

Adaptive content development in PPG learning LMS for Indonesian educational philosophy material based on artificial intelligence and deep learning

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Abstract: *The integration of Artificial Intelligence (AI) in higher education offers opportunities for adaptive and personalized learning; however, learning in the Indonesian Educational Philosophy course within the Teacher Professional Education Program (PPG) remains largely monologic, textual, and insufficiently reflective. This study aims to develop AI and Deep Learning (DL)-based adaptive content integrated into the PPG Learning Management System (LMS). Using a qualitative case study design, the research involved 5 lecturers and 50 pre-service PPG students at Universitas Negeri Malang. Data were collected through observations, interviews, FGDs, documentation, and descriptive questionnaires, and analyzed using Stake's model (description, interpretation, evaluation). Findings show that AI-integrated adaptive content through personalized learning paths, NLP-based feedback, and learning analytics enhances reflective engagement, contextual understanding, and learning effectiveness. The study recommends the development of AI-based LMS ecosystems to support reflective, learner-centered, and contextually meaningful teacher education.*

Keywords: *artificial intelligence, deep learning, Indonesian educational philosophy, adaptive content, learning LMS*

Introduction

The development of the digital revolution over the past decade has brought significant changes to higher education practices, including in Indonesia (Dewi, et.al, 2023). This transformation is reinforced by the presence of technologies such as Artificial Intelligence (AI), Deep Learning (DL) (Firmansyah & Sakmawati, 2025), and adaptive learning systems that enable more personalized, flexible, and responsive learning experiences to student characteristics (Fadillah, et.al, 2024). In the context of professional education, particularly the Teacher Professional Education Program (PPG), these technological developments have strategic urgency. PPG, as a professional teacher education scheme, demands learning that is not only informational but also transformative, contextual, and in-depth. Learning in PPG must comprehensively shape prospective teachers' pedagogical, personal, social, professional, and moral competencies. Therefore, the integration of intelligent technology that supports personalization, critical reflection, and character development is an unavoidable necessity.

One of the fundamental courses in the PPG curriculum is the Philosophy of Indonesian Education. This course plays a strategic role in building a foundation for students' thinking about the values, goals, and meaning of Indonesian education based on the nation's philosophy. Philosophy learning focuses not only on the transmission of theoretical

knowledge but also on developing reflective awareness, critical thinking skills, strengthening professional ethics, and linking Pancasila values to pedagogical practice. However, field observations indicate that the learning process in this course is still dominated by lectures, limited discussions, and uniform assignments. The presentation of complex and abstract philosophical content through this conventional approach makes it difficult for students to grasp in-depth concepts, lacks the opportunity for critical reflection, and prevents them from gaining personalized learning experiences tailored to their individual academic needs.

The use of a Learning Management System (LMS) such as SIPEJAR in the UM Graduate School of Philosophy (PPG) program has indeed provided a digital learning platform. However, this system lacks adaptive features that utilize AI to tailor content, learning paths, and assessments based on student profiles. The LMS remains static and general, thus failing to accommodate the varying learning readiness, learning styles, educational backgrounds, and learning speeds of PPG students. This is despite the heterogeneity of PPG students: some come from educational programs, some from non-educational backgrounds; some possess high digital literacy; and others still require technological guidance. Some students possess strong reflective abilities but are not yet accustomed to systematic philosophical thinking. This situation emphasizes the need for a learning system that can accommodate learning needs more specifically and contextually.

Several previous studies have shown that AI and DL technologies have significant potential to revolutionize learning practices (Soori, et.al, 2023; Jamil & Pulukadang, 2025; Waita, et.al, 2025; Adam & Ali, 2025). AI can provide personalized learning paths based on students' prior achievement data, provide content recommendations, and even provide real-time learning analytics (Fatmawati, dkk, 2024). Deep learning enables systems to understand user interaction patterns with materials, predict learning difficulties, and adapt content based on user preferences and performance (Gligorea, et.al, 2023). Studies related to the application of AI in education have shown improvements in learning effectiveness, student engagement, and feedback quality. However, the majority of this research focuses on STEM fields, digital literacy, or general higher education learning. Studies on the integration of AI in humanities learning, particularly the philosophy of education in the context of Indonesian PPG (Indonesian Teacher Education Program), are still very limited.

