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AI AS A PEDAGOGICAL COMPANION IN HIGHER EDUCATION: TRANSFORMING TEACHING AND LEARNING PRACTICES IN THE ERA OF GENERATIVE ARTIFICIAL INTELLIGENCE

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Abstract

This study aims to analyze how artificial intelligence (AI) functions as a learning companion in transforming learning and teaching practices in a higher education setting. The study employed a qualitative approach using a dual-case study design, conducted in two classes in the Education Study Program at Sangga Buana YPKP University in Bandung. The participants consisted of 50 individuals, including 10 faculty members and 40 students who had direct experience with AI-based learning. Data were collected through semi-structured interviews, non-participant observation of AI-assisted learning activities, and document analysis covering course syllabi, learning materials, assessment guidelines, AI usage policies, and student assignment artifacts. The data were analyzed using reflective thematic analysis, combining deductive and inductive approaches, and were strengthened through source triangulation, participant validation, peer discussion, audit trails, and researcher reflexivity. The results of the study indicate that AI serves as a learning companion that expands access to explanations, provides rapid feedback, supports the exploration of ideas, and facilitates personalized learning. The integration of AI also transforms the role of instructors from knowledge transmitters to facilitators, designers of learning experiences, evaluators of information, and mediators of critical AI use. At the same time, students demonstrate increased opportunities to develop autonomy, self-regulation, and reflection on the learning process. However, the effectiveness of human–AI collaboration is significantly influenced by AI literacy, trust, transparency, information accuracy, academic integrity, data privacy, and human oversight mechanisms. The research concludes that AI is most productive when positioned as a pedagogical partner that enhances human capabilities, rather than as a substitute for instructors or students.

Keywords: artificial intelligence, AI learning companion, higher education, collaborative learning, personalized learning, student autonomy, human-centered AI

Abstrak

Penelitian ini bertujuan menganalisis bagaimana artificial intelligence (AI) berfungsi sebagai learning companion dalam mentransformasi praktik pembelajaran dan pengajaran di lingkungan perguruan tinggi. Penelitian menggunakan pendekatan kualitatif dengan desain dual-case study yang dilaksanakan pada dua kelas di Program Studi Pendidikan, Universitas Sangga Buana YPKP Bandung. Partisipan terdiri atas 50 orang, yaitu 10 dosen dan 40 mahasiswa yang memiliki pengalaman langsung dalam pembelajaran berbasis AI. Data dikumpulkan melalui wawancara semi-terstruktur, observasi nonpartisipan terhadap aktivitas pembelajaran berbantuan AI, dan analisis dokumen yang mencakup RPS, materi pembelajaran, pedoman asesmen, kebijakan penggunaan AI, serta artefak tugas mahasiswa. Data dianalisis menggunakan reflective thematic analysis dengan mengombinasikan pendekatan deduktif dan induktif serta diperkuat melalui triangulasi sumber, participant validation, diskusi sejawat, audit trail, dan refleksivitas peneliti. Hasil penelitian menunjukkan bahwa AI berperan sebagai pendamping pembelajaran yang memperluas akses terhadap penjelasan,

menghasilkan umpan balik cepat, mendukung eksplorasi ide, dan memfasilitasi personalisasi pembelajaran. Integrasi AI juga mengubah peran dosen dari penyampai pengetahuan menjadi fasilitator, perancang pengalaman belajar, evaluator informasi, dan mediator penggunaan AI secara kritis. Pada saat yang sama, mahasiswa menunjukkan peningkatan peluang untuk mengembangkan otonomi, regulasi diri, dan refleksi terhadap proses belajar. Namun, efektivitas kolaborasi manusia–AI sangat dipengaruhi oleh literasi AI, kepercayaan, transparansi, akurasi informasi, integritas akademik, privasi data, dan mekanisme pengawasan manusia. Penelitian menyimpulkan bahwa AI paling produktif ketika diposisikan sebagai mitra pedagogis yang memperkuat kapasitas manusia, bukan sebagai pengganti dosen maupun mahasiswa.
Kata kunci: *artificial intelligence, AI learning companion, pendidikan tinggi, pembelajaran kolaboratif, personalisasi pembelajaran, otonomi mahasiswa, human-centered AI*

Introduction

Artificial intelligence (AI) has moved from the periphery of educational technology toward the center of contemporary higher education. The emergence of generative artificial intelligence (GenAI), particularly large language models (LLMs), has accelerated this transition by enabling systems to generate explanations, provide feedback, summarize complex information, support writing and coding, and interact conversationally with learners. Consequently, AI is no longer confined to administrative automation or conventional intelligent tutoring systems; it increasingly participates directly in teaching, learning, assessment, and academic decision-making. Recent systematic reviews demonstrate that the rapid diffusion of ChatGPT and other GenAI systems has substantially expanded the scope of AI-supported educational practices, while simultaneously creating new pedagogical, ethical, and institutional challenges (Albadarin et al., 2024; Batista et al., 2024; Wu et al., 2025).

The significance of this transformation lies not simply in the availability of a new technological tool, but in the possibility of reconfiguring the relationship between human cognition and educational technology. Earlier educational technologies generally positioned learners and lecturers as primary actors who used digital systems as instruments to access information or facilitate instruction. GenAI introduces a qualitatively different interaction because the technology can generate, explain, question, critique, reorganize, and adapt information through natural-language dialogue. Research on human–AI interaction in learning demonstrates that students can engage with AI in qualitatively different ways: some use AI actively to construct knowledge, whereas others interact with it passively and mechanically. Such differences matter because the educational value of AI depends not only on the system's capabilities but also on how learners engage cognitively with the technology (Wang et al., 2023).

