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### Human–AI Co-Learning in the Social Media Era: Exploring University Students' Experiences of Learning with Generative AI and Social Media

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#### ABSTRACT

The widespread adoption of generative artificial intelligence (GenAI) and educational content on social media has transformed how university students access information, collaborate with peers, and construct knowledge across diverse educational contexts. This study explores university students' experiences of integrating GenAI tools and social media into their everyday learning practices across Pakistan, Malaysia, and Singapore, offering a cross-national qualitative perspective on Human–AI co-learning in higher education. Semi-structured interviews were conducted with 18 university students, comprising six participants from each country and representing diverse academic disciplines who regularly used GenAI applications alongside social media for educational purposes. The interview data was analyzed using reflexive thematic analysis to identify recurring patterns and contextual similarities and differences. The findings revealed six major themes: the evolution of Human–AI co-learning, social media as a knowledge community, personalized and self-directed learning, critical thinking versus AI dependency, cross-cultural digital learning practices, and responsible AI with digital competence. While participants across all three countries viewed GenAI and social media as complementary learning resources, differences emerged in institutional support, digital literacy, and technology adoption practices. Based on these findings, the study proposes a cross-national Human–AI co-learning framework and an actionable institutional roadmap to support responsible, inclusive, and sustainable AI-enhanced learning in higher education.



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## 1. Introduction

In the world of higher education, generative artificial intelligence (GenAI) has become one of the most impactful technological advancements, revolutionizing the ways students learn, access solutions to academic challenges, and interact with learning materials. Unlike the traditional educational technologies that largely function as information delivery channels, GenAI technologies may be leveraged to develop interaction, adaptation, and conversation for learning to foster knowledge construction, creativity, and personalized academic support. Social media has also become a more than just communication platform; it's a learning environment that enables students to share ideas, access learning tools and resources, communicate with each other and participate in broader knowledge communities. Hence, the synergy of GenAI and social media has ushered in a novel digitally mediated learning landscape wherein the learning behaviors and academic engagement are triply influenced by human intelligence, artificial intelligence, and online social interaction. The phenomenon is new and is changing the face of education from technology-assisted learning to Human-AI co-learning where AI is not only used for information retrieval but also as an active learning partner. While AI-powered learning tools have been rapidly adopted by universities around the world, the student experience with the use of GenAI and social media continues to be shaped by the institutional readiness, technological capacity, culture, and digital literacy. It is therefore crucial to understand how students from different education systems interact with these technologies, and how these technologies can be utilized to foster responsible and effective learning environments. For this reason, this study examines co-learning experiences between Human and AI in three countries where students are enrolled at universities and are

spread across a range of different technological levels, educational digitalization and AI adoption: Pakistan, Malaysia and Singapore.

### 1.1 Background of the Research

The rapid evolution of GenAI has transformed the landscape of higher education dramatically, ushering in the era of intelligent systems that can produce explanations, summarize complicated ideas, assist with academic writing, and foster collaborative learning. These capabilities have also provided students with greater opportunities for personalized learning and have prompted a reconsideration of traditional teaching and assessment practices (Xu et al., 2025). In recent times, scholarly insights have begun shifting AI's role from that of a substitute for teachers to a supportive learning companion that can augment critical thinking, creativity, and learner autonomy when integrated into the right pedagogical contexts (Creely & Carabott, 2025). Furthermore, recent reviews indicate that higher education institutions are shifting from just adopting AI to using AI for augmentation, where students and teachers collaborate in producing knowledge through ongoing dialogue with intelligent systems (Chugh & Jain, 2026). Meanwhile, social media platforms such as YouTube, LinkedIn, Instagram, Facebook, TikTok, and Reddit have emerged as significant alternative learning spaces outside of school, facilitating learning through communities and user-generated content while connecting learners with one another. GenAI, in combination with social media, forms interdependent digital ecosystems that facilitate collaborative, self-directed and lifelong learning. In the ASEAN region and neighboring countries, the transformation of education has been rapid via Education 4.0 which has focused on digital innovation, learner-centered education and technological competence (Jamaludin et al., 2020). This diversity in technological readiness,

institutional capacities, and digital competitiveness among nations, evident in parallel developments in AI use, inevitably impacts educational experiences (Ali et al., 2026). Moreover, comprehensive institutional strategies are gaining more traction, covering the issues of governance, ethics, digital inclusion, and educational sustainability for the effective integration of AI (Wang et al., 2025). The developments highlight the need to investigate Human-AI co-learning in a variety of educational contexts and not just one national context.

## 1.2 Problem Statement

Although the use of GenAI in higher education has increased, the research literature has tended to concentrate on either technological acceptance or performance or academic outcomes in relation to AI-supported learning, with comparatively little attention paid to students' lived experience of Human-AI co-learning in various national settings. Although there is emerging evidence of the potential to greatly enhance collaborative learning and student engagement through the use of AI, the success of such implementation is contingent on the digital competencies, critical evaluation skills, and support systems within institutions (Gyasi et al., 2025). In spite of the benefits of personalized learning and self-directed learning, educators and institutions face challenges with overreliance on AI, a loss of critical thinking, and information credibility (Tu et al., 2025). Likewise, AI uses peer relationships, supervisory interactions, and collaborative learning, which are not fully understood (Lai et al., 2025). Additionally, students envision opportunities and dangers arising from the adoption of AI, including ethical considerations, academic integrity, and responsible usage (Chea & Deng, 2026). Furthermore, digital literacy is becoming a fundamental skill for effective Human-AI collaboration, but there is limited evidence that provides comparisons between students' experiences across different

educational systems (Yang & Jiang, 2026). This research aims to fill these gaps by investigating the Human-AI co-learning experiences of university students in Pakistan, Malaysia, and Singapore.

## 1.3 Research Questions

- RQ1.** How do university students in Pakistan, Malaysia, and Singapore experience Human-AI co-learning through the combined use of generative AI and social media?
- RQ2.** How do generative AI and social media influence students' learning behaviors, academic engagement, and collaborative learning experiences?
- RQ3.** What opportunities and challenges do students encounter while integrating generative AI into their everyday learning practices?
- RQ4.** How do institutional contexts and digital literacy shape Human-AI co-learning experiences across the three countries?
- RQ5.** What conceptual framework can explain Human-AI co-learning within digitally connected higher education environments?

## 1.4 Research Objectives

- RO1.** To explore university students' experiences of Human-AI co-learning using generative AI and social media.
- RO2.** To examine how generative AI and social media influence learning behaviors, engagement, and collaboration.
- RO3.** To identify the opportunities and challenges associated with AI-supported learning in higher education.
- RO4.** To compare Human-AI co-learning experiences across Pakistan, Malaysia, and Singapore.
- RO5.** To develop a conceptual framework explaining Human-AI co-learning in

digitally connected learning environments.