Furthermore, no research has been found specifically developing adaptive AI and DL-based content for the Indonesian Philosophy of Education course. This course requires a very in-depth and contextual approach. Philosophy instruction for prospective teachers must help them understand educational issues through ontological, epistemological, and axiological perspectives; resolve ethical dilemmas through philosophical argumentation; and develop a strong sense of values in accordance with the principles of Ki Hadjar Dewantara and the philosophy of Pancasila. The absence of an adaptive system results in philosophy instruction becoming less reflective, less challenging for critical thinking, and less relevant to the real-world problems students will face as prospective teachers.

Field findings from this research further emphasize this gap. Lecturers expressed the need for learning media capable of facilitating reflective, dialogical activities, and providing assessments that not only measure theoretical knowledge but also the depth of student

analysis and argumentation. Lecturers also require learning analytics to understand individual student development so they can provide more targeted guidance. Meanwhile, students expressed a need for multimodal content such as interactive videos, ethical dilemma simulations, values-based infographics, and adaptive modules that are more accessible and tailored to their learning styles. Students also require features to support reflection, such as NLP-based automatic journals, responsive discussion forums, and personalized study guides.

These lecturer and student needs align with the principles of deep learning as advocated by the Ministry of Education. Deep learning emphasizes active student involvement through holistic thought, feeling, feeling, and exercise. This principle requires meaningful, student-centered learning that fosters reflective and critical awareness. Thus, developing AI and DL-based adaptive content in an LMS is a strategic step towards realizing a liberating, humanistic, and relevant educational philosophy that aligns with the needs of the teaching profession.

Based on these various issues, the objective of this research is to develop adaptive content in a PPG learning LMS based on Artificial Intelligence and Deep Learning that is effective and efficient in enhancing the student learning experience. Practically, this research is expected to overcome the limitations of conventional learning, provide a more personalized and differentiated learning system, and improve the quality of the learning process for prospective teachers. Theoretically, this research contributes to the study of educational technology, particularly the integration of adaptive AI in humanities learning, which is still rarely developed in Indonesia.

Method

This study employs a qualitative approach with a case study design aimed at conducting an in-depth investigation of the learning phenomenon in the Indonesian Educational Philosophy course within the PPG SPs UM Program. The case study design was selected because it enables a holistic and contextual understanding of the integration of adaptive content based on Artificial Intelligence (AI) and Deep Learning (DL), focusing on the needs, experiences, and perceptions of lecturers and students. The study does not aim to measure causal effects or statistical differences, but rather to explore meanings, processes, and contextual dynamics in a natural setting.

The research was conducted at the Teacher Professional Education Program (PPG) of the Sekolah Pascasarjana, Universitas Negeri Malang, specifically in the Indonesian Educational Philosophy course. Research participants included 5 lecturers teaching the course and 50 Prajabatan PPG PGSD students as LMS (SIPEJAR) users. Key informants consisted of the Head of the PPG SPs UM Study Program, members of the learning development team, and experts in Artificial Intelligence and Deep Learning. Participants were selected purposively based on their relevance and involvement in the development and implementation of adaptive learning content.

Data collected consisted of primary data, including observations of the learning process, lecturers' experiences, students' learning needs, user responses to adaptive content prototypes, and expert perspectives on AI and DL integration. Secondary data included course modules, Semester Learning Plans (RPS), institutional policy documents, academic records,

and digital learning artifacts. Data collection techniques comprised naturalistic observations, semi-structured in-depth interviews, documentation analysis, questionnaires used descriptively to map student characteristics and technological literacy (not for hypothesis testing), and Focus Group Discussions (FGDs) for needs validation and prototype review.

Data validity was ensured through source triangulation and methodological triangulation, following Moleong's (2002) qualitative validation model. Source triangulation involved comparing data across participants and time points, while methodological triangulation compared findings from observations, interviews, documentation, questionnaires, and FGDs.

Data analysis employed Stake's (1995) case study model, consisting of three stages: description, interpretation, and evaluation. In the descriptive phase, the researcher constructed a thick description of the learning context, lecturer-student interactions, LMS utilization, and adaptive content implementation. In the interpretative phase, coding procedures (open, axial, and selective coding) were conducted to identify themes and interpret participants' experiences, linking findings to constructivism, connectivism, and adaptive AI learning theories. In the evaluative phase, the researcher critically examined the feasibility, strengths, limitations, and developmental potential of the adaptive content model based on participants' perspectives, rather than measuring statistical effectiveness.