This development challenges the conventional conceptualization of AI as merely an instructional instrument. In higher education, GenAI can function as an interactive cognitive partner that supports questioning, idea generation, explanation, feedback, reflection, and problem solving. Sharples (2023), for example, conceptualizes generative AI for education as a social and conversational system in which learning emerges through interaction among learners, teachers, AI

systems, and informational resources. Similarly, empirical research has shown that ChatGPT can be incorporated into learning activities designed to strengthen communication, reasoning, and other higher-order competencies when students are required to critically interrogate rather than simply reproduce AI-generated outputs (Michalon & Camacho-Zuñiga, 2023). Thus, the more consequential question is no longer whether AI should be present in university classrooms, but how human–AI collaboration should be pedagogically structured so that AI augments rather than displaces human learning.

The potential educational benefits of such collaboration are particularly evident in personalized and adaptive learning. AI-enabled systems can process learner interactions and provide differentiated explanations, recommendations, feedback, and learning pathways. A systematic review by Gligorea et al. (2023) indicates that AI-supported adaptive learning can facilitate individualized educational experiences by adjusting content and learning processes to students' needs. This capability is especially relevant to higher education, where classrooms increasingly contain learners with heterogeneous levels of prior knowledge, learning strategies, interests, and academic needs. GenAI can therefore operate as an on-demand learning companion, allowing students to ask follow-up questions, request alternative explanations, obtain immediate feedback, and revisit difficult concepts without waiting for scheduled interactions with lecturers.

Evidence from higher education further indicates that students are already actively incorporating ChatGPT into their learning practices. For example, a large-scale study involving Indonesian higher education students found that facilitating conditions strongly predicted behavioral intention to use ChatGPT, which subsequently predicted actual use for learning (Strzelecki, 2023). This finding is important because it demonstrates that AI adoption in universities is not merely a future possibility; it is already becoming embedded in students' everyday learning behavior. Similarly, research on undergraduate students indicates that engagement with GenAI varies across academic disciplines, suggesting that AI-supported learning cannot be understood as a uniform technological intervention independent of disciplinary and pedagogical context (Qu et al., 2024).

Nevertheless, the educational value of AI should not be equated automatically with technological availability. The expansion of GenAI also generates significant concerns regarding cognitive dependency, misinformation, academic integrity, privacy, bias, and the erosion of student agency. Systematic evidence indicates that ChatGPT can produce useful educational outputs but can also generate inaccurate or fabricated information, creating risks when students accept AI-generated responses without verification (Albadarin et al., 2024; Montenegro-Rueda et al., 2023). The central pedagogical problem is therefore not simply whether AI produces correct answers, but whether students remain cognitively engaged in evaluating, contextualizing, challenging, and applying those answers.

This issue is particularly important for higher education because universities are expected not merely to transmit information but to develop critical thinking, epistemic judgment, academic autonomy, creativity, and disciplinary expertise. If students employ GenAI primarily as a substitute for cognitive effort, the technology may weaken rather than strengthen these educational objectives. Conversely, when AI is positioned as a scaffold that stimulates questioning, comparison, reflection, and revision, it can potentially strengthen higher-order learning. The distinction between AI substitution and AI augmentation therefore becomes central to understanding the pedagogical consequences of GenAI. Academic integrity represents another major tension. The ability of GenAI systems to generate essays, reports, computer code, and other academic outputs has challenged conventional assumptions about authorship and assessment. A systematic review of empirical research on ChatGPT in education demonstrates that research has expanded rapidly since the emergence of ChatGPT, while institutions continue to grapple with appropriate forms of assessment and responsible use (Albadarin et al., 2024). More recent evidence likewise indicates that GenAI creates both educational opportunities and risks for academic integrity, making digital literacy, explicit institutional guidance, and redesigned assessment increasingly important (Bittle & El-Gayar, 2025). Accordingly, treating AI merely as an object of prohibition is insufficient; universities need pedagogical frameworks that teach students how to collaborate with AI ethically, critically, and transparently.

This challenge also changes the role of lecturers. The increasing availability of AI-generated explanations and learning resources does not eliminate the need for educators; instead, it potentially shifts the lecturer's role from primary information transmitter toward learning designer, facilitator, critical evaluator, mentor, and orchestrator of human–AI interaction. Research examining university responses to GenAI shows that institutions increasingly recognize the need to revise curriculum, assessment, and faculty practices rather than simply prohibit AI use. Institutional guidance increasingly emphasizes alignment between AI use and learning objectives, curriculum redesign, and multifaceted assessment rather than reliance exclusively on AI-detection technologies.

This transformation requires a corresponding expansion of lecturers' digital and AI competencies. The systematic review of ChatGPT implementation in education by Montenegro-Rueda et al. (2023) found that successful educational integration depends substantially on teachers' capacity to understand and use the technology appropriately. Similarly, recent research on pre-service teachers demonstrates that educators can envision GenAI supporting individualized learning, formative assessment, questioning, and self-directed learning, while simultaneously expressing concerns about accuracy and student dependency. These findings indicate that effective AI integration requires teachers to understand not only what AI can do, but also when AI should and should not be used pedagogically.

The emerging concept of human-centered AI provides an important theoretical foundation for this transformation. Human-centered AI emphasizes designing and deploying AI systems around human values, agency, accountability, transparency, and meaningful human control. In educational settings, this perspective implies that technological sophistication should not become the primary criterion for evaluating AI systems. Instead, the central question should be whether AI strengthens students' capacity to learn, reason, collaborate, and make informed decisions. Research on human-centered AI emphasizes that AI systems should be understood within broader sociotechnical relationships rather than as autonomous technological entities (Qian, 2023; Wilkens et al., 2023).

Consequently, the metaphor of AI as a "classroom companion" provides a potentially productive conceptual alternative to the dominant binary of "AI as tool" versus "AI as replacement." A companion is neither a passive instrument nor an autonomous substitute for the human educator. Rather, it participates in an interaction in which humans retain responsibility for goals, values, interpretation, judgment, and decision-making, while AI contributes computational capabilities such as rapid information processing, content generation, personalization, and continuous feedback. This conceptualization is consistent with emerging research that frames educational GenAI as a collaborative rather than purely instrumental technology (Sharples, 2023; Wang et al., 2023).

