

Artificial Intelligence-Based Pedagogical Transformation: The Role of Humans, Dependence on AI, and Ethical Governance in the Indonesian Education Ecosystem

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Proceedings of the Kalijaga International Conference on Education 2026

Abstract. The rapid development of Artificial Intelligence (AI), particularly generative AI, has transformed educational practices and raised ethical concerns regarding AI dependency, critical thinking, human agency, academic integrity, data privacy, algorithmic bias, and the changing role of teachers. This article aims to examine the ethical implications of AI-based pedagogical transformation and develop a human-centered framework for AI integration in the Indonesian education ecosystem. The method used in this study is a qualitative philosophical-conceptual approach that combines a literature review and normative philosophical analysis. Contemporary studies on AI in higher education, AI dependency, critical thinking, teacher agency, academic integrity, and AI ethics are examined alongside international educational frameworks and Indonesian regulations on AI and education. Luciano Floridi's conception of AI as a form of artificial agency provides a central framework for analyzing the relationship between human and artificial agency in education. The analysis shows that existing studies have extensively examined AI dependency, critical thinking, teacher agency, academic integrity, and AI governance, but these dimensions are often examined as separate issues. The results of this study find that both can be integrated through the concept of human pedagogical agency. Reliance on AI becomes ethically problematic when artificial agency begins to replace human epistemic and pedagogical agency. To conceptualize this process, this paper introduces pedagogical agency displacement, which refers to the gradual transfer of educational judgment, reasoning, interpretation, and decision-making from human actors to artificial systems in a way that undermines human autonomy and responsibility. In the Indonesian context, the institutionalization of Artificial Intelligence and Coding and the development of national guidelines for the responsible use of AI represent a transition from technology adoption to educational governance. The paper concludes that AI should function as an augmentative, not a substitutive, technology, while maintaining human judgment, critical thinking, teacher responsibility, accountability, equity, and data protection as fundamental conditions of ethical pedagogical transformation.

Keywords: Artificial Intelligence; AI Dependence; Critical Thinking; Teacher Role; AI Ethics

INTRODUCTION

Artificial Intelligence (AI), particularly generative AI, is increasingly being used in educational practice. Its rapid development has transformed the relationship between teachers, students, knowledge, and technology. AI is now widely used to generate learning materials, provide explanations, assist with academic writing, and facilitate the personalization of learning. AI research in higher education demonstrates the growing importance of applications such as personalization, prediction, assessment, and adaptive learning, while raising concerns about ethics, methodological rigor, and institutional responsibility [1]. Generative AI has further extended this transformation by enabling systems to participate directly in activities previously associated with human cognitive and pedagogical work [2]. Thus, the educational potential of AI creates a tension between enhancement and replacement. AI can enhance education when it provides alternative explanations or assistance with repetitive tasks, but can also be a substitute when students or teachers increasingly delegate intellectual and pedagogical assessment to artificial systems.

This issue is particularly evident in the growing concern about AI dependency, a condition in which AI becomes the dominant mechanism students use to formulate ideas, solve problems, make decisions, or produce intellectual work. Greater reliance on AI-based learning tools can be associated with reduced confidence in independent decision-making and lower engagement in active learning [3]. This suggests that the ethical issue of AI lies partly in the possibility that technological assistance could gradually change the distribution of human and artificial agency. This issue is closely related to critical thinking. AI can generate arguments, provide alternative perspectives, and support learning, but students must still evaluate the

validity, relevance, and justification of its output. Furthermore, the relationship between AI and critical thinking has been identified as an increasingly important area of research and emphasizes the need for pedagogical strategies that prevent AI from replacing higher-level cognitive processes [4]. Furthermore, AI integration can also change the role of teachers. Generative AI can support lesson planning, content creation, assessment, and administrative tasks. However, teaching involves contextual interpretation, interpersonal relationships, ethical judgment, and responsibility towards learners. Research on teacher agency shows that generative AI changes the relationship between teacher agency and student epistemic agency, making teacher judgment and pedagogical dialogue increasingly important [5]. Therefore, teachers cannot be reduced to users of technology; they remain responsible for determining when, why, and how AI should participate in the educational process.