### 1.5 Significance of the Research

This study contributes to the emerging literature on Human-AI collaboration by going beyond the technological application and exploring students' experiences of Human-AI co-learning in digitally connected educational contexts. The study looks at Pakistan, Malaysia and Singapore, providing cross-cultural insights into the influence of institutional frameworks, digital proficiency and educational environments on students' engagement with GenAI and social media. The findings add to qualitative research by offering a framework that explains Human-AI co-learning from the university students' perspective rather than from the perspective of institutions or technology developers. From a practical perspective, the study provides evidence-based recommendations for higher education institutions, educators, curriculum designers, and policymakers to consider when incorporating AI in a responsible way and promoting critical thinking, ethical use of technology, collaborative learning, and digital competence. The understanding of students' experience is a crucial component in the design of inclusive, learner-centered, and sustainable educational practices that can maximize the benefits of emerging intelligent technologies while reducing the academic and ethical risks.

## 2. Literature Review

### 2.1 Theoretical Framework

The theoretical foundations of this study are Human-AI co-learning, Social Constructivism, and Self-directed Learning. These perspectives together elucidate the processes that students interact with and engage with in the co-construction of knowledge, with AI, other students, and digital learning communities. Human-AI co-learning is a learning paradigm that sees AI as an intelligent learning partner, aiding in idea

generation, problem solving, feedback, and reflection during the learning process (Chan et al., 2026). Likewise, in the context of Human-AI collaboration, studies suggest that meaningful learning is most likely to occur when AI complements rather than supplants human cognition, thereby enabling students to exercise judgment, creativity, and critical evaluation (Gyasi et al., 2025; Puerta-Beldarrain et al., 2025). Social Constructivism also emphasizes that knowledge is created within a social context, through dialogue and social meaning making. In a digitally connected world, these interactions can happen before, after, and between class hours, across social media spaces and through conversations with AI, all of which can influence students' learning experiences (Creely & Carabott, 2025). In addition to these viewpoints, Self-directed Learning emphasizes the learner's capacity to recognize his/her own learning requirements, to find the resources to fulfill them, to monitor his/her own learning, and to evaluate the results of his/her learning. This autonomy can be further enhanced by using GenAI to give personalized explanations, adaptive feedback, and continuous learning support (Tu et al., 2025). According to Hwang et al. (2026), AI has evolved from a mere intelligent educational tool to a sophisticated learning collaborator, capable of supporting long-term cognitive development. These theoretical approaches offer a comprehensive framework for studying Human-AI co-learning in today's Higher Education system. The new study extends the theoretical knowledge of Human-AI co-learning by showing that successful collaboration between students and smart systems requires a well-designed learning process, digital culture nurturing, and ethical considerations regarding the integration of competencies. The study further expands the theoretical understanding of Human-AI co-learning by highlighting that purposeful learning design, digital culture and ethical dimensions of

technologies integration are crucial to successful collaboration between students and intelligent systems. Researchers have pointed to the need to actively develop AI-enabled learning environments to support learner agency and collective development of knowledge through collaboration, instead of merely automating the learning process (Chan et al., 2026; Reyes-Sánchez, 2026). The study has also revealed that in various educational settings, students are redefining academic writing, creativity, and learning processes with interaction with the generative AI (Chatto & Logronio, 2025; Ringvold et al., 2024; Lee et al., 2024; Erişti & Freedman, 2024). Valuable insights also come from a more holistic view of how digital transformation should be inclusive, ethical, and the influence of context on technology uptake within education ecosystems have been discussed (Blayone & Mykhailenko, 2025; Mannan et al., 2026; Yaseen et al., 2026). While studies on AI in social media behavior, project management, and macroeconomic development offer valuable insights into digital transformation (Jamil et al., 2026; Mahmood et al., 2026; Ali & Rasheed, 2026), the principles of organizational adaptation and technology-enabled decision making can also be applied to the theoretical frameworks of Human-AI co-learning.

## **2.2 Human-AI Co-learning in Higher Education**

Generative AI has transformed the relationship between student and educational technology, creating a new paradigm in which knowledge is co-constructed with AI. Generative AI has fundamentally changed the way that students and educational technologies interact, shifting to a new paradigm of Human-AI co-learning for knowledge construction. Intelligent systems have increasingly been integrated with students to collaborate in brainstorming, academic writing, critical reflection, and problem-solving tasks (Chan

et al., 2026). This shift is part of the trend of moving from using technology to embracing hybrid intelligence, where AI works in tandem with human thinking. The study of the last few years has shown that the critical interpretation that allows students to understand AI-generated content as well as independent thinking and academic agency are essential to successful Human-AI collaboration. Studies conducted over the past several years have highlighted the importance of students' capacity to critically interpret AI-generated content while maintaining independent thinking and exercising academic agency (Yang & Jiang, 2026). Likewise, engineering education studies show that students' professional identities become more positive when AI is designed to be a collaborative tool with students to facilitate exploration rather than replacing decision-making (Dokter, 2025). Another aspect of adult learning research is that AI-powered education fosters lifelong learning, allowing individuals to receive personalized support not only in the classroom but also outside of its walls (Jōgi et al., 2026). Sinclair (2026) believes that the future education system must intentionally look after technological innovations along with maintaining human education values to safeguard creativity, ethics, and holistic development. Xu et al. (2025) argue that AI should be incorporated into educational approaches that foster collaboration, critical analysis, and ethical knowledge production, thus enriching these perspectives. To summarize, these investigations demonstrate Human-AI co-learning as an innovative framework for the transformation of higher education.

## **2.3 Social Media as Collaborative Learning Environment**

Social media has become a dynamic educational platform for learners to produce, share and assess knowledge outside traditional learning environments. YouTube, LinkedIn, Instagram, Reddit, Facebook, and

TikTok are just a few platforms that are becoming important spaces for peer learning, collaborative conversations, professional networking, and instant access to learning. These platforms are not just used for communication, but also for participatory learning, fostering ongoing interactions between learners. The studies have shown that AI tools can be integrated with social media platforms to track engagement, tailor learning experiences, and gain insights into student learning behaviors (Ullah et al., 2024). Likewise, AI-driven social media platforms have revolutionized digital communities, making them collaborative spaces for sharing knowledge and fostering innovation in various fields (Sarjon et al., 2026). The use of technology for collaboration, co-creation and problem solving across cultures, among geographically dispersed learners, is further shown using global digital learning networks (Rani et al., 2026). Research in communication education shows that teachers are increasingly seeing generative AI and social media as complementary tools that can enhance digital pedagogy but also present new challenges for teachers and students (Mateus et al., 2024). Similarly, AI-powered project-based learning fosters collaborative communication and hands-on learning experiences (Liu et al., 2025), and the use of AI in pedagogy promotes peer learning, knowledge exchange, and collaborative problem-solving among Generation Z students (Baskoro et al., 2023). The results reveal the critical role of social media in learning environments that integrate human and AI. The results highlight the importance of social media in Human-AI co-learning environments.