However, the existing literature remains fragmented. Much of the early research has focused on technology acceptance, perceived usefulness, academic integrity, student attitudes, or the technical capabilities of ChatGPT, while fewer studies examine how AI changes the underlying pedagogical relationship among lecturers, students, and learning content. Existing systematic reviews similarly identify a need for more empirical and interdisciplinary research examining how GenAI can be incorporated into curriculum, assessment, teaching strategies, and authentic learning rather than merely studying whether students use the technology (Ogunleye et al., 2024; Wu et al., 2025).

Furthermore, recent reviews demonstrate that the field is expanding faster than institutional and pedagogical frameworks can accommodate. A 2024 systematic review of GenAI and higher education identified teaching, learning, assessment, and institutional practice as major areas of transformation, while also highlighting unresolved questions concerning ethical use and effective implementation (Batista et al., 2024). A 2025 review similarly identified substantial variation in students' and educators' responses to GenAI, reinforcing the argument that adoption cannot be reduced to a simple technological diffusion process (Wu et al., 2025).

Therefore, a significant research opportunity exists in moving the discussion from "AI adoption" toward "human–AI pedagogical collaboration." Such a shift requires examining AI not simply according to whether it improves efficiency, but according to how it changes classroom interaction, student agency, lecturer roles, personalization, feedback, critical thinking, and learning responsibility. The central concern becomes whether AI can be integrated into university classrooms

as a pedagogically mediated companion that expands human capabilities while preserving human agency.

Against this background, the present study conceptualizes AI as a pedagogical companion in higher education and investigates how human–AI collaboration reshapes contemporary teaching and learning practices. The study is grounded in the assumption that meaningful AI integration emerges when technological capabilities are deliberately connected with pedagogical objectives, lecturer expertise, student agency, and institutional governance. Rather than treating AI as either an educational panacea or an existential threat to university teaching, this study positions it as a sociotechnical partner whose educational value depends on the quality of human–AI interaction. Such a perspective is particularly important at a time when universities are moving from experimentation toward institutionalization of GenAI. Recent evidence already demonstrates that universities are developing policies, curricula, and classroom practices in response to GenAI, but substantial variation remains in how these technologies are pedagogically framed and operationalized.

Accordingly, the study contributes to the emerging literature by shifting the analytical focus from AI as a technological artifact to AI as a participant in pedagogical processes. This perspective provides a basis for examining how AI can support personalized learning, formative feedback, collaborative knowledge construction, lecturer facilitation, and student self-regulation while simultaneously addressing the risks of dependency, misinformation, inequity, privacy violations, and academic misconduct. The ultimate objective is not to determine whether AI should replace existing educational practices, but to understand how universities can redesign teaching and learning so that human intelligence and artificial intelligence operate complementarily. Such a human-centered, pedagogically grounded approach is essential for developing higher education systems in which AI enhances—not diminishes—the intellectual, social, and ethical purposes of university education.

Research Method

Research Design

This study employs a qualitative dual-case study design to examine how artificial intelligence (AI) functions as a facilitator of collaborative learning in contemporary college classrooms. A qualitative approach was chosen because this study aims to understand the meanings, experiences, interactions, and pedagogical transformations that emerge when AI is integrated into the teaching-and-learning process, rather than merely measuring the frequency or effectiveness of AI use. This study specifically focuses on the transition from viewing AI as a technological tool to understanding AI as a collaborative pedagogical partner that interacts with students and faculty in the learning process.

A dual case study design was adopted to capture variations in AI-supported teaching practices across various university courses and classroom contexts. Each selected course was treated as a

separate case, while cross-case analysis was subsequently conducted to identify recurring patterns and contextual differences. This study is guided by a human-centered AI perspective, which emphasizes active human roles, autonomy, transparency, trust, accountability, and the complementary relationship between human educators and AI systems. Thus, this study does not conceptualize AI as a replacement for instructors, but rather as an interactive resource whose educational value depends on how it is designed, interpreted, supervised, and pedagogically integrated by humans.

The primary analytical focus encompasses four dimensions: (1) AI-supported learning interactions, (2) the transformation of the instructor's role, (3) student autonomy and personalized learning, and (4) the ethical and institutional conditions of AI integration. These dimensions are derived from the conceptual arguments established in the introduction and are treated as illuminating concepts, not as predetermined variables.

Research Setting and Participants

This study was conducted in university-level classrooms where AI-based applications have been integrated into teaching and learning activities. The study sites included courses in which students and faculty used generative AI or other AI-based educational applications for activities such as information exploration, brainstorming, material explanation, feedback, formative assessment, writing support, problem-solving, and personalized learning assistance.

Participants were selected using purposeful sampling, with inclusion criteria designed to ensure that participants had direct experience with AI-supported classroom activities. Participants consisted of university faculty and undergraduate students who had actively participated in courses involving AI-supported learning. Faculty members were included because their changing pedagogical roles are central to understanding the transition from knowledge transmission to facilitation, instructional design, guidance, and critical oversight. Students were included because their experiences provide direct evidence regarding autonomy, personalization, engagement, trust, self-regulation, and their perceptions of AI as a learning companion.

The final sample consisted of 50 participants, including 10 faculty members and 40 students, drawn from [2] classes in the Education program at Sangga Buana YPKP University in Bandung. Participant characteristics included academic role, field of study, teaching or learning experience, frequency of AI use, and the types of AI applications used in classroom activities. To ensure contextual diversity, participants were selected from courses with different pedagogical orientations, rather than from a single academic discipline.

Data Sources

Three complementary data sources were used to strengthen the credibility of the findings: semi-

structured interviews, classroom observations by uninvolved parties, and document analysis.