The philosophical dimension of this transformation is then examined through Luciano Floridi's conception of AI as a new form of artificial agency rather than intelligence [6]. AI systems can successfully perform goal-oriented tasks without possessing intelligence in the same sense as humans. This distinction is crucial in education because the performance of functional tasks does not necessarily imply pedagogical understanding or responsibility. AI systems can produce coherent explanations or lesson plans, but the determination of their educational suitability remains a matter of human judgment. Therefore, this paper aims to examine how artificial agency can impact students' epistemic autonomy and teachers' pedagogical responsibility. The paper proposes the concept of pedagogical agency displacement to describe the gradual transfer of judgment, reasoning, interpretation, and educational decision-making from human actors to artificial systems in a way that undermines human autonomy and responsibility.

This issue is relevant in Indonesia, which has shifted from general discussions about AI to formal education governance through AI ethics guidelines, the implementation of Coding and Artificial Intelligence in education, and national guidelines on the ethical, safe, wise, and responsible use of digital technology and AI [7], [8], [9]. Research in Indonesia also identifies concerns regarding academic integrity, over-reliance, privacy, algorithmic bias, and institutional readiness [10], [11], [12]. These developments indicate that ethical questions about AI in education are no longer merely technological but increasingly concern the preservation of the role of humans in educational institutions.

Therefore, this paper addresses three questions: (1) How does AI-based pedagogical transformation impact human pedagogical agency? (2) How do AI dependency, critical thinking, and teacher agency relate to artificial agency? and (3) What principles should guide human-centered AI governance in the Indonesian education ecosystem?

MATERIALS AND METHODS

This research employs a qualitative philosophical-conceptual approach, employing a systematic literature review and normative philosophical analysis. It attempts to examine the conceptual and ethical implications of AI-based pedagogical transformation, particularly the relationship between artificial agency and human pedagogical agency. A qualitative approach was used because the primary research question concerns the meaning, implications, and normative status of AI in educational settings. Therefore, this study focuses on the interpretation of concepts and arguments. The philosophical analysis is primarily based on Luciano Floridi's conception of AI as a form of artificial agency [6]. This theoretical framework is used to critically examine contemporary educational phenomena related to AI dependency, critical thinking, teacher agency, academic integrity, and AI governance.

RESULTS AND DISCUSSION

Artificial Intelligence and the Transformation of Educational Institutions

transformation brought about by AI in education is not simply the expansion of technological tools but the reconfiguration of agency in the educational process. Contemporary AI systems can generate explanations, summarize texts, generate learning materials, assist with academic writing, and support assessments. As a result, AI is increasingly participating in activities previously performed primarily by teachers and students [1], [2]. This transformation can be understood through Floridi's conception of AI as a form of artificial agency. According to Floridi, AI does not need to possess intelligence in the human sense to perform tasks successfully; its significance lies in its ability to act effectively in an increasingly structured information environment [6]. In the world of education, this shows that AI can perform certain cognitive and pedagogical functions without having the contextual understanding, moral responsibility, or educational intentions associated with human actors.

The distinction between artificial agency and human agency is therefore fundamental. AI systems can generate lesson plans, but they cannot independently determine the broader educational goals that those

lessons should fulfill. Similarly, AI can provide feedback on student writing, but the interpretation of students' intellectual development remains the responsibility of the teacher. Functional performance, in this sense, should not be equated with pedagogical assessment. The integration of AI itself generates a new distribution of agency among three main actors: students, teachers, and AI systems. Students are increasingly using AI to support learning and knowledge production, teachers are using AI to support pedagogical and administrative work, and AI systems are increasingly performing functions that influence educational decision-making. The primary ethical issue is not the existence of artificial agency itself, but the conditions under which its expansion affects human autonomy and responsibility.