#### **2.4 Personalized Learning and Self-directed Learning**

Personalized learning and self-directed learning are two of the biggest benefits of generative AI. Conventional digital resources do not adapt to the learning needs of

individual students, and GenAI does. GenAI allows students to get customized explanations, immediate feedback and approaches to problems that allow for different ways of solving them. These skills help to motivate students to take greater initiative in planning, monitoring and evaluating their learning. Perception and action in learning are facilitated by adaptive instructional support from personalized AI systems which also foster learner autonomy, as noted by Tu et al. (2025). Similarly, the evidence from Pakistan shows that AI-based learning environments have a great impact on students' self-regulated learning, where students engage in independent learning and reflective thinking (Asad et al., 2026). A study that looks at the self-directed learning of children also emphasizes the need to both give children a chance to have autonomy while providing them with the proper human guidance to have their learning supported by an AI system that is responsible (Xie et al., 2026). In addition to technical skills, AI literacy impacts learners' trust, confidence, and openness to the use of intelligent learning systems, especially when they critically assess information created by AI systems, as opposed to accepting it on a gut feeling (Zhang et al., 2026). Hwang et al. (2026) also argue that AI-assisted learning will take another series of steps from intelligent education software to collaborative cognitive partners that accompany learners in their learning process throughout. Taken together, these studies show that personalized learning and self-directed learning are key aspects of human-AI co-learning.

#### **2.5 Digital Literacy, Ethics and Responsible AI**

As more artificial intelligence tools enter higher education, digital literacy and ethical awareness have become a must-have skill for effective learning. Digital literacy involves students' critical analysis and evaluation of digital information, use of artificial

intelligence-generated information responsibly and ethically and making informed decisions in digital academic contexts. With the growing sophistication of AI systems, students need to be not only technically proficient but also able to identify potential ethical concerns such as bias, misinformation, transparency, privacy, and academic integrity. Collective learning, critical thinking, and intelligent system responsible use are critical components of digital literacy, not only technology-related but also developed through the use of AI, according to Arshad et al. (2026). Likewise, digital literacy is one of the key enablers for students to achieve maximum synergy between human and artificial intelligence, autonomy and thinking control. (Yang & Jiang, 2026). In addition, the role of AI implementation in ethical implementation is also crucial, promoting transparency in policies, responsible innovation, and sustainable educational transformation (Wang et al., 2025). As socially intelligent AI agents emerge, Pirjan and Petroșanu (2025) argue that we need to reimagine the ethical communication and responsible use of technology. Similarly, Morris and Malady (2025) argue that while faculty and students understand the importance of responsible use of AI in teaching and learning, they also see it as an ongoing process that needs to be guided by ethical principles and continually discussed with support from institutions. Overall, these voices all highlight the importance of merging the principles of digital literacy and ethics in Human-AI co-learning environments.

## **2.6 Cross-national Adoption of AI in Education**

The way AI is implemented in higher education is quite distinct between countries, varying for a myriad of reasons such as different educational policies, cultural expectations, institutional readiness, and technological infrastructure. As a consequence, comparative research is

gaining in importance to explore how the contextual factors affect students' learning experiences of emerging technologies. In general, the promotion of learner-centered pedagogies using advanced technology has been a part of the Educational 4.0 (E4.0) movement in ASEAN, and so has been the increase of institutional investments in digital transformation (Jamaludin et al., 2020). The results of comparative studies conducted in Mexico, Peru and Spain offer a glimpse of the opportunities and uncertainties that educators face when contemplating the integration of generative AI in their instruction, and the role that local cultures of education play in the process of integrating AI. The results of comparative studies across Mexico, Peru, and Spain illustrate the opportunities and uncertainties that educators encounter when considering the integration of generative AI into their teaching practices, as well as the influence of local educational cultures on the adoption of AI. In the field of language education, too, studies in Thailand, the Philippines, and Indonesia reveal that cultural values play a significant role in shaping perceptions of Human-AI collaboration (Purnawan & Prilyasinta, 2025). Across generations, there is also evidence that students' attitudes towards generative AI also vary by educational background and familiarity with technology, as well as previous learning experiences (Funa & Gabay, 2026). Studies with Chinese post-graduate students also reveal the instructional advantages and concerns of incorporating AI, such as concerns about academic integrity and independent study (Chea & Deng, 2026). In addition to education, comparative studies across nations reveal that the extent of AI adoption and the institutional capacity to do so significantly vary between countries and regions (Ali et al., 2026). The research findings highlight the need for investigating Human-AI co-learning across different countries.

## 2.7 Gaps in Existing Research

While the research literature reveals a developing field of academic research related to generative artificial intelligence in higher education, there are still significant gaps. Previously, the studies on the adoption, acceptance, learning outcomes of AI have mostly been quantitative, lacking a deeper understanding of students' lived experiences and meaning-making processes in Human-AI co-learning environments (Xu et al., 2025; Chugh & Jain, 2026). Second, the concept of Human-AI co-learning is still in its infancy with limited research on students' active collaboration in learning responsibility with an intelligent system (Chan et al., 2026). Third, although studies have focused on the adoption of AI in individual countries, comparative qualitative studies that analyze the adoption of AI in different educational contexts are limited, especially in the context of Pakistan, Malaysia and Singapore (Jamaludin et al., 2020; Chea & Deng, 2026). Lastly, the existing literature has focused on either the use of generative AI or social media alone, without considering their interaction and how they can collectively form integrated digital learning systems to influence collaboration, knowledge building, and learner autonomy (Ullah et al., 2024; Rani et al., 2026). In response to these gaps, in the present study, a qualitative cross-national design is adopted to gain a holistic and comprehensive understanding of Human-AI co-learning through two approaches: (1) by exploring how Pakistani, Malaysian, and Singaporean university students incorporate generative AI and social media into their daily learning routines and (2) by providing a conceptual framework that explains the phenomenon of Human-AI co-learning in the context of higher education.

## 3. Research Methodology

A qualitative research methodology was used in this study to gain insights into university students' lived experiences of Human-AI co-

learning using the combined use of generative artificial intelligence and social media. Since the study aimed at understanding the perceptions, interpretations and experiences of the participants in their natural educational contexts, rather than measuring the predetermined relationship between the variables, a qualitative approach was deemed appropriate. The methodology was aimed at providing rich, contextually relevant insights and also allowing for cross-country comparisons of students' learning from Pakistan, Malaysia and Singapore.