First, semi-structured interviews were conducted with faculty members and students to explore their experiences with AI-supported teaching and learning. Interview questions covered participants' perceptions of AI as a tool versus a collaborative partner, changes in classroom interactions, personalized learning, student autonomy, the transformation of the instructor's role, trust, transparency, perceived benefits, ethical issues, and institutional support. Open-ended questions were used to allow participants to describe experiences that researchers might not have anticipated.

Second, non-participant observation was conducted during AI-supported classroom activities. This observation focused on how students interacted with AI, how instructors facilitated the use of AI, how AI-generated information was evaluated, how students collaborated with their peers while using AI, and how responsibility for learning decisions was shared among students, instructors, and the AI system. Special attention was given to moments when AI recommendations were accepted, questioned, modified, or rejected by human participants.

Third, document analysis was conducted to examine institutional and pedagogical evidence related to AI integration. These documents include course syllabi, lesson plans, learning management system materials, assessment guidelines, AI usage policies, instructional materials, and examples of AI-supported student assignments, if available. Document analysis was used to determine whether AI integration was formally incorporated into pedagogical planning or remained an informal classroom practice.

The use of various data sources enabled methodological triangulation, allowing claims emerging from the interviews to be compared with observed classroom practices and documentary evidence.

Research Instruments

The primary research instrument was a semi-structured interview protocol developed based on the conceptual dimensions of human-centered AI and AI-supported collaborative learning. The protocol consists of questions grouped into five domains:

1. AI–student interactions, including how students use AI to explore, explain, generate, and evaluate knowledge;
2. AI–instructor interactions, including how instructors monitor, adapt, and integrate AI-generated outputs;
3. student personalization and autonomy, including individualized feedback, learning pathways, self-regulation, and decision-making;
4. pedagogical transformation, including changes in instructor responsibilities, classroom interactions, assessment, and instructional design; and

5. ethics and governance, including privacy, transparency, bias, academic integrity, accountability, and institutional regulations.

The observation protocol followed similar dimensions while allowing researchers to record unexpected interactions and contextual phenomena. A document analysis framework was used to identify evidence of explicit AI integration, pedagogical objectives, assessment procedures, ethical provisions, and human oversight mechanisms. Prior to data collection, these instruments were reviewed by two faculty members specializing in educational technology, higher education, and educational research to assess the relevance of the content, clarity, and alignment with the research objectives. Necessary revisions were incorporated before field implementation.

Data Collection Procedures

Data collection was conducted in four stages. First, the researchers identified university courses that intentionally or routinely integrated AI into classroom learning activities. Institutional approval and informed consent were obtained prior to participant recruitment and data collection. Second, classroom observations were conducted during selected AI-supported learning sessions. The researchers positioned themselves as non-participating observers to minimize disruption to classroom interactions. Field notes documented the pedagogical context, forms of AI use, student responses, instructor interventions, interaction patterns, and examples of critical evaluation of AI-generated information. Third, individual semi-structured interviews were conducted with instructors and students following the classroom observations. Interviews were conducted in Indonesian, audio-recorded with participants' permission, transcribed verbatim, and then cross-checked against the original recordings to minimize transcription errors. Fourth, relevant institutional and instructional documents were collected and analyzed. Data collection continued until theoretical saturation was reached, marked by the point at which additional interviews and observations yielded few new conceptual categories or explanations.

Data Analysis

Data were analyzed using reflective thematic analysis, following a systematic process consisting of familiarization, pre-coding, theme development, theme review, theme definition, and reporting. Interview transcripts, observation notes, and documents were first read repeatedly to build a deep understanding of the dataset. Meaningful segments related to AI-supported teaching and learning were then preliminarily coded. This coding process combined deductive and inductive approaches. Deductive codes were derived from the conceptual framework, specifically the human role, trust, transparency, personalization, autonomy, faculty transformation, ethical governance, and human–AI collaboration. At the same time, inductive coding allows unexpected themes to emerge directly from participants' experiences and classroom observations.

Subsequent analysis shifts from descriptive codes to more analytical categories. For example, codes regarding individualized feedback, adaptive explanations, and differentiated learning materials are grouped into the broader category of AI-supported personalization. Codes related to instructor monitoring, verification of AI outputs, pedagogical adaptation, and student guidance were synthesized into human supervision and pedagogical mediation. A cross-case analysis was then conducted to compare patterns across different courses and participant groups. Special attention was given to the similarities and differences between the perspectives of instructors and students. The final analytical model was developed by examining how AI-supported interactions contribute to changes in learning autonomy, pedagogical roles, and classroom relationships, while institutional conditions and ethics were treated as contextual factors influencing these processes.

Reliability

The credibility of this study was established through data triangulation, participant validation, peer discussion, and an audit trail. Data triangulation involved comparing interview narratives with classroom observations and documentary evidence. When discrepancies arose, the researchers referred back to the original data rather than assuming that one source was necessarily more accurate than another. Participant validation was conducted by sharing preliminary interpretations with selected participants to determine whether the emerging descriptions adequately represented their experiences. Discussions with peers involved deliberations on coding and emerging themes with researchers experienced in educational technology and qualitative research. An audit trail was maintained throughout the research process, documenting decisions regarding participant selection, data collection, coding, theme development, and interpretation. Reflexivity was also integrated into the analytical process. The researchers kept reflective notes on their assumptions about AI, higher education, and technology-mediated learning to distinguish participants' perspectives from the researchers' interpretations.

Ethical Considerations

This study adheres to established ethical principles for educational research. Participants were informed about the study's objectives, the voluntary nature of their participation, their right to withdraw, and procedures to protect confidentiality. Written consent was obtained prior to interviews and observations. Because the use of AI may involve sensitive educational data, special attention was given to privacy, data protection, academic integrity, and the responsible use of AI. Personal identifiers were removed during transcription and analysis, and participants and institutions were pseudonymized. Any AI-generated material included in the dataset was treated as research data and was not automatically accepted as accurate information. Researchers remain responsible for interpretation and verification, in line with a human-centered research approach.