This transformation can be described as a shift from primarily human-centered pedagogical relationships to a more distributive pedagogical environment. In such an environment, educational outcomes are increasingly shaped by the interaction between human and artificial agents. However, the distribution of tasks does not mean an equal distribution of responsibilities. Human actors remain responsible for defining educational goals, evaluating AI output, and accepting the consequences of educational decisions. This is where the ethical challenges of AI in education must be understood as challenges related to the distribution of power and responsibility. AI can extend human capacities, but its educational legitimacy depends on whether this artificial expansion of power maintains, rather than undermines, human pedagogical power.

AI Dependence and the Risk of Cognitive Substitution

The relationship between AI dependency and human cognitive autonomy suggests that AI dependency should not be defined solely by the frequency of AI use. Excessive use of AI can represent an efficient and appropriate form of technological assistance. Dependency becomes ethically significant when AI increasingly becomes the primary mechanism students use to formulate ideas, solve problems, make decisions, and produce intellectual output.

Research examining AI reliance in higher education suggests that over-reliance can be associated with reduced confidence in independent decision-making and reduced active engagement in learning [3]. This suggests that this pattern of reliance is important because ethical issues arise when students gradually shift from using AI as an intellectual resource to using it as a substitute for intellectual activity. This distinction can be illustrated through two forms of AI use. In the first, a student develops an initial argument independently and then uses AI to generate counterarguments or identify potential weaknesses. In this situation, AI serves as an augmentative tool because the student's intellectual role remains central to the process. In the second, a student delegates the formulation of research questions, argument development, evidence selection, and conclusion formation to AI.

This is where AI begins to function as a substitutive agent. AI-assisted learning becomes problematic not because the technology performs cognitive tasks, but because educators may gradually become accustomed to delegating tasks that are essential for intellectual development. If students consistently delegate reasoning, interpretation, and judgment, the educational process risks prioritizing answer production over intellectual capacity development. Reliance on AI then has implications beyond individual learning outcomes. Dependence can alter students' understanding of authorship, responsibility, and knowledge. If an answer is generated by AI, students may still submit or use it, but they must determine whether they understand and can defend the reasoning behind it. Consequently, the problem of dependency is also a problem of epistemic responsibility.

From Floridi's perspective, this can be understood as a transformation in the relationship between human agency and artificial agency. AI becomes ethically problematic when its ability to act successfully encourages human actors to abdicate responsibility for acting and judging. Therefore, the problem is not artificial agency itself, but the possibility that human agency will become increasingly passive in AI-mediated educational environments.

Critical Thinking as the Preservation of Epistemic Agency

Critical thinking plays a central role in preserving human agency in AI-mediated education. The relationship between AI and critical thinking is becoming increasingly important, especially following the widespread adoption of generative AI [4]. However, this relationship should not be understood as inherently negative or positive. AI can support critical thinking by providing alternative perspectives, generating questions, identifying potential counterarguments, and expanding access to information. However, these benefits depend on whether users remain capable of evaluating AI-generated output. Therefore, critical thinking is not replaced by greater availability of information. Rather, the proliferation of AI-generated content may increase the need for evaluative judgment.

The main difference lies between AI-assisted critical thinking and AI-substituted thinking. AI-assisted critical thinking occurs when students actively engage with AI output by questioning assumptions,

comparing arguments, verifying evidence, and identifying errors. AI-substituted thinking occurs when students receive AI-generated responses without engaging in this evaluation process.

