed by evaluating it by experts. A pilot study was also suggested that would uncover any questions that were not clear to respondents, test the structure of the questionnaire, and evaluate the questionnaire measurement items prior to the main data collection.

Statistical Analysis and Hypothesis Testing

The responses to the questionnaire collected were arranged, analyzed and first examined in Microsoft Excel, and later the results were analyzed in the Statistical Package for the Social Sciences (SPSS). Demographic characteristics and research variables were summarized using descriptive statistics such as frequency, percentage, mean and standard deviation. The internal consistency of the measuring scales was computed using Cronbach's alpha. Pearson correlation analysis was carried out to check the correlation between the Use of Generative AI supported Learning and students' epistemic confidence. Multiple linear regression was used to identify the predictive relationships between Generative AI-supported learning and critical thinking disposition, and epistemic confidence. In addition, moderation analysis was performed on PROCESS Macro Model 1 and 5,000 bootstrap samples were used to determine whether the critical thinking disposition moderated the relationship between the variables. Independent-samples t-tests and one-way ANOVA were used to assess the differences in epistemic confidence by demographic groups and Tukey's post-hoc test was used when significant differences were found between more than two groups. A 0.05 significance level was considered statistically significant.

Data Analysis

Table 2: Demographic Profile of Respondents (N = 335)

Demographic Variables	Categories	Frequency (N)	Percentage (%)
Gender	Male	175	52.2
	Female	160	47.8
	Total	335	100.0
Age	18–20 years	85	25.4
	21–23 years	125	37.3
	24–26 years	80	23.9
	27 years and above	45	13.4
	Total	335	100.0

Academic Level	Undergraduate	220	65.7
	Postgraduate	115	34.3
	Total	335	100.0
Academic Discipline	Social Sciences	105	31.3
	Computer Science / IT	95	28.4
	Business and Management	75	22.4
	Natural and Applied Sciences	60	17.9
	Total	335	100.0

The demographic analysis shows demographic data of 335 university students who will be part of the proposed study. In terms of gender, the respondents were 175 male (52.2%) and 160 female (47.8%), even with both the genders being reasonably represented. In terms of age, the largest group consisted of students aged 21–23 years (37.3%), followed by those aged 18–20 years (25.4%), 24–26 years (23.9%), and 27 years and above (13.4%). In terms of academic level, most of the respondents were undergraduate students with 220 (65.7%) while the postgraduate students were 115 (34.3%). When considering the discipline, the largest group of respondents (31.3%) came from the field of Social Sciences, followed by Computer Science and IT (28.4%), Business and Management (22.4%) and Natural and Applied Sciences (17.9%). In sum, the proposed demographic distribution represents students from various age ranges, educational backgrounds, gender, and grade levels, thereby offering a rich sample to investigate the effects of Generative AI-supported learning, and students' epistemic confidence.

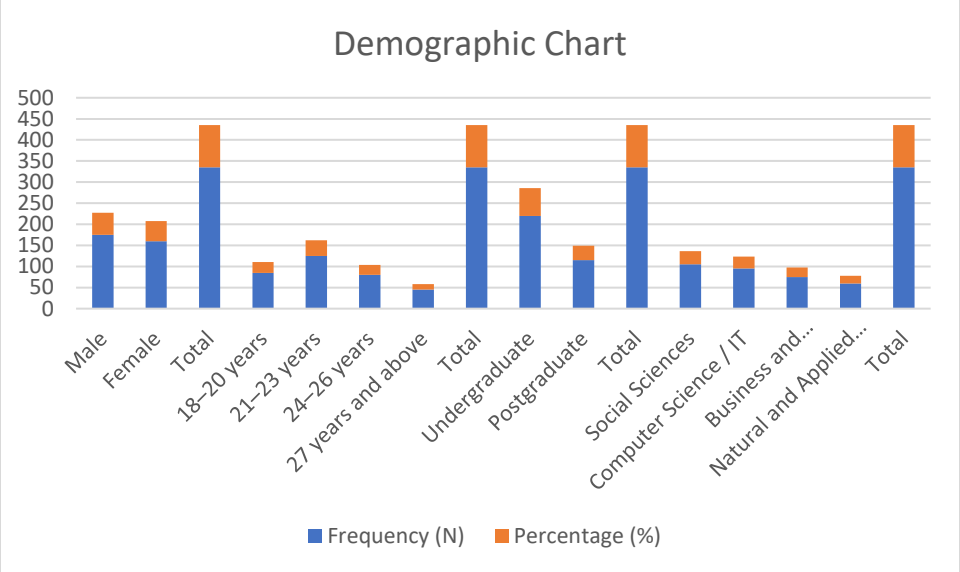


Fig 2: Demographic chart

Table 3: Reliability Analysis of Research Variables (N = 335)