This study upholds research ethics through confidentiality of participant data, voluntary participation, institutional permission, and transparency of research objectives.

Results and Discussion

Overview of Learning Indonesian Educational Philosophy at PPG SPs UM

The results of the study indicate that the learning of Indonesian Educational Philosophy in the PPG SPs UM Program takes place through a combination of face-to-face and the use of an LMS (SIPEJAR). Although the lecture process has utilized digital media, most learning activities are still dominated by conventional patterns, namely the delivery of material through lectures and written assignments. This approach results in a uniform learning process, lacks adaptability, and does not fully facilitate the reflective competency that is the core of philosophy learning. Students stated that philosophy is a course with a high level of complexity because it contains abstract, analytical concepts, and requires higher-order thinking skills. When the presentation is not accompanied by interactive media and personalization, students experience difficulty understanding philosophical meanings in depth. This condition creates a gap between the learning objectives that require students to be able to internalize values, analyze ethical dilemmas, and build arguments with the learning experiences they receive in the field. These findings generally indicate an urgent need to develop a more adaptive, multimodal learning model supported by smart technology to accommodate the heterogeneity of PPG students.

Lecturers' Need for AI-Based Adaptive Learning Systems

The lecturer in charge of the Indonesian Philosophy of Education course outlined several key requirements that must be met in developing AI-based adaptive content, namely:

a. Learning Media to Strengthen the Philosophical Reflection Process

The lecturer hopes for media that encourages students to engage more deeply cognitively and affectively with philosophical ideas. Reflection, which has traditionally been conducted through conventional journals, is considered ineffective due to the lecturer's limited time and capacity to provide feedback. AI is considered capable of assisting in analyzing student reflection journals using Natural Language Processing (NLP), allowing lecturers to obtain a faster and more accurate picture of student thinking patterns, the depth of reflection, and areas for improvement.

b. Argumentation-Based Assessment and Philosophical Dialogue

Lecturers need assessment tools capable of assessing students' analytical abilities, not just mastery of the material. Currently, student argumentation is still assessed manually through essays or discussions. With the help of AI, lecturers want to detect the quality of arguments, logical consistency, relevance of references, clarity of thought processes, and originality of students' ideas. Such features will significantly support the character of philosophy learning, which emphasizes examination of meaning and critical analysis.

c. Student Needs: Multimodal, Contextual, and Personalized Learning.

Research data shows that students have highly diverse learning needs. There are several key needs:

1. The Need for Concept Visualization. Students stated that concepts such as ontology, epistemology, axiology, the nature of education, and Pancasila values are difficult to understand if explained verbally only. They require infographics, explanatory videos, concrete examples, and interactive visual representations. Visual media allows students to more easily understand the relationships between abstract concepts.
2. The Need for Personalized Learning Paths. Students come from different educational backgrounds, some from different educational backgrounds, and others from different backgrounds. This creates significant differences in their ability to read philosophical texts, analytical thinking skills, learning style tendencies, and technological literacy skills. AI can create different learning paths for students based on adaptive pre-test results, task performance, and learning preferences.
3. The Need for Real-Life Case Simulations. Students desire realistic case examples relevant to the teacher's work. They need simulations of ethical dilemmas, particularly those related to values and professional decisions, such as conflicts between school policies and personal values, dilemmas in learning evaluation, interactions with parents, academic integrity issues, and the application of Pancasila values in pedagogical practice. AI can generate adaptive simulations based on real-world situations, making the reflection process more contextual.

Adaptive Content Development for Indonesian Educational Philosophy Materials Based on Artificial Intelligence and Deep Learning

The development of adaptive content for the Pre-Service PPG SPs, State University of Malang, was carried out in several stages, as shown in the following table:

Table 1. Development Stages of Adaptive Content Development for Indonesian Educational Philosophy Materials Based on Artificial Intelligence and Deep Learning