Findings from Indonesian higher education reinforce these concerns. Research on Indonesian doctoral students shows that AI is already being used in various stages of academic work, including brainstorming, drafting, translation, data analysis, and literature management. At the same time, students expressed concerns about over-reliance, academic integrity, and the potential impact of AI on critical thinking [10]. These findings suggest that technology adoption and ethical awareness can go hand in hand, but awareness alone does not necessarily prevent dependency. Therefore, AI literacy should not be limited to technical competency. Knowing how to formulate effective commands or operate AI tools does not automatically make AI users critical. This study argues that AI literacy should comprise at least three interrelated dimensions: technical literacy, epistemic literacy, and ethical literacy.

Technical literacy relates to the ability to understand and operate AI systems. Epistemic literacy relates to the ability to evaluate the reliability, evidence, limitations, and potential biases of AI-generated output. Ethical literacy relates to the ability to determine whether a particular use of AI is appropriate, responsible, and consistent with educational values. All three dimensions are crucial for preserving epistemic agency. Students should not simply ask AI for answers; they should also be able to ask why an answer should be accepted. In this sense, critical thinking represents the human capacity to maintain intellectual responsibility in a distributed environment comprised of human and artificial agency.

The Role of Teachers in the Era of Artificial Agency

AI is often presented as a technology that can automate or support activities traditionally performed by teachers. However, the expansion of AI doesn't necessarily diminish the importance of teachers. Rather, it changes the nature of teachers' active roles. Research on teacher agency in the context of generative AI suggests that teachers increasingly need to respond to changes in students' epistemic agency and the uncertainties posed by AI-generated knowledge [5]. Therefore, the role of teachers extends beyond the technical uses of AI. Teachers must determine how AI should be integrated into learning, which activities should remain primarily human-driven, and how students can use AI without losing intellectual autonomy.

The findings of this study indicate that the role of teachers comprises at least five functions. First, teachers serve as epistemic evaluators, assessing the accuracy and educational relevance of AI-generated information. Second, they serve as pedagogical designers, determining how AI should be integrated into learning activities. Third, they act as ethical mediators, setting boundaries for the responsible use of AI. Fourth, they serve as guardians of student roles by designing learning processes that encourage independent reasoning. Finally, teachers remain responsible decision-makers because crucial pedagogical judgment cannot be completely outsourced to AI systems.

This distinction is crucial when considering Floridi's concept of artificial agency. AI systems can perform educational functions without assuming responsibility for their consequences. However, teachers remain responsible for educational decisions because pedagogical work involves relationships, values, context, and normative judgments. The expansion of the role of artificial intelligence, then, ultimately results in a paradox: the more functional tasks AI performs, the more important human normative judgments become. AI may be able to reduce some workloads, but it cannot eliminate the need for teachers to determine what education should achieve. Consequently, the role of teachers should be strengthened, not weakened, by the integration of AI.

From AI Ethics to Pedagogical Governance

Studies on AI ethics in higher education have identified recurring concerns about fairness, accountability, transparency, privacy, bias, and academic integrity [13], [14], [15]. These concerns suggest that ethical AI cannot be achieved simply by improving technological systems. Educational institutions must also establish structures that govern how AI is used. The distinction between ethical principles and governance is crucial. An institution can declare that AI must be used responsibly, but that statement remains insufficient unless that responsibility is translated into concrete procedures. Students and teachers need guidance on the appropriate use of AI, ownership, disclosure, assessment, verification, data protection, and accountability. Furthermore, ethical challenges arise at both the individual and institutional levels. At the individual level, students and teachers must use their judgment about when and how to use AI. At the institutional level, universities and schools must define the rules, resources, and accountability mechanisms that shape these individual choices. This is where AI ethics in education must be understood as a form of pedagogical governance.

Pedagogical governance refers to institutional arrangements that ensure AI remains aligned with educational goals. Such governance must address not only technological risks but also the preservation of human roles.

model must ask several questions: Who remains accountable when AI influences educational decisions? How can students challenge AI-generated outcomes? What forms of AI assistance are acceptable in academic assessment? How should the use of AI be disclosed? How can institutions protect student data? And how can access to AI be distributed without deepening existing educational inequalities? These questions demonstrate that AI ethical challenges cannot be separated from institutional responsibilities. Individual users cannot be expected to solve structural problems like biased systems, unequal access, or inadequate data governance alone.