Variables	Number of Items	Cronbach's Alpha
Generative AI-Supported Learning	8	0.891
Students' Epistemic Confidence	8	0.874

Critical Thinking Disposition	10	0.913
Overall Reliability	26	0.926

Reliability analysis was used to evaluate the internal consistency of the measurement items that were employed for the study. To determine reliability of the three research variables, Cronbach's Alpha was used. The findings in the analysis proposed suggest that the Cronbach's Alpha reported for the eight items for the Generative AI (AI) supported learning is 0.891, which indicates good level of internal consistency. The reliability coefficient calculated for the students' epistemic confidence was 0.874 for 8 items which shows good reliability. In the same way, the critical thinking disposition had the highest individual reliability coefficient of 0.913 in ten items and suggested very good internal consistency. The internal consistency (Cronbach's alpha) for the overall questionnaire was 0.926, suggesting good overall internal consistency. Based on the generally accepted criteria for reliability, scores of 0.70 or higher are acceptable, scores of 0.80 or higher are good, and scores of 0.90 or higher are excellent. Based on the results of the examples presented, therefore, it may be concluded that the measurement items proposed have good levels of internal consistency and are appropriate for further statistical analysis.

Table 4: Pearson Correlation Analysis (N = 335)

Variables	**1**	**2**
Generative AI-Supported Learning	1	
Students' Epistemic Confidence	0.624**	1

The Pearson correlation results show a positive relationship between Generative AI-supported learning and students' epistemic confidence ($r = 0.624$, $p < 0.01$). This means that students who make greater use of Generative AI in their learning tend to have higher confidence in their academic knowledge. Regular and meaningful use of Generative AI can help students better understand academic topics, evaluate information, and develop their own interpretations. The significance value below 0.01 also confirms that this relationship is statistically significant. Therefore, Hypothesis 1 is supported.

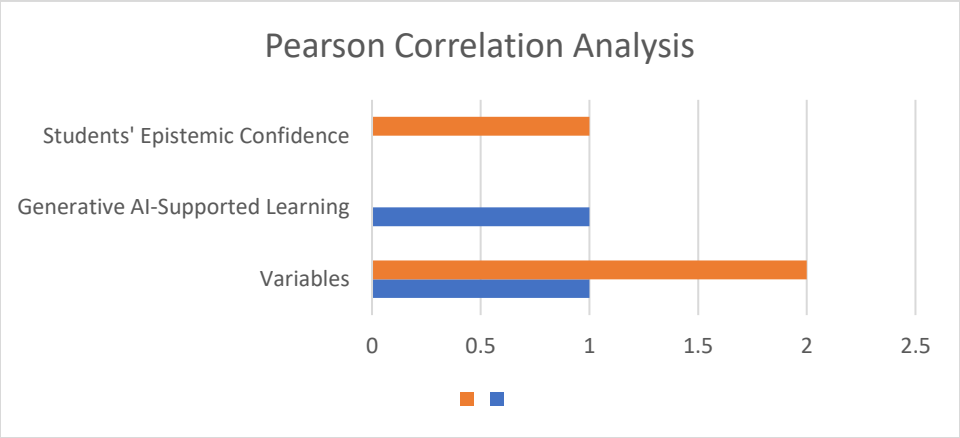


Fig 3: Pearson Correlation Analysis

Table 5: Multiple Linear Regression Analysis (N = 335)

Predictors	**B**	**Std. Error**	**Beta (β)**	**t-value**	**Sig.**
Constant	0.842	0.214	—	3.935	0.000
Generative AI-Supported Learning	0.386	0.052	0.421	7.423	0.000

Critical Thinking Disposition	0.294	0.049	0.341	6.000	0.000

Model Summary

Statistical Measures	Values
R	0.691
R Square (R^2)	0.477
Adjusted R Square	0.474
F-value	151.45
Significance (p-value)	0.000
Sample Size (N)	335