Results and Discussion

The analysis of interviews, non-participant classroom observations, and institutional documents identified four interconnected themes that explain how artificial intelligence (AI) functions as a collaborative learning companion in university classrooms: (1) AI-supported learning interaction and knowledge co-construction, (2) transformation of the lecturer's role from knowledge transmitter to pedagogical mediator, (3) increased student autonomy and personalized learning, and (4) the emergence of trust, ethical awareness, and institutional conditions as boundary factors of human–AI collaboration. Cross-case analysis of the two classes revealed broadly similar patterns, although the intensity and form of AI use differed according to instructional objectives, lecturer mediation, and students' digital competence.

AI as a Collaborative Learning Companion

Across the two cases, AI was not used exclusively as a mechanism for retrieving information or producing completed assignments. Instead, students frequently used AI through iterative interaction involving questioning, comparing, revising, and verifying information. Classroom observations indicated that students commonly initiated learning activities by formulating questions to AI, examining the generated responses, and subsequently discussing or modifying those responses with peers and lecturers. This pattern indicates a shift from one-directional technology use toward dialogic human–AI interaction. Students did not simply receive AI-generated answers; rather, AI became an additional conversational layer within the learning process. In several observed activities, students asked follow-up questions when the initial AI response was considered too general, requested alternative explanations, and compared different responses before deciding which information was useful for their learning task.

The interviews further indicated that students valued AI particularly when they encountered difficulties understanding concepts. AI was perceived as providing immediate explanations without requiring students to wait for the next classroom meeting. This characteristic was especially important for students who were reluctant to ask questions publicly. AI therefore functioned as an accessible preliminary source of clarification before students returned to lecturers or peers for further discussion. However, the findings also demonstrate that students did not consistently regard AI-generated information as authoritative. Several participants described the need to check AI outputs against lecture materials, textbooks, academic sources, or explanations provided by lecturers. This behavior was particularly evident when students encountered unfamiliar concepts or information that appeared inconsistent with previously learned material. Thus, AI-supported learning in the two cases was characterized by a cycle of generation, evaluation, verification, and revision, rather than passive acceptance.

The observational data reinforce this finding. Students who used AI most productively tended

to engage in iterative prompting and critical comparison, whereas students with weaker digital literacy were more likely to accept the first generated response. This difference suggests that the educational contribution of AI is mediated by students' capacity to interrogate and evaluate AI outputs. The cross-case findings therefore indicate that AI operates most effectively as a learning companion when it complements, rather than replaces, human reasoning. The interaction can be represented as:

Student question → AI response → critical evaluation → peer/lecturer discussion → revision → learning outcome.

This pattern demonstrates that the pedagogical value of AI lies not simply in its capacity to generate content but in its capacity to stimulate additional cycles of inquiry and reflection.

Transformation of the Lecturer's Role

The second major finding concerns a substantial change in how lecturers perform their pedagogical roles. Across both cases, lecturers increasingly functioned as facilitators, learning designers, validators, and critical mediators, rather than serving exclusively as the primary source of information. Classroom observations showed that lecturers frequently allowed students to consult AI before classroom discussion. Rather than immediately providing the correct answer, lecturers used students' AI-generated responses as starting points for questioning and discussion. Students were asked to explain why they accepted particular responses, identify potential weaknesses in AI-generated explanations, and connect AI outputs with course concepts.

This practice transformed the lecturer's role from "providing answers" to "designing conditions for critical learning." The lecturer remained essential because AI could generate plausible but incomplete, contextually inappropriate, or inaccurate responses. Consequently, lecturers assumed responsibility for establishing conceptual boundaries, correcting misconceptions, selecting appropriate learning resources, and helping students distinguish academically reliable information from unsupported AI-generated claims. Interview data also indicated that lecturers increasingly perceived their responsibilities as extending beyond technological competence. Effective AI integration required lecturers to understand both the capabilities and limitations of AI. Participants emphasized the importance of knowing when AI could facilitate learning and when direct human intervention remained necessary.

The findings consequently reveal a form of pedagogical redistribution rather than pedagogical replacement. Some routine functions—such as generating examples, summarizing information, producing preliminary explanations, or providing immediate feedback—could be delegated partially to AI. However, higher-order pedagogical responsibilities remained human-centered, particularly interpretation, contextualization, ethical judgment, emotional support, and evaluation of student understanding.

The relationship can therefore be conceptualized as:

TRADITIONAL CLASSROOM	AI-SUPPORTED CLASSROOM
LECTURER AS PRIMARY INFORMATION SOURCE	Lecturer as facilitator and learning designer
STUDENT RECEIVES INFORMATION	Student interrogates and evaluates information
FEEDBACK PRIMARILY PROVIDED BY LECTURER	AI provides preliminary feedback; lecturer validates and contextualizes
KNOWLEDGE TRANSMISSION	Knowledge co-construction
FIXED LEARNING PATHWAY	More adaptive learning pathways
LECTURER-CENTERED INTERACTION	Human–AI–peer–lecturer interaction

The findings indicate that AI does not eliminate the lecturer's relevance. Instead, it raises the pedagogical importance of lecturers as mediators of meaning, quality, and responsible technology use.

AI-Supported Personalization and Student Autonomy

The third theme concerns the relationship between AI use, personalization, and student autonomy. Participants described AI as particularly valuable because it could respond to different levels of prior knowledge and provide explanations in alternative formats. Students could ask AI to simplify difficult concepts, provide examples, reorganize information, or explain a topic from a different perspective. This capability generated a more flexible learning environment than the conventional one-size-fits-all model. Students could determine the depth, pace, and form of interaction according to their individual needs. Consequently, AI was frequently described not simply as a source of information but as an on-demand learning companion.