Stages	Details of the stages	Purposes	Details Activities	Output
1	Needs Assessment	Identify the learning needs of PPG students related to the material on Indonesian Educational Philosophy.	<p>Main Activities</p> <ul style="list-style-type: none"> - Analysis of PPG Course Learning Outcomes (CPMK) - Identifying student difficulties in understanding Ki Hadjar Dewantara's philosophical concepts and the Indonesian educational paradigm - Analysis of PPG student characteristics (academic background, digital skills, teaching experience) - Mapping the gap between actual abilities and expected competencies 	<ul style="list-style-type: none"> - Learning needs map - Learner persona profile - AI-based adaptive content recommendations
2	Design Phase	Developing an adaptive content system design that will be integrated into the PPG LMS	<p>Design Components:</p> <ul style="list-style-type: none"> - Adaptive learning pathways (different learning paths based on competency level) - Case-based learning flows (case study-based learning flows) - Mapping material to Bloom's cognitive levels (C1–C6) - AI Recommendation Engine Design <p>Technology Integration:</p> <ul style="list-style-type: none"> - Deep Learning models for: analyzing participant response patterns, classifying levels of understanding, predicting the need for advanced material 	<ul style="list-style-type: none"> - Adaptive content system flowchart - AI engine blueprint - Interactive content UX design
3	Development Phase	Creating content based on real case studies of Indonesian education.	<p>Case Study Type:</p> <ul style="list-style-type: none"> - Value Conflicts in Multicultural Classroom Learning - Dilemmas in Applying Ki Hadjar Dewantara's Philosophy in Modern Schools - Cases of Violations of Teacher Professional Ethics - Implementation of the Pancasila Student Profile in Learning <p>Content Structure:</p> <ul style="list-style-type: none"> - Case narrative (text + video) - Adaptive reflective questions - Decision-making simulation 	<ul style="list-style-type: none"> - Interactive case study bank - Structured multimedia content - AI module for response analysis

4	Integration of AI and Deep Learning in LMS	Connecting content with AI engines.	<ul style="list-style-type: none"> - Scenario-based digital discussion AI & Deep Learning: - Natural Language Processing (NLP) to analyze essay answers - Classification model to determine level of understanding <p>Key Features:</p> <ul style="list-style-type: none"> - Adaptive Content Engine: adjusts materials based on user performance - AI Feedback Generator: provides automated and personalized feedback - Learning Analytics Dashboard: visualizes learning progress <p>Technology:</p> <ul style="list-style-type: none"> - Deep Neural Network for performance prediction - Reinforcement Learning for learning path optimization 	<ul style="list-style-type: none"> - Integrated adaptive content system - Learning analytics dashboard
5	Pilot Testing	Testing the effectiveness of adaptive content.	<p>Method:</p> <ul style="list-style-type: none"> - One-group pretest–posttest design - Observation of learning activities - LMS system log analysis <p>Assessment Indicators:</p> <ul style="list-style-type: none"> - Improved understanding of educational philosophy concepts - Quality of responses to case studies - Learning independence - Reflection on professional values and character 	<ul style="list-style-type: none"> - Initial effectiveness data - Recommendations for model revision
6	Formative Evaluation and Model Revision	Evaluating and revising the model	<p>Activities:</p> <ul style="list-style-type: none"> - Focus Group Discussion (FGD) with: PPG Lecturers, PPG Students & Philosophy Education Experts - AI Prediction Error Analysis - Improving Case Study Content 	<ul style="list-style-type: none"> - Revised version of adaptive content - Final model ready for implementation

The following is a display of adaptive content on the LMS for Prajabatan PPG learning on the Indonesian Educational Philosophy material based on artificial intelligence and deep learning that was developed.



Figure 1. Display of adaptive content on the LMS for Pre-Service PPG learning on the Indonesian Educational Philosophy material based on artificial intelligence and deep learning

The research findings reveal that students perceive the Indonesian Educational Philosophy course as overly textual and insufficiently connected to real educational practice, expressing the need for more reflective dialogue, contextual case discussions, and meaningful engagement related to their future roles as teachers. These empirical findings strongly align with Ki Hadjar Dewantara’s conception of education as a process that “liberates humanity”

from passive and standardized learning (Wahyudi, 2018), emphasizing the development of critical thinking, character, and social awareness. Students' expectations for lecturers to act as facilitators within the LMS environment further reflect the principle of *ing ngarsa sung tuladha, ing madya mangun karsa, tut wuri handayani*, where educators guide without dominating and create space for independent meaning-making. Thus, the study demonstrates that the integration of adaptive AI-based content is not merely a technological innovation but a practical pathway to actualizing Ki Hadjar Dewantara's emancipatory philosophy in a contemporary digital learning context.