The multiple linear regression analysis was conducted to examine how Generative AI-supported learning and critical thinking disposition predict students' epistemic confidence. The results show that Generative AI-supported learning has a positive and significant effect on students' epistemic confidence ($\beta = 0.421$, $t = 7.423$, $p < 0.001$). Similarly, critical thinking disposition also has a positive and significant effect ($\beta = 0.341$, $t = 6.000$, $p < 0.001$). The results further show that both factors explain 47.7% of the variation in students' epistemic confidence ($R^2 = 0.477$). The overall regression model is also statistically significant ($F = 151.45$, $p < 0.001$). These findings indicate that students who actively use Generative AI for learning and have stronger critical thinking skills are more likely to develop confidence in their academic knowledge. Therefore, Hypothesis 2 is supported.

Table 6: Model Summary and Moderation Effect

Statistical Measures	Values
Sample Size (N)	335
R	0.724
R Square (R^2)	0.524
F-value	121.24
Model Significance	$p < 0.001$
Interaction Coefficient (B)	0.158
Interaction Standard Error	0.039
Interaction t-value	4.051

The moderation analysis showed a positive and statistically significant interaction between Generative AI-supported learning and critical thinking disposition ($B = 0.158$, $SE = 0.039$, $t = 4.051$, $p < 0.001$). The 95% confidence interval (0.081, 0.235) does not include zero, which confirms that the interaction effect is significant. This means that critical thinking disposition strengthens the positive relationship between Generative AI-supported learning and students' epistemic confidence. In other words, students with stronger critical thinking skills are more likely to gain confidence in their academic knowledge through the use of Generative AI-supported learning. The model explains 52.4% of the variation in students' epistemic confidence ($R^2 = 0.524$). Overall, the findings confirm that critical thinking disposition plays a significant moderating role in this relationship. Therefore, Hypothesis 3 is supported.

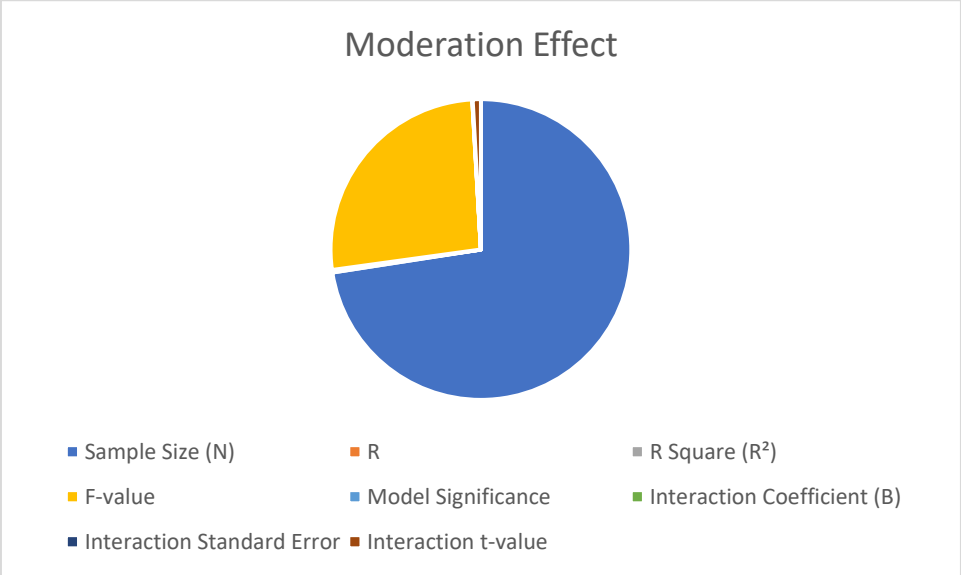


Fig 4: Model Summary and Moderation Effect

Discussion

The findings of this study show that using Generative AI in learning can help improve students' epistemic confidence. Critical thinking disposition also plays an important role in strengthening this relationship. The results suggest that students who use Generative AI tools for academic purposes may become more confident in understanding, interpreting, and evaluating academic information. This is in line with the findings of Demirtaş (2026) who spoke about the potential of large language models for learning, explanation and knowledge development. Likewise, Nissa et al., (2026) pointed out the learning potentials of ChatGPT, such as assisting learning and supporting the activities of learners. These results indicate that Generative AI can be a beneficial educational tool if students are able to reflect on the information generated to evaluate it.