Observation data revealed several manifestations of this autonomy. Students independently selected when to use AI, formulated their own questions, requested additional explanations, and revised their outputs before presenting them to peers or lecturers. This process reduced students' dependence on lecturers for immediate clarification and encouraged them to take greater responsibility for managing their learning process. Nevertheless, increased autonomy did not automatically result in improved learning. The findings indicate that autonomy was productive when accompanied by critical self-regulation. Students who actively evaluated AI responses demonstrated more sophisticated interactions than those who simply copied AI-generated material. This distinction is important because technological accessibility can simultaneously increase learning autonomy and create opportunities for intellectual dependency.

The study therefore identifies a dual pathway:

AI accessibility → increased learning autonomy → critical inquiry and self-regulation

but also:

AI accessibility → reduced effort → uncritical acceptance → potential learning dependency.

The difference between these pathways depends largely on students' digital and academic literacy and the extent of lecturer supervision.

This finding positions student autonomy not as the absence of lecturer involvement but as supported autonomy. Students become more independent because AI expands their access to explanations and feedback, while lecturers provide the epistemic and ethical framework within which that independence can be exercised responsibly.

Human–AI Collaboration Requires Trust and Critical Verification

The fourth theme concerns trust. Although participants generally expressed positive attitudes toward AI, their trust was conditional rather than absolute. Students appreciated the speed, accessibility, and responsiveness of AI, but many recognized that AI-generated information could be inaccurate or insufficiently contextualized. This produced an important distinction between functional trust and epistemic trust. Students could trust AI to help them brainstorm, generate questions, simplify explanations, or provide alternative perspectives without necessarily trusting every factual statement produced by the system.

Classroom observations demonstrated that lecturers played an important role in establishing appropriate levels of trust. When lecturers explicitly instructed students to verify AI-generated information, students were more likely to compare AI outputs with academic sources. Conversely, when AI was presented merely as a convenient answer-generating technology, students were more likely to accept its outputs without sufficient verification. The findings therefore suggest that trust should not be understood as an unquestioning acceptance of AI. Rather, appropriate trust emerges through transparency, verification, and human oversight. This is particularly important in higher education because academic learning requires students to develop the capacity to distinguish evidence-based knowledge from plausible but unsupported claims.

The interviews also identified ethical concerns involving academic integrity, privacy, dependence on AI, and the boundaries of acceptable AI assistance. Students and lecturers recognized that the use of AI for brainstorming or preliminary feedback was qualitatively different from submitting AI-generated work as if it were entirely one's own. Consequently, responsible AI integration requires explicit pedagogical expectations concerning disclosure, verification, authorship, citation, and appropriate levels of AI assistance.

Institutional and Pedagogical Conditions Shaping AI Integration

The findings further indicate that classroom-level AI adoption cannot be separated from institutional conditions. Document analysis showed that AI integration was influenced by the extent to which course design, assessment procedures, and institutional expectations accommodated AI-

supported learning. The two cases revealed that AI use was more pedagogically meaningful when lecturers deliberately incorporated it into learning activities rather than leaving students to use AI independently. Structured tasks, explicit instructions, and opportunities for discussion helped transform AI from an external technological tool into an integrated component of the learning environment.

Conversely, the absence of clear institutional guidance created uncertainty concerning acceptable AI use. Students could differ considerably in their interpretation of whether AI assistance constituted legitimate learning support or inappropriate academic assistance. This finding demonstrates that technological availability alone is insufficient for meaningful AI transformation. The institutional environment therefore operates as an enabling or constraining condition. Effective integration requires at least four forms of support: lecturer digital competence, clear AI-use guidelines, assessment redesign, and institutional mechanisms for ethical governance.

Cross-Case Synthesis

Cross-case analysis demonstrated that the two classrooms shared the same fundamental transformation but differed in the degree of pedagogical integration. In both cases, AI increased access to immediate explanations, supported individualized learning, and created additional opportunities for interaction. However, the strongest learning effects were observed where lecturers actively mediated AI use and students were required to evaluate and discuss AI-generated information. The cases therefore suggest that AI availability is not equivalent to AI-enabled pedagogical transformation. The transformation occurs when AI is embedded within an intentional pedagogical architecture that combines technological capability with human judgment.

The resulting model can be summarized as follows:

AI capabilities → human–AI interaction → lecturer mediation + student critical engagement → personalized learning and autonomy → collaborative knowledge construction

while trust, digital competence, ethical governance, institutional policy, and assessment design function as contextual conditions influencing the strength and direction of these relationships.

This model positions AI as a third participant in the instructional ecosystem, alongside students and lecturers, but not as an autonomous educational agent. AI contributes computational capacity, rapid feedback, generative possibilities, and adaptive interaction; students contribute agency, interpretation, inquiry, and responsibility for learning; while lecturers contribute pedagogical expertise, contextual judgment, ethical oversight, and human relational support.

Summary of the Main Findings

Overall, the study generated four principal findings:

1. AI transformed classroom interaction from predominantly lecturer-mediated information delivery toward more iterative human–AI–peer learning interactions.

2. The lecturer's role was reconfigured rather than eliminated, with greater emphasis on facilitation, learning design, verification, mentoring, and ethical oversight.
3. AI increased opportunities for personalized learning and student autonomy, but these benefits depended on students' critical digital literacy and self-regulation.
4. Trust and ethical governance emerged as essential conditions for meaningful AI integration, requiring verification of AI outputs, transparency regarding AI use, academic-integrity safeguards, and institutional guidance.

Taken together, the findings support the proposition that the educational significance of AI in higher education is not determined primarily by the sophistication of the technology but by the quality of human–AI collaboration constructed through pedagogical design. AI becomes a genuine classroom companion when it extends students' capacity to inquire, assists lecturers in facilitating learning, and remains embedded within a framework of human agency, critical judgment, accountability, and ethical responsibility.