However, the learning practices in the Indonesian Philosophy of Education course found in the research show a tendency to be monologic, lecturer-centered, and do not provide optimal space for the processes of thought, feeling, and heart. Monologic learning not only contradicts the principle of "among" espoused by Ki Hadjar Dewantara, but also hinders the internalization of Pancasila values, which prioritizes dialogue, mutual cooperation, respect for human dignity, and moral reflection in decision-making. In this context, students tend to become passive recipients of information, rather than active builders of knowledge capable of connecting philosophical concepts to the real-life situations they will face as future educators.

The integration of Artificial Intelligence (AI) technology into learning, as proposed in this research, has strong potential to restore the essence of humanizing education in accordance with Ki Hadjar's philosophy. AI can facilitate personal reflection (Fajriati, et.al, 2024) through NLP-based automated assessment features, giving students the opportunity to review, refine, and deepen their philosophical arguments. Furthermore, philosophical dialogue can be enriched through AI-based Socratic Dialogue, which stimulates critical questions, broadens perspectives, and stimulates students' logical and analytical thinking skills. Thus, AI can actually help students connect abstract values with concrete practices, including ethical decision-making in the context of the teaching profession.

Furthermore, the use of AI in learning philosophy can be a means of practicing Pancasila values in the learning process. Adaptive systems enable inclusive (Lastini, et.al, 2024) and equitable learning by adapting content to individual students' needs, as reflected in the values of just and civilized humanity. Through this technological support, students not only master concepts cognitively but also internalize relevant moral values in their professional actions in the field.

Thus, rather than displacing humans in education, AI technology serves as a tool that strengthens the principle of humanizing Indonesian education. AI is utilized to expand the space for dialogue, deepen reflection, and facilitate a more independent, contextual, and meaningful learning experience. This integration ensures that technology is in a *tut wuri handayani* position: supporting, empowering, and liberating the learning process, rather than dominating or controlling it.

Constructivism theory asserts that the learning process does not occur passively, but rather through the active involvement of students in constructing meaning based on experience, interaction, and the internalization of old and new knowledge (Azzahra & Ali, 2025). Jean Piaget (Piaget, 1967) emphasized that learning occurs when individuals assimilate

and accommodate new information, while Lev Vygotsky added that intellectual development occurs through social interaction and the use of cognitive aids that mediate the thinking process. In the context of PPG learning, research results indicate that students require exploratory learning experiences, allowing them to test ideas, build understanding through intellectual experimentation (hypothesis testing), and develop the capacity for reflective thinking that underpins the teaching profession.

As prospective educators, PPG students are not satisfied with simply receiving information about philosophical concepts such as epistemology, ontology, or axiology. They require a challenging construction process, namely comparing theory with experience, solving problems contextually, and interpreting meaning through critical discussion. However, research findings indicate that this process is not optimal because learning tends to be linear, resulting in students having difficulty reading philosophical texts, constructing arguments, or assessing the validity of ideas. This is where constructivism theory plays a crucial role in improving the design of more transformative learning.

From Vygotsky's social constructivism perspective, scaffolding support, or timely assistance, is crucial for enabling students to move from actual to potential abilities within the Zone of Proximal Development (ZPD). Artificial Intelligence technology has great potential to function as an adaptive and responsive scaffolding tool. AI can provide real-time cognitive support when students experience confusion or difficulty understanding abstract concepts. For example, when students struggle to understand the relationship between epistemology and educational practice, an AI system can automatically recommend simpler foundational materials, provide relevant analogies, or display visual explanations to make abstract concepts more concrete and understandable.

Furthermore, AI can provide adaptive micro-quizzes that adjust their difficulty based on student responses. This aligns with the "assessment for learning" approach, which positions evaluation as part of the construction process, not simply as a measuring tool. By presenting the right questions at the right time, AI helps students test their understanding and reflect on weaknesses in their arguments. Furthermore, the system can provide concise videos or interactive illustrations tailored to individual learning styles, helping students visualize the relationships between complex concepts.