Indonesia's Education Ecosystem: From AI Adoption to AI Governance

Indonesia is increasingly shifting from general technology adoption towards institutionalization and governance of AI. This development is reflected in national ethics guidelines, the implementation of Coding and Artificial Intelligence in formal education, and broader guidelines on the responsible use of digital technology and AI [7], [8], [9]. The regulatory environment in Indonesia is crucial because it recognizes that AI should not be introduced into education solely as a technical innovation. National policies increasingly emphasize ethical, safe, prudent, and responsible use. This direction is consistent with the broader argument in this paper that AI integration should be evaluated based on its impact on human capabilities and educational responsibilities.

The application of programming and artificial intelligence also represents a significant transition. Students are no longer simply positioned as consumers of AI technology; they are increasingly expected to develop knowledge about AI as part of their formal education. However, AI education should not be limited to computational or technical skills. If AI is understood as a form of artificial agency that increasingly participates in human decision-making, students must also develop the ability to understand its ethical and social consequences. Recent research in Indonesia further identifies challenges related to privacy, algorithmic bias, oversight, academic integrity, infrastructure gaps, digital literacy, and institutional policy gaps [11], [12]. These concerns suggest that Indonesia's education ecosystem faces a dual challenge: it must develop technological capacity while protecting ethical and pedagogical values. Therefore, the effectiveness of AI governance must be evaluated not only on whether institutions adopt AI ethically, but also on whether teachers and students retain meaningful authority over educational reasoning and decision-making.

Shifting Pedagogical Agency as a Conceptual Contribution

Based on the previous analysis, this study develops the concept of pedagogical agency transfer as its main conceptual contribution. The shift in pedagogical agency refers to the gradual transfer of educational judgment, reasoning, interpretation, and decision-making from human actors to artificial systems in a way that undermines human pedagogical autonomy, responsibility, or authority. The concept aims to integrate issues often discussed separately in the existing literature. AI dependency concerns the increasing reliance on artificial systems. Critical thinking concerns the preservation of epistemic judgment. Teacher agency concerns human authority in pedagogical relationships. AI ethics concerns the principles governing artificial systems. Institutional governance concerns the structures within which these principles are implemented.

Therefore, AI is pedagogically augmentative when it extends human capabilities while preserving human judgment. AI is pedagogically substitutive when it performs functions in a way that undermines human judgment, autonomy, or responsibility. The concept of pedagogical agency displacement itself provides a theoretical basis for evaluating AI integration beyond technological efficiency. The relevant question is no longer simply whether AI works effectively. Instead, educational institutions must ask what forms of human agency are maintained, altered, or potentially replaced when AI becomes part of pedagogical practice.

CONCLUSION

This paper examines the ethical implications of AI-driven pedagogical transformation through the relationship between artificial agency and human pedagogical agency. Using Floridi's conception of AI as a form of artificial agency, this study argues that AI's ability to successfully perform tasks should not be equated with human pedagogical judgment. Reliance on AI becomes a critical ethical issue when technological assistance gradually becomes a substitute for independent reasoning and decision-making. Critical thinking becomes a central mechanism for preserving critical thinking skills. Therefore, AI literacy must go beyond technical competence to encompass epistemic and ethical literacy. Furthermore, AI governance must explicitly address the preservation of human roles in pedagogy. Thus, the ethical integration of AI in education must be guided by the principles of human agency, pedagogical accountability, critical AI literacy, teacher agency, data protection, equity and inclusion, and institutional

accountability. These principles position AI as a complementary technology, not a substitute for human educational responsibilities.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest in the preparation, writing, analysis, and publication of this paper. The authors have no financial, institutional, professional, or personal interests that could have influenced the research process, interpretation of the findings, or conclusions presented in this study.

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