### 3.1 Research Design

A qualitative exploratory research design with semi-structured interviews was used in the study. This design enabled the participants to speak about their experience of using generative AI and social media in their academic learning, and the researchers to delve deeper into new issues. Qualitative inquiry is appropriate for studying complex education phenomena, in which many perspectives, contextual influences and subjective meanings influence participants' experience. The study was based on reflexive qualitative research where knowledge is co-constructed with the researcher and participants. Data interpretation applied the Reflexive Thematic Analysis by Braun et al. (2022) and Byrne (2022) which is a flexible, but rigorous method for identifying themes of meaning within a qualitative data set but also allows themes to emerge from the participants' narrative inductively.

### 3.2 Sampling Strategy

Using purposeful maximum variation sampling, a range of perspectives was captured around Human-AI co-learning in a variety of educational contexts. Six students from each country, from higher education institutions in Pakistan, Malaysia and Singapore, were selected to participate in this study and were part of the group that used generative AI applications with social media

regularly for academic purposes. The selection of participants was deliberate to ensure maximum diversity in their academic disciplines, level of study, and demographics; and to maximize information-rich cases while being mindful of ensuring that they have sufficient diversity in their experiences. The sampling strategy aimed to go beyond identifying the similarities and differences between the three national contexts. There are studies in qualitative research that have been conducted on lived experience, organizational practice, and technology use in complex social settings, which have also utilized similar purposeful participant selection (Ashraf et al., 2025; Khan et al., 2026).

### 3.3 Data Collection

Semi-structured interviews were used to gather primary data from January to March 2026. Depending on participants' availability and geographical location, interviews were conducted either face-to-face or through secure online video conferencing platforms. The interview guide included open-ended questions related to students' experiences of the use of generative AI, social media learning practices, collaborative learning, perceived benefits, ethical concerns, digital literacy and future expectations related to the use of AI to support education. Probing questions were added to clarify participants' responses and to elicit rich examples from their learning experiences. The interviews were transcribed verbatim and analyzed. Each interview lasted approximately 40 to 60 minutes. The choice of semi-structured interviewing was made to allow flexibility in exploring new insights and create consistency in the data across participants, as was successfully used in previous qualitative studies for organizational transformation and technology-enabled experiences (Rehmat et al., 2025; Abrar & Amjad, 2026).

### 3.4 Data Analysis

The interview transcripts were analyzed using the Reflexive Thematic Analysis of Braun and Clarke. Initially, the researchers familiarized themselves with the data through repeated reading of interview transcripts before generating initial codes that reflected meaningful statements related to Human-AI co-learning. Broad categories of similar codes were then compared and contrasted, interpreted and developed into a broader theme with an iterative process through which reflection and refinement took place. Themes were checked throughout the analysis against the original data to ensure the themes were conceptually consistent with the data and participants' experiences accurately represented. The interpretive rigor was underscored through the reflexive discussions among the researchers, which helped reduce the individual researchers' biases and increased the analytical credibility. Reflexive Thematic Analysis is a flexible and transparent method that is well suited for exploring complex education experiences with emerging technologies (Braun et al., 2022; Byrne, 2022). Also, Hole's (2024) suggestions on careful interpretation, transparency and researcher reflexivity were considered throughout the analytical process. In addition, the overall approach to analysis is also in line with Ashraf et al. (2025) who used qualitative thematic procedures in previous exploratory studies.

### 3.5 Ethical Considerations

Participation was entirely voluntary and all participants were fully informed about the purpose of the study, the interview protocols, the safeguards to ensure confidentiality, and their right to withdraw at any time without any penalty. Informed written consent was obtained from all participants before the start of the interviews. Participants were assigned identification codes in place of their real names to maintain confidentiality and all identifying information was removed during

transcription and reporting. Interview recordings and transcripts were securely archived in password-protected digital files accessible only to the research team. The researchers were transparent, respected the participant profile is presented in Table 1.

opinions of the participants, and ensured the ethical treatment of qualitative data during the research process in line with the existing ethical standards of qualitative research (Rehmat et al., 2025; Ashraf et al., 2025).

**Table 1.** *Participant Profiles*

| ID  | Country   | Discipline              | Year of Study | AI Tools Used    | Social Media Used  | Frequency of AI Use | Experience with GenAI |
|-----|-----------|-------------------------|---------------|------------------|--------------------|---------------------|-----------------------|
| P1  | Pakistan  | Computer Science        | 4th Year      | ChatGPT, Gemini  | YouTube, LinkedIn  | Daily               | 2 Years               |
| P2  | Pakistan  | Business Administration | Master's      | ChatGPT, Copilot | Instagram, YouTube | Daily               | 2 Years               |
| P3  | Pakistan  | Engineering             | 3rd Year      | ChatGPT, Claude  | Reddit, YouTube    | Several times/week  | 1.5 Years             |
| P4  | Pakistan  | Education               | Master's      | ChatGPT          | Facebook, YouTube  | Daily               | 2 Years               |
| P5  | Pakistan  | Information Technology  | Final Year    | ChatGPT, Gemini  | LinkedIn, Reddit   | Daily               | 3 Years               |
| P6  | Pakistan  | Media Studies           | 4th Year      | ChatGPT, Copilot | TikTok, Instagram  | Several times/week  | 1 Year                |
| P7  | Malaysia  | Computer Science        | Master's      | ChatGPT, Gemini  | YouTube, LinkedIn  | Daily               | 2 Years               |
| P8  | Malaysia  | Business                | 3rd Year      | ChatGPT          | Instagram, YouTube | Daily               | 2 Years               |
| P9  | Malaysia  | Artificial Intelligence | Final Year    | ChatGPT, Claude  | Reddit, LinkedIn   | Daily               | 3 Years               |
| P10 | Malaysia  | Education               | Master's      | ChatGPT, Gemini  | Facebook, YouTube  | Several times/week  | 2 Years               |
| P11 | Malaysia  | Data Science            | 4th Year      | ChatGPT, Copilot | LinkedIn, Reddit   | Daily               | 2 Years               |
| P12 | Malaysia  | Communication           | 3rd Year      | ChatGPT          | TikTok, Instagram  | Daily               | 1.5 Years             |
| P13 | Singapore | Computer Engineering    | Final Year    | ChatGPT, Gemini  | YouTube, LinkedIn  | Daily               | 3 Years               |
| P14 | Singapore | Business Analytics      | Master's      | ChatGPT, Claude  | LinkedIn, YouTube  | Daily               | 2 Years               |
| P15 | Singapore | Information             | 4th Year      | ChatGPT,         | Reddit,            | Daily               | 3 Years               |

| ID  | Country   | Discipline    | Year of Study | AI Tools Used   | Social Media Used  | Frequency of AI Use | Experience with GenAI |
|-----|-----------|---------------|---------------|-----------------|--------------------|---------------------|-----------------------|
|     |           | Systems       |               | Copilot         | LinkedIn           |                     |                       |
| P16 | Singapore | Psychology    | Master's      | ChatGPT         | Instagram, YouTube | Several times/week  | 2 Years               |
| P17 | Singapore | Digital Media | Final Year    | ChatGPT, Gemini | TikTok, Reddit     | Daily               | 2 Years               |
| P18 | Singapore | Education     | Doctoral      | ChatGPT, Claude | LinkedIn, YouTube  | Daily               | 3 Years               |