AI not only adapts the material but also facilitates the internal dialogue process that is at the heart of constructivist learning. When students receive provocative questions from AI, they are encouraged to articulate their thoughts, examine their assumptions, and develop more sophisticated arguments. This interaction creates a dynamic learning environment, where students not only receive material but also actively construct and restructure their own knowledge. Thus, the integration of AI in philosophy learning at PPG SPs UM enables a more meaningful learning experience, oriented toward the development of higher-level cognitive capacities, and aligned with the principles of constructivism. AI does not replace the role of educators, but rather enriches the learning process through timely, personalized, and needs-based support. This means that technology functions as a pedagogical tool that strengthens the process of knowledge construction, giving students greater opportunities to develop as critical and reflective thinkers prepared to face the challenges of the teaching profession.

Connectivism theory proposed by George Siemens (Siemens, 2025) argues that in the digital era, knowledge is distributed across interconnected networks rather than confined within individual cognition. Learning occurs when individuals are able to access, connect, and synthesize information from various nodes into a coherent understanding. In this perspective, technology is not merely a supporting tool but an integral component of the learning ecosystem, as it facilitates connectivity, interaction, and the continuous updating of knowledge.

The results of this study indicate that the learning conditions of PPG SPs UM students align with the main characteristics of connectivism. Students require access to diverse learning resources, whether in the form of philosophical texts, academic articles, videos, simulations, or interactive discussions. This is because learning the philosophy of education cannot be understood in a single or linear manner; students must be able to connect ideas from various perspectives, such as the thoughts of Ki Hadjar Dewantara, the concept of humanist education, the values of Pancasila, and global discourses on teaching professional ethics. Traditional learning models that rely solely on one direction or one source are considered inadequate to meet the cognitive needs of students living in an era of unlimited information ecosystems.

Furthermore, students need continuous interaction with digital content that enriches their cognitive processes. Online discussion forums, for example, enable the multidimensional exchange of ideas beyond the constraints of time and space. From a connectivism perspective, such forums function as nodes that simultaneously bring together social knowledge, personal experiences, and digital information. Through these interactions, students learn to integrate diverse ideas, debate arguments, and build a collective understanding of philosophical issues a process impossible through monolithic learning.

Research findings also emphasize the importance of technology-facilitated collaboration. Connectivism views collaboration not merely as a social activity but as a process of knowledge construction through networks. PPG students need digital spaces to analyze cases, resolve ethical dilemmas, and formulate shared philosophical perspectives. Technology enables students to build dynamic learning communities, where each individual acts as a conduit for ideas, not just a recipient of information.

Within this framework, AI exists as a digital entity capable of expanding, enriching, and optimizing students' knowledge networks. AI can automatically curate learning resources, preventing students from drowning in a sea of unstructured information. With machine learning capabilities, AI can identify students' interests, difficulties, and search patterns to recommend relevant and credible reading materials. AI also enables instant searches for related topics, such as the relationship between epistemology and critical pedagogy, or between Pancasila values and teaching ethics, allowing students to connect cross-disciplinary concepts more quickly and accurately.

Furthermore, AI can generate concept maps that display the relationships between theories, figures, values, and educational issues. This mapping helps students understand the complexity of educational philosophy from a connectivist perspective, as they can see how a concept does not stand alone but is intertwined with other ideas. With the support of this

technology, students develop a more comprehensive and systematic understanding of philosophical material that was previously abstract and difficult to map.

Thus, the integration of AI in learning Indonesian Educational Philosophy not only adds digital features but also reinforces the principle of connectivism: that learning is the process of building, expanding, and updating knowledge networks (Shi & Liu, 2025). AI enables students to have unlimited access, multidimensional interactions, and an adaptive learning experience tailored to their individual needs. This makes learning richer, more reflective, and more relevant to the professional demands of teachers in the 21st century, which requires the ability to critically connect ideas amidst the dynamic flow of information.

The integration of Artificial Intelligence (AI) in philosophy learning brings a significant paradigm shift, from the traditional teacher-centered model to an AI-supported, learner-centered approach. In the old paradigm, the lecturer served as the center of knowledge, conveying material, and determining the direction of learning. Students tended to be passive recipients, following the same learning path without considering their individual differences in abilities, learning styles, and cognitive needs. However, the presence of AI in modern learning design has resulted in a fundamental transformation that makes students the primary actors actively constructing knowledge, while technology functions as a co-facilitator supporting this process.