Discussion

The research findings indicate that the integration of artificial intelligence (AI) into learning in two classes within the Education Study Program at Sangga Buana YPKP University in Bandung is no longer limited to an instrumental function but has begun to evolve into a form of human–AI collaboration that influences how students acquire knowledge, complete assignments, and interact with instructors. Findings from observations, interviews, and document analysis reveal that students use AI to explore information, generate initial ideas, obtain alternative explanations, solve problems, and receive rapid feedback. However, AI does not yet function as a substitute for instructors. Instead, the pedagogical value of AI emerges when students and faculty retain key cognitive and pedagogical functions—particularly in verifying information, assessing the quality of AI outputs, contextualizing knowledge, and making learning decisions. These findings reinforce the view that generative AI in education should be positioned as an augmentative technology, not a substitutive one, as its effectiveness heavily depends on pedagogical design and the quality of human-technology interactions (Kasneci et al., 2023; Tlili et al., 2023; UNESCO, 2023).

One key finding is a shift in learning interaction patterns from a relatively linear model—where instructors present material and students receive information—to a more dialogic and iterative pattern. Students do not merely ask AI to provide answers but use AI to pose follow-up questions, compare different explanations, request examples, simplify complex concepts, and develop alternative problem-solving strategies. This pattern indicates that AI can function as a *cognitive scaffold* that expands students' opportunities for independent exploration. From this perspective, AI becomes a kind of *learning companion* that is flexibly available whenever students need an explanation or feedback. These findings align with those of Kasneci et al. (2023), who demonstrated

that large language models have the potential to support personalization, brainstorming, and tutoring; however, these benefits must be accompanied by human supervision, as AI models can also generate inaccurate information. Thus, AI's primary contribution lies not in its ability to automatically generate answers, but in its capacity to create a space for dialogue that allows students to test, refine, and expand their understanding.

At the same time, the research findings indicate that the use of AI does not automatically lead to deeper learning. Some students tend to accept AI-generated answers without verifying them when tasks are perceived as routine. This situation highlights a tension between cognitive offloading and cognitive engagement. When AI is used to take over the thinking processes that students should be performing, the technology has the potential to reduce cognitive engagement. Conversely, when AI is used as a subject for critique and comparison with other academic sources, the technology can actually foster evaluation, reflection, and critical thinking. Bender et al. (2021) have previously noted that a language model's ability to generate coherent text is not synonymous with its ability to produce accurate or meaningful knowledge. In an educational context, this implies that students need *AI literacy*—the ability to understand AI's epistemic limitations—rather than merely operational skills in using chatbots. Cotton et al. (2024) also emphasize that the use of generative AI in education must be situated within a clear framework of academic integrity so that the convenience of the technology does not overshadow learning objectives.

The next finding relates to the increasing personalization of learning. Students utilize AI to obtain explanations tailored to their level of understanding, request relevant examples, simplify explanations, and receive immediate feedback. This phenomenon demonstrates that AI can expand the capacity for differentiated learning in classes with relatively large student numbers. Compared to conventional learning, students have the opportunity to ask questions repeatedly without having to wait for the next lecture session. This finding is consistent with Tlili et al. (2023), who identified ChatGPT's potential as a tutor, facilitator, and dialogue partner in learning environments. However, AI-based personalization should not be understood as a substitute for the personalization provided by instructors. AI can tailor responses based on student input, but it does not fully understand the social, emotional, cultural, and academic developmental contexts of students as educators can. Therefore, the most productive form of personalization in this study emerged when AI recommendations were combined with instructors' interpretations and interventions.

This shift also explains the transformation in the instructors' roles identified in the study. Instructors no longer function solely as the primary source of information but increasingly take on the roles of learning facilitator, instructional designer, critical evaluator, and human supervisor. Instructors guide students in selecting sources, formulating appropriate questions, evaluating AI outputs, and connecting the information obtained to learning outcomes. This shift is important

because the effective use of AI requires instructional design that explicitly defines when students may use AI, for what purposes, how its outputs must be verified, and which parts of the assignment must still be completed independently. Zawacki-Richter et al. (2019) have shown that research on AI in higher education often emphasizes technological aspects, while pedagogical dimensions and the role of educators have not received adequate attention. The findings of this study emphasize that the success of AI in higher education actually depends on instructors' ability to design productive relationships between technology, students, course content, and learning objectives.

This transformation of the instructor's role is also closely linked to the growing need for AI literacy among educators. The research results indicate that faculty members need to understand not only how to use AI, but also how to integrate it into pedagogy, assess the validity of outputs, identify biases, and explain the limitations of AI use to students. Kasneci et al. (2023) identify the human ability to scrutinize and guide AI outputs as a critical component in the utilization of large language models. Thus, faculty members' AI competencies cannot be reduced to technical skills such as *prompting*. These competencies encompass *pedagogical AI literacy*—the ability to align AI capabilities with learning objectives while also determining when AI should not be used. In this context, faculty members serve as agents who ensure that technology enhances the pedagogical process rather than dominating it.

From the students' perspective, the use of AI is also linked to increased learner autonomy. Students have greater control over the pace, depth, and form of assistance they need. They can study outside of class time, request additional explanations, and engage in independent exploration. However, this autonomy is not unlimited freedom. Productive autonomy requires the ability to make epistemic decisions: determining which information is trustworthy, when to consult primary sources, and when to question AI-generated answers. Therefore, AI actually places greater demands on *self-regulated learning*. Students need not only to know "how to use AI," but also "how to manage the use of AI for learning." Kasneci et al. (2023) and Lo (2023) demonstrate that generative AI holds immense potential in education, but its effectiveness depends on users' ability to manage the technology's limitations and risks.