#### 4. Findings and Discussion

Thematic analysis identified six interrelated themes that illuminate the experiences of university students in Pakistan, Malaysia, and Singapore regarding Human-AI co-learning facilitated by the integration of generative artificial intelligence and social media. The results revealed common experiences of the respondents from the three countries and contextual differences in the use of technology, institutional support, learning independence and digital skills. Students perceived generative AI and social media as complementary educational tools that enhanced learning effectiveness, collaboration, and academic engagement, but also posed new challenges in terms of critical thinking and responsible use of technology.

##### 4.1 Theme 1: Evolution of Human-AI Co-learning

A key observation was the shift in the relationships between students and generative AI. Participants no longer viewed AI simply as a search engine or content creation tool, but as a proactive learning companion to help with brainstorming, conceptual understanding, assignment planning, academic writing, and problem solving. In all three countries, students described their interactions with AI as more of an iterative learning conversation than an information retrieval process. Many participants adjusted their prompts to get the best answers and also continued discussion to get the understanding right, rather than

taking what the AI came up with at face value. While the overall trend was similar in all three countries, there were variations in the integration of AI into the learning process. Pakistani students also used AI to enhance learning support when it was inadequate or to access learning materials. The importance of using AI to enhance productivity, structure coursework and manage multiple academic tasks was highlighted by Malaysian participants. In Singapore, students cited AI as a logical outgrowth of technology-driven learning, which they incorporated into their research, collaborative efforts, presentations, and independent work. The other interesting insight was the shift in students' perceptions about the role of AI in education. Many of the participants initially saw AI as a solution to create answers. The experience, however, changed this perspective to a new concept of collaborative learning and the use of AI as an intelligent assistant that inspired exploration, reflection, and knowledge refinement. Students typically felt that AI tools were not a replacement for learning, but a means to facilitate learning and prompt them to develop their own knowledge evaluation and application skills. This finding aligns with new viewpoints that view Human-AI co-learning as a new model of education, where the AI component assists with cognition while maintaining learners' agency (Chan et al., 2026; Jögi et al., 2026).

## 4.2 Theme 2: Social Media as a Knowledge Community

The second theme demonstrates that social media has become an integral component of university students' learning ecosystems. Participants consistently reported using platforms such as YouTube, LinkedIn, Reddit, Facebook, Instagram, and TikTok for educational purposes rather than solely for entertainment or social interaction. These platforms provided access to instructional videos, professional discussions, collaborative communities, peer recommendations, and practical demonstrations that complemented classroom learning.

Participants commonly described a learning process in which social media and generative AI were used sequentially and interactively. Students frequently discovered educational resources through social media before employing AI to summarize content, clarify difficult concepts, generate additional examples, or critically evaluate the information encountered online. Others explained that AI recommendations often directed them toward high-quality educational channels, scholarly resources, and online communities that further enriched their understanding. Consequently, learning no longer occurred through isolated technologies but through interconnected digital ecosystems where AI and social media reinforced one another.

Cross-country differences were also observed. Pakistani students primarily valued social media for expanding access to free educational resources unavailable through their institutions. Malaysian participants highlighted collaborative learning through discipline-specific online communities, while Singaporean students emphasized professional networking and exposure to international academic perspectives through platforms such as LinkedIn and specialized discussion forums.

Participants further indicated that social media fostered collaborative learning by exposing them to diverse viewpoints, alternative problem-solving approaches, and interdisciplinary discussions that extended beyond formal classroom instruction. Such interactions strengthened academic confidence while encouraging continuous learning through participation in global digital communities. These findings suggest that social media functions not merely as a communication platform but as a collaborative knowledge ecosystem that complements Human-AI co-learning by facilitating interaction, knowledge sharing, and collective learning. This observation is consistent with previous research emphasizing the growing importance of AI-supported collaborative digital learning environments (Rani et al., 2026; Liu et al., 2025).

## 4.3 Theme 3: Personalized Learning

Personalized learning was the most promising aspect of GenAI to the participants' learning experiences. AI applications were used to deliver personalized explanations, feedback, and learning trajectories, tailored to students' prior knowledge, learning styles, and academic experiences, as opposed to traditional digital learning materials. This adaptability enabled students to study independently while progressing at their own pace and revisiting challenging concepts whenever necessary. Participants in all three countries shared how AI minimized the obstacles of traditional learning. Students enjoyed being able to get answers to their questions right away, to ask for simple explanations of complicated concepts, to ask practice questions, to get feedback on their assignments, and to see different points of view without having to wait for the teacher. This gave students the ability to learn on their own time and learn to deal with something they don't know. The results also indicate that personalized learning had a

positive impact on students' self-directed learning ability. Instead of relying solely on lectures or books, participants were increasingly taking charge of their learning, recognizing what they lacked, asking for specific support with AI and tracking their learning progress as well as considering the options for other solutions. Several students reported that AI helped them to engage in more exploratory learning by enabling them to further delve into a topic and adjust explanations as they deepened the learning. Despite these advantages, participants recognized the need for engagement on the part of the learner for effective personalization. Learners understood the importance of questioning what AI has generated, comparing resources and using their own judgment to make learning meaningful. This led to the perception of personalization as a way to support learning autonomy rather than passive learning dependence on intelligent technologies. The results support the previous study that shows that the creation and use of generative AI can enhance the learners' autonomy, adaptive learning, and self-directed learning, as long as it is done properly (Tu et al., 2025; Asad et al., 2026).