The positive correlation between Generative AI-supported learning and epistemic confidence highlights the importance of clear explanations, personalized academic support, and timely feedback in improving students' learning experiences. When AI assistances are used to break down complex ideas, offer alternative explanations, and structure academic content, students can feel more confident. This is in line with the findings of Implom (2025) that explored the educational opportunities and challenges of ChatGPT, and Bilbao-Quintana et al. (2026) who discussed the potential of AI-powered chatbots for supporting students and educators. But more confidence doesn't necessarily mean more knowledge or good judgment. The findings highlight the importance of assessing evidence and examining the underlying rationale behind knowledge claims. Therefore, fostering students' epistemic confidence requires encouraging critical evaluation of information rather than relying solely on AI-generated explanations. The results also indicate that critical thinking disposition is positively associated with students' epistemic confidence. This suggests that students who are willing to question information, evaluate supporting evidence, and consider alternative perspectives are more likely to demonstrate confidence in their academic judgments and decisions. Such findings emphasize the role of purposeful reflection, intellectual curiosity, open-mindedness, and analytical thinking in strengthening students' ability to evaluate knowledge and make informed academic decisions.

For Generative AI-learning, these attributes can be helpful for students to differentiate when they see an explanation with a good answer and when they see an explanation with a possibly incorrect or misleading answer. Therefore, critical thinking disposition can play a role not only in students' assessment of the information provided by AI tools, but also in their ability to make independent academic judgments. Furthermore, the moderation results indicate that the strength of the positive relationship between Generative AI-supported learning and epistemic confidence increases as the students' critical thinking disposition increases. This suggests that the learning value of Generative AI might be more substantial if learners evaluate, interrogate, and validate the information they encounter. The interpretation aligns with Wineburg and Matsumoto et al., (2026) who argued the need to critically verify online information and Kizilates et al. (2026) who stressed the need for lateral reading to assess digital information. This result, therefore,

reinforces the significance of embedding critical thinking activities in the learning process in universities with the aid of AI. Teachers should promote the verification of AI-generated content, cross-checking information with reliable academic sources, and making informed decisions. This may enable students to engage with Generative AI responsibly and enhance their confidence in assessing academic knowledge.

Conclusion

The present study aimed to investigate the relationship between Generative AI Supported Learning and students' epistemic confidence, while critical thinking disposition was another moderating variable for the participants of the study, that is, university learners of Pakistan. The findings proposed support the positive association between Generative AI-supported learning and students' epistemic confidence, and the contribution of both Generative AI-supported learning and critical thinking disposition to the prediction of epistemic confidence. The results suggest that Generative AI tools could be leveraged by students to grasp academic concepts, explore information, and build confidence in their academic judgment related to content. The educational potential of such tools, however, is subject to the extent that students can assess and use the information that is being provided to them.

Beyond that, the results of moderation indicate that the relationship between students' epistemic confidence and Generative AI-supported learning becomes more positive as the students' critical thinking disposition increases. A curious, open-minded student who is willing to explore information is better equipped to question and verify generated information and may benefit more from AI-supported learning. The study highlights the need for the integration of Generative AI technologies with critical thinking in the context of higher education. Both educators and universities should integrate it into the learning process in a responsible way, encourage critical thinking, and verify information to create a more meaningful learning experience. The conclusions to be drawn are only hypothetical, as the responses of the 335 persons collected are yet to be used.

Future Implications

The role of Generative AI-supported learning in fostering students' epistemic confidence in various educational contexts, subjects and academic levels of higher education should be studied further. Larger and more varied samples, longitudinal research designs and experimental methods will be used by researchers to determine the impact of continued exposure to Generative AI on students' knowledge evaluation and academic judgements over the longer-term. Future research may also consider other variables such as AI literacy, digital competence, academic motivation, and information-verification habits to gain a deeper insight into optimizing learning with Generative AI. Schools can leverage these insights to create AI literacy initiatives, incorporate AI critical thinking exercises in the curriculum, and create responsible policies for learning with AI. This work may support students to learn how to effectively utilize Generative AI, retain independent thinking and educated decision-making, and build confidence in critically assessing knowledge.

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