Research findings also indicate that trust is a critical factor in the relationship between students, instructors, and AI. Students tend to use AI more intensively when they perceive the technology as user-friendly, responsive, and capable of providing relevant answers. However, this research suggests that unchecked trust can pose problems. AI may provide answers that appear convincing but are incorrect, biased, or lack adequate source support. Therefore, this study demonstrates that the most constructive form of trust is not *blind trust*, but rather calibrated trust—trust accompanied by an awareness of the system's limitations. UNESCO (2023) emphasizes the importance of a human-centered approach to the use of generative AI that safeguards human agency, transparency, security,

and accountability. Field findings support this principle because students still need instructors as pedagogical authorities who help determine whether AI outputs are suitable for use in specific academic contexts.

Ethical considerations and academic integrity emerged as other key findings. The integration of AI creates ambiguity regarding the boundary between technological assistance and the replacement of students' intellectual work. When students delegate the entire process of writing, analysis, or problem-solving to AI, the purpose of assessment may lose its validity because the final product no longer fully represents the students' competencies. Conversely, when AI is used to generate initial ideas, provide feedback on drafts, or help students identify weaknesses in their arguments—which they then verify and develop on their own—its use can support learning. Cotton et al. (2024) emphasize the need for academic policies that are adaptive to generative AI, while Rudolph et al. (2023) point out that the emergence of ChatGPT requires higher education institutions to rethink their assessment practices. Thus, the research findings indicate that the main challenge is not simply banning or allowing AI, but redesigning assessments so that they continue to measure human thought processes and competencies.

In this context, changes to assessment design are a logical consequence of using AI as a *classroom companion*. Assignments that merely require the reproduction of information are becoming increasingly susceptible to automation. Conversely, assessments that ask students to explain their thought processes, justify their decisions, compare AI outputs with scientific literature, engage in reflection, and generate contextual solutions will be better able to maintain their pedagogical function. Cotton et al. (2024) and Rudolph et al. (2023) both demonstrate that generative AI challenges traditional assumptions about authorship and the evaluation of learning. The findings of this study expand on this argument by showing that AI can be used not merely as an object to be controlled through policy, but as an integral part of assessment design that intentionally fosters *critical AI literacy*.

Findings regarding human oversight also reveal that the quality of learning is determined not only by the sophistication of the technology, but by the configuration of relationships among students, instructors, and AI. In the observed classroom, AI provided speed and breadth of response; students offered questions, interpretations, and evaluations; while the instructor provided context, guidance, and pedagogical validation. These relationships formed a three-actor configuration that can be termed a human–AI pedagogical partnership. This concept differs from a substitution approach because AI does not take over educational authority. AI expands students' cognitive capacities and enhances instructors' pedagogical efficiency, but the final decisions regarding the goals, relevance, value, and responsibility of learning remain with humans. Kasneci et al. (2023) and Tlili et al. (2023) provide conceptual support for the idea that generative AI is most productive when positioned as a facilitator

of pedagogical interactions, rather than as a substitute for educators.

At the institutional level, research findings indicate that AI integration requires a more comprehensive governance framework. The use of AI in the classroom cannot be adequately regulated through informal instructions from faculty members alone, as it involves data privacy, intellectual property rights, transparency, algorithmic bias, security, and academic integrity. UNESCO (2023) identifies regulation and governance as critical elements in the use of generative AI in education and research. The research findings support this perspective by demonstrating that the success of AI as a *classroom companion* requires alignment among institutional policies, faculty competencies, student AI literacy, curriculum design, and evaluation mechanisms. In other words, AI integration is a matter of socio-technical transformation, not merely the adoption of new digital tools.

Overall, the research results lead to the proposition that AI makes its strongest pedagogical contribution when three conditions occur simultaneously: AI provides augmentation, students retain agency, and instructors maintain pedagogical oversight. If any one of these elements is missing, the benefits of AI may be diminished. AI without human oversight can generate misinformation; students without agency may become dependent on AI; and instructors without AI literacy may use the technology superficially or even in a counterproductive manner. These findings position AI not as the center of learning, but as a component within a learning ecosystem that remains human-centered. Thus, the metaphor "AI as a classroom companion" carries stronger theoretical implications than simply referring to AI as a "tool." "Companion" implies an interactive, adaptive, and ongoing relationship, yet one that remains within a human-controlled pedagogical framework.

The main contribution of this research lies in developing an understanding that AI transformation in higher education should not be measured solely based on the level of technology adoption or the frequency of AI application use. A more meaningful measure is the extent to which AI enhances the quality of pedagogical interactions, expands student autonomy, strengthens reflective and critical thinking skills, helps instructors design more adaptive learning experiences, and maintains human accountability. This perspective broadens the literature, which has tended to position AI as *educational technology*, by situating it within the context of the human–technology pedagogical relationship. In the context of higher education, the future of AI is not primarily determined by how "intelligent" the system is, but by how well educational institutions are able to design responsible relationships between human intelligence, artificial intelligence, and pedagogical intelligence.

Conclusion

This study shows that the integration of artificial intelligence (AI) in higher education should no longer be understood merely as the use of technology to improve efficiency, but rather as a transformation of the pedagogical relationship between students, faculty, and technology. The findings indicate that AI functions as a *learning companion* that supports knowledge exploration,

provides feedback, personalizes learning, and aids in problem-solving, while also encouraging students to develop independence, reflection, and self-regulation. However, these benefits do not arise automatically from the presence of AI. The role of faculty members remains fundamental as facilitators, instructional designers, evaluators of information, and overseers of the critical and ethical use of AI. Effective AI integration also depends on trust, transparency, digital literacy, and a clear division of responsibilities between humans and AI systems. On the other hand, issues such as data privacy, the accuracy of AI outputs, algorithmic bias, academic integrity, and technological dependence present challenges that must be managed at the institutional level. Thus, this study affirms that the *AI as a companion* paradigm offers a more human-centered approach than the *AI as a substitute* paradigm. AI should enhance human pedagogical capacities, not replace them; therefore, AI-based learning transformation must be directed toward creating a higher education ecosystem that is adaptive, collaborative, critical, ethical, and remains human-centered.

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