#### **4.4 Theme 4: Critical Thinking versus AI Dependency**

Participants unanimously recognized the educational value of generative AI but also raised concerns about over-reliance on intelligent technologies. Students noted that the ease and speed of AI responses might lessen the opportunity for critical thinking, if students do not reflect on what they are typing. Many of the participants said that AI enabled them to complete tasks that might otherwise have been daunting in academic contexts but noted that they had to evaluate what they were given, compare, and reason before trusting the output of AI. Students therefore perceived critical thinking as an important academic integrity competence in AI-supported learning. Variations were seen

between the three countries. Pakistani students highlighted a lack of institutional guidance, which contributed to increased reliance on publicly available AI tools. One of the recurring themes that emerged from the conversations with the students in Pakistan was the issue of relying on AI, a situation where they felt they lacked adequate academic support and increasingly turned to AI tools for assistance. The Malaysian participants shared their reflections on how to strike a balance between AI support and expectations placed by institutions on originality and independent learning. Overall, Singaporean students were more familiar with the procedures for verifying information, as they reported that they often cross-checked AI-generated content with scholarly databases, institutional resources, and peer-reviewed literature before it was included in their academic writing. The participants also pointed out issues with misinformation, fake citations, algorithmic bias, and overly relying on AI-generated summaries. While AI enhanced learning efficiency, students felt that over time, relying on AI-generated answers without critical analysis might lead to a decline in analytical thinking skills, creativity, and problem-solving skills. Instead, they focused on how AI should be used as a tool for facilitating learning, not replacing it. The results show that the successful implementation of Human-AI co-learning requires the learner's cognizance to be maintained and their reflective interaction with the AI-generated knowledge to be promoted. The results corroborate earlier studies that emphasize the need to evaluate students' performances critically and responsibly while utilizing the advantages of using AI for learning (Chea & Deng, 2026; Yang & Jiang, 2026).

#### **4.5 Theme 5: Cross-cultural Digital Learning Practices**

This analysis identified both similarities and contextually different aspects of the students' digital learning experiences in Pakistan,

Malaysia and Singapore. The amount of time spent on generative AI and social media was high with participants from all three countries using both technologies on a regular basis in their academic life. The learning behaviors, learning outcomes, and learning expectations of students, however, were affected by the educational environment in which the technologies were employed. Accessibility, affordability, and the potential of AI to fill the gap of insufficient educational resources were key concerns raised by the participants from Pakistan. AI-generated explanations helped students understand concepts individually, enhanced their academic writing skills, and provided learning support outside of the classroom. Malaysian students mentioned the use of AI in interdisciplinary subjects, collaborative learning, and productivity as areas where they have seen an institutional push to implement digital learning. By contrast, Singaporean participants viewed AI as a commonplace part of technologically modern learning spaces in which intelligent systems were used to augment research, project-based learning, and independent learning, with robust institutional digital infrastructure. Although there are some contextual variations, the educational benefits that participants identified in all three countries were similar, such as increased flexibility in learning, better collaboration, better academic confidence and increased opportunities for self-directed learning. Students also expressed shared concerns about the credibility of information, ethical use of AI, and the need for ongoing digital skills development. The results indicate that national educational systems influence the patterns of AI use, but the core concepts of Human-AI co-learning seem to be quite similar across different cultural settings. In conclusion, the results underscore the need for the development of AI-based teaching methods that are adapted to the context and foster inclusive and learner-centered digital learning.

#### **4.6 Theme 6: Responsible AI and Digital Competence**

The last theme highlights the need for responsible use of AI to support successful Human-AI co-learning that goes beyond technology access, which demands high levels of digital competence. Throughout the study, participants emphasized the importance of a balanced approach to generative AI, noting that it requires knowledge of its strengths, as well as its limitations. Students highlighted the need for verifying information created by AI, acknowledging algorithmic bias, safeguarding personal privacy, ensuring academic honesty, and using AI ethically during learning. Participants across the three countries saw digital competence as a multidimensional skill that consists of technical skills, information literacy, ethics, and responsible decision making. Students did not view digital competence as just knowing a certain tool but rather interpreted it as a skill to formulate good prompts, critically assess outputs, use several sources of information and apply AI responsibly in the academic setting. Participants also acknowledged the importance of the role universities can play in fostering these skills through structured guidance, institutional policies and AI literacy programs. Again, institutional contexts were reflected in the differences across countries. In Pakistan, students highlighted the importance of having more formal training into responsible use of AI in the university curriculum. Collaborative efforts and faculty support were identified by Malaysian participants, which fostered proper integration of AI. Malaysian participants emphasized the importance of collaborative efforts and faculty guidance for the proper integration of AI. Students from Singapore talked about more advanced institutional structures that facilitate responsible AI use, such as the increased consciousness of ethical guidelines and digital governance. However, the

participants expressed a consensus that digital competence would be an integral part of a graduate's competence in the future, where the use of artificial intelligence in education and work is growing. The results align with prior studies that highlight the importance of digital literacy, ethical governance of AI technologies, and responsible Human-AI collaborations as key conditions for sustainable technology-enhanced learning (TEL) (Arshad et al., 2026; Wang et al., 2025).

#### 4.7 Synthesis of Findings

The six themes collectively demonstrate that Human-AI co-learning is a multidimensional educational process with continuous interaction between students, generative AI and digitally linked learning communities. In all countries – across Pakistan, Malaysia and Singapore – participants universally thought of AI as a partner for active learning, as a tool that would improve academic engagement, personalize learning, improve collaboration and support the construction of knowledge, and not merely as a tool for academics. This process was reinforced by the use of social

media platforms, which served as a dynamic knowledge-sharing environment for students to share their ideas, access educational materials, and join in shared learning experiences. Meanwhile, participants were aware that AI's educational value can be maximized if critical thinking and academic integrity are upheld, along with forming solid digital competencies that can help promote responsible technology use. While there were variations across the three countries in their patterns of AI adoption due to institutional support, technological infrastructure, and digital readiness, the principles of Human-AI co-learning were remarkably similar. The results indicate that achieving sustainable AI-enhanced higher education is not just about technological advancements, but also about cultivating reflective students who can master the use of AI tools, social media, and human knowledge, in the context of interactive digital learning spaces. The results resonate with current theories of Human – AI collaboration, which focus on hybrid intelligence, learner autonomy, and responsible educational innovation (Puerta-Beldarrain et al., 2025; Hwang et al., 2026).

**Table 2.** *Thematic Analysis of Findings*

| Theme                               | Sub-Themes                                                                              | Representative Evidence                                                                                                                                                           | Interpretation                                                                                                              | Countries                     |
|-------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Evolution of Human-AI Co-learning   | AI as learning partner; Cognitive support; Interactive learning; Academic collaboration | Students increasingly used GenAI for brainstorming, conceptual clarification, assignment planning, academic writing, and problem solving instead of simple information retrieval. | Human-AI interaction has evolved into collaborative knowledge construction where AI augments learners' cognitive processes. | Pakistan, Malaysia, Singapore |
|                                     | Digital collaboration; Peer learning; Knowledge sharing; Educational communities        | Students integrated AI with YouTube, LinkedIn, Reddit, Facebook, Instagram, and TikTok to enhance collaboration, resource sharing, and academic engagement.                       | Social media complements AI by functioning as a collaborative digital learning ecosystem.                                   |                               |
| Social Media as Knowledge Community |                                                                                         |                                                                                                                                                                                   |                                                                                                                             | Pakistan, Malaysia, Singapore |
| Personalized                        | Adaptive learning;                                                                      | Participants used AI for                                                                                                                                                          | AI facilitates                                                                                                              | Pakistan,                     |

| Theme                                     | Sub-Themes                                                                               | Representative Evidence                                                                                                                          | Interpretation                                                                                                  | Countries                     |
|-------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------|
| Learning                                  | Self-directed learning; Learning autonomy; Individualized support                        | customized explanations, revision, feedback, practice activities, and independent learning based on individual needs.                            | personalized and self-directed learning while strengthening learner autonomy.                                   | Malaysia, Singapore           |
| Critical Thinking versus AI Dependency    | Information evaluation; AI reliance; Verification; Independent reasoning                 | Students appreciated AI efficiency but emphasized validating information, avoiding overdependence, and maintaining analytical thinking.          | Effective Human–AI co-learning requires balancing technological assistance with critical thinking.              | Pakistan, Malaysia, Singapore |
| Cross-cultural Digital Learning Practices | Institutional context; Technology adoption; Learning culture; Educational infrastructure | Similar learning benefits were reported across countries, while institutional support and digital readiness influenced AI integration practices. | National educational contexts shape AI adoption, although core Human–AI learning experiences remain consistent. | Pakistan, Malaysia, Singapore |
| Responsible AI and Digital Competence     | AI literacy; Ethical awareness; Digital responsibility; Academic integrity               | Participants emphasized responsible AI use, prompt engineering, information verification, privacy awareness, and ethical decision making.        | Digital competence is essential for sustainable and responsible Human–AI co-learning in higher education.       | Pakistan, Malaysia, Singapore |

#### 4.8 Discussion

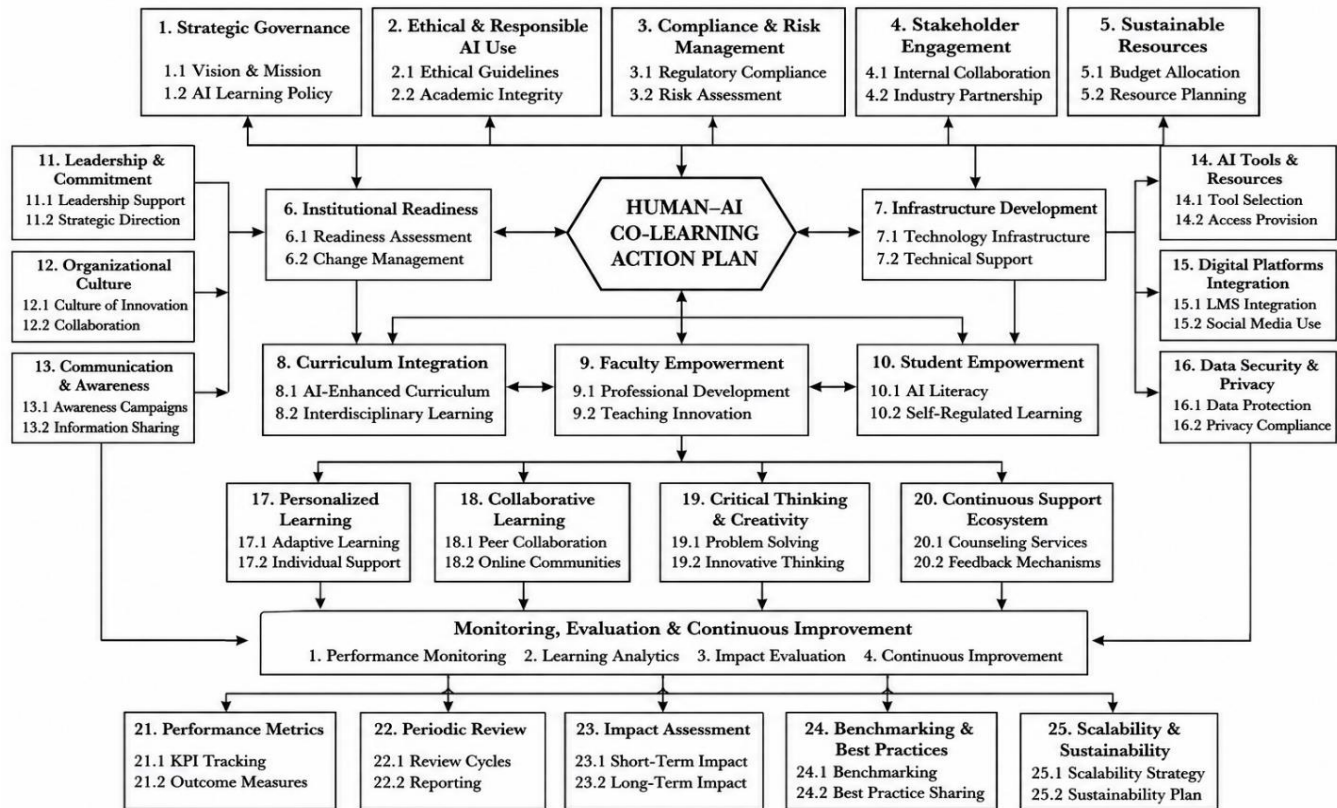
The results are indicative of the shift to Human–AI co-learning, a learning paradigm in which generative artificial intelligence and social media are changing the way that university students learn, communicate with peers, and manage their learning. Rather than seeing AI as a replacement for learning, participants in Pakistan, Malaysia, and Singapore regarded it as a learning partner that boosts cognitive engagement while maintaining the core importance of human judgment in learning. This observation aligns with the idea of Human–AI co-learning put forward by Chan et al. (2026), which highlights the coexistence and interactions of human and AI systems in the learning process. Likewise, the results are in line with the Human–AI collaboration discussion presented by Puerta-Beldarrain et al. (2025),

who state that the best outcomes result from how AI complements human skills. The results also deepen knowledge of the concept of Human–AI co-learning in the context of interwoven digital learning ecosystems, in which social media and generative AI are connected and complementary resources for learning. The students were consistently incorporating the educational content they gained from social media with the explanations they created with the AI, showing that learning is now happening in more than one technological space and is a collaborative process. This finding corresponds with the pedagogical model suggested by Creely and Carabott (2025), and there is evidence that digital learning networks facilitate co-construction and interaction to build knowledge together (Rani et al., 2026). Moreover, this study's

findings align with prior studies suggesting that Generative AI promotes autonomous learning and personalized instruction, as well as self-directed learning (Tu et al., 2025). The connection between adopting AI and critical thinking is an important contribution of the present study. Participants identified significant educational values inherent in the use of AI but regularly expressed a need to verify information produced by AI, probe AI outputs, and engage in independent thinking to promote meaningful learning. The findings reflect worries about over-reliance on AI reported by Chea and Deng (2026), and they support the notion proposed by Yang & Jiang (2026) that digital literacy is key to successful Human-AI collaboration. The participants did not reject the use of AI but rather called for a balanced approach to its integration, where technology is used to enhance efficiency but is not the sole means of problem-solving. The overall sentiment among participants was not one of opposition to AI adoption, but rather a call for a balanced approach that integrates AI tools with reflective thinking and ethical decision-making. The comparative design also adds to the body of literature by showing the effect of national educational contexts on the patterns of using AI while not fundamentally changing students' perceptions of Human-AI co-learning. The Pakistani participants indicated greater accessibility and educational support, while the Malaysian students pointed to the benefits of collaboration and productivity,

and the Singaporeans showed increased institutional integration and digital maturity. However, the basic learning experiences were very much the same in all three countries. The findings contribute to comparative education literature, as they show that the role of the technological infrastructure and institutional readiness are reflected in the implementation practices, while the collaborative learning processes remain the same in various education systems (Jamaludin et al., 2020; Funa & Gabay, 2026). Lastly, the results indicate that the promotion of responsible use of AI should be considered an integral part of education and not an add-on technical skill. The participants associated effective Human-AI co-learning with all the following digital literacy, ethical awareness, information evaluation, and academic integrity consistently. Overall, this observation aligns with other literature that has focused on responsible AI governance in higher education (Wang et al., 2025), as well as the need to promote AI literacy in university education, equipping graduates for the increasingly intelligent digital world. The study contributes to the growing body of literature by combining three elements—Human-AI co-learning, social media learning, and cross-cultural educational perspectives—to present a comprehensive qualitative framework that elucidates how students co-create knowledge in the context of AI in higher education.

**Figure 1.** Action Framework for Strengthening Human–AI Co-Learning Across Higher Education Systems



## 5. Conclusion

The aim of this study was to examine the experiences of university students in Human-AI co-learning in the context of generative artificial intelligence (GenAI) and social media in three countries of Pakistan, Malaysia, and Singapore. It adopted a qualitative cross-country design and explored students' everyday learning practices with AI and how they are influenced by the national educational contexts. The results show that Human-AI co-learning has not only become a process of technology use, but is an educational process in which the learner, the AI system and the digital community all participate in the construction of knowledge, in the learning process, in critical thinking and in self-directed learning. Students generally perceived GenAI as an active learning partner that they use for brainstorming, clarifying complex concepts, organizing coursework,

improving academic writing, and solving academic problems, and that it is important to critically evaluate AI-generated outputs and maintain academic integrity. Social media platforms also enhanced AI by providing a platform for collaborative knowledge sharing and learning, enabling community engagement, the sharing of resources, ongoing education, and exposure to a variety of educational viewpoints. The cross-country comparison showed similarities and differences in the learning experiences of students. The Pakistani participants focused on the transformative potential of AI in making education more accessible and addressing resource constraints, while the Malaysian students noted the potential of AI in enhancing productivity, interdisciplinary innovation, and effective management of academic workloads. The Singaporeans described AI as a seamless part of technologically advanced learning environments, with robust

institutional support and digital readiness. Nevertheless, the potential importance of digital literacy, ethical use of AI, independent thinking and responsible decision making were consistently highlighted across all three countries. The results show that the co-learning between human and AI requires institutional support, learner agency and digital competence as well as technological competence. This study contributes to the current knowledge by introducing a cross-national Human-AI co-learning model in addition to an actionable institutional roadmap and offers concrete recommendations for universities aiming to create responsible, inclusive, collaborative, and sustainable learning and development ecosystems that equip students for the changing digital societies and knowledge economies.

### 5.1 Theoretical Implications

This study makes several theoretical contributions to the emerging literature on Human-AI co-learning. First, it extends the conceptualization of Human-AI collaboration by demonstrating that AI functions as a collaborative learning partner within digitally connected educational ecosystems rather than as an isolated technological tool. Second, the findings integrate Human-AI co-learning with Social Constructivism and Self-directed Learning by illustrating how knowledge is co-constructed through interactions among learners, AI systems, and online communities. Third, the cross-country comparison demonstrates that institutional contexts influence technology adoption while the underlying processes of collaborative learning remain consistent across diverse educational systems. Finally, the proposed conceptual framework advances qualitative scholarship by explaining Human-AI co-learning through students' lived experiences instead of technology acceptance or system performance. These contributions enrich existing theoretical discussions concerning collaborative intelligence, learner autonomy,

AI-supported education, and digitally mediated knowledge construction (Chan et al., 2026; Puerta-Beldarrain et al., 2025; Gyasi et al., 2025; Creely & Carabott, 2025; Hwang et al., 2026).

### 5.2 Practical Recommendations

The findings offer several practical recommendations for higher education stakeholders. Universities should develop comprehensive AI strategies that integrate generative AI into curriculum design while establishing clear institutional policies regarding responsible AI use, academic integrity, and digital ethics. Faculty members should redesign learning activities to encourage critical thinking, collaborative problem solving, and reflective engagement with AI rather than emphasizing content reproduction. Students should be encouraged to develop AI literacy, information evaluation skills, and responsible technology practices that enable them to use intelligent systems as learning partners instead of replacing independent thinking. Policymakers should invest in digital infrastructure, faculty development, and AI governance frameworks that promote equitable access to intelligent educational technologies across different institutional contexts. Collectively, these initiatives will help establish sustainable Human-AI co-learning environments that enhance educational quality while preparing graduates for increasingly AI-driven academic and professional settings.

### 5.3 Limitations and Future Research Directions

Despite its contributions, the study has several limitations. First, the research involved eighteen participants from three countries, limiting the generalizability of the findings to broader higher education populations. Second, the study adopted a qualitative design that focused on participants' experiences rather than measuring relationships among educational variables. Future research should expand the

geographical scope by including additional countries representing different educational, cultural, and technological contexts to provide a broader understanding of Human–AI co-learning. Mixed-methods research combining qualitative exploration with quantitative validation would further strengthen theoretical development by examining relationships among AI literacy, digital competence, learning engagement, and educational outcomes. Longitudinal

studies are also recommended to investigate how students' interactions with generative AI evolve over time as technologies, institutional policies, and educational practices continue to mature. Such research will contribute to developing more comprehensive theoretical and practical frameworks for AI-enhanced higher education in rapidly changing digital environments.

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### Declaration of Conflicting Interest

The author declared no potential conflicts of interest with respect to research.

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