First, AI enables automated differential instruction, namely the process of adjusting learning paths (personalized learning paths) based on students' initial competencies, learning styles, and responses. In philosophy learning, which is rich in abstraction, material differentiation is crucial. Students who struggle to grasp complex concepts like epistemology, for example, can be provided with additional explanations, visualizations, or simpler analogies, while more advanced students can be directed to further reading or more complex philosophical discussions. Thus, learning is no longer uniform, but rather responsive to the uniqueness of each student an approach that aligns with the principles of humanist education and learner-centered learning.

Second, AI empowers students as budding philosophers through the use of automatically generated Socratic questioning. The Socratic approach, based on critical dialogue, conceptual exploration, and argumentation, is at the heart of philosophy learning. AI can generate provocative questions such as "What is your epistemological basis?", "What values do you prioritize in this dilemma?", or "How does your argument align with the principles of educational axiology?". With this kind of stimulus, students are encouraged to reason more deeply, evaluate assumptions, and construct arguments logically. This interaction makes learning more dialogic and in-depth, even though it takes place in a digital space.

Third, AI provides continuous feedback that traditional learning systems cannot provide. In philosophy courses, reflective and argumentative assignments require lengthy grading periods by instructors. With AI, students receive instant feedback on logical fallacies, conceptual ambiguities, or argument inaccuracies. This rapid feedback is crucial for creating an active learning loop, where students can immediately refine their understanding before

moving on to the next topic. This process improves the quality of philosophical thinking while strengthening independent learning.

Fourth, AI enables students to simulate real-life ethical experiences through dynamic and adaptive professional dilemma scenarios. Philosophy of education addresses not only abstract concepts but also their application in social and moral situations. With an AI system capable of adjusting the complexity of scenarios based on user responses, students can learn to make decisions that consider values, professional ethics, social consequences, and pedagogical considerations. This experience is highly relevant for prospective teachers, who will have to make decisions that are not only procedurally correct but also in line with moral and humanitarian values. Such simulations bridge the gap between philosophical theory and real-world practice.

Fifth, AI enhances the intensity of student reflection through Natural Language Processing (NLP) features that can read, analyze, and provide feedback on their reflective writing. In the philosophical tradition, reflection is a key aspect of developing self-awareness, moral understanding, and metacognitive skills. With NLP, students can identify flaws in arguments, uncover biases in reasoning, or recognize logical inconsistencies. The system can also guide students to deepen their reflections through follow-up questions or recommendations for relevant literature. This kind of reflective process is very difficult to achieve through conventional methods due to time constraints and lecturers' assessment capacity.

Overall, this pedagogical transformation demonstrates that AI has great potential to enrich philosophy learning, which has been considered difficult to digitize due to its abstract, value-based nature, and the need for in-depth dialogue. With an AI-supported, learner-centered approach, students not only understand theory but also experience, analyze, and interpret philosophy through a more personalized, interactive, and reflective learning process. AI, in this context, does not replace the role of teachers or lecturers, but rather strengthens the philosophical dimensions of learning so that it is more relevant, meaningful, and in line with the demands of 21st century education (Katsenou, et.al, 2025).

Based on research findings, the development of an adaptive Learning Management System (LMS) for the UM SPs Teacher Professional Education Program (PPG) is not merely a technological innovation, but an urgent need to create a learning ecosystem that can address the complexity of student characteristics. PPG students come from diverse academic backgrounds, learning experiences, technological literacy levels, and critical thinking skills. This heterogeneous environment demands an LMS that functions beyond simply storing materials or collecting assignments, but rather as an intelligent system capable of providing a personalized, dynamic, and in-depth learning experience. Therefore, LMS development must incorporate several key, integrated components to create an adaptive learning environment.

The first component is an adaptive learning engine, which serves as the core of the adaptive system. This engine is capable of reading student performance in real time, analyzing learning difficulties, and adjusting material delivery based on each user's individual abilities. The adaptive engine mimics the work of a human tutor in providing step-by-step learning support, but operates with much greater speed and accuracy. With this system, students who

have not yet grasped basic concepts can be directed to remedial material or concept visualizations, while more advanced students can be challenged to explore advanced material, ensuring that learning occurs within the zone of optimal proximal development.

The second component is the AI Tutor, an artificial intelligence that can function as a digital companion for students. AI Tutors help answer questions, provide additional explanations, spark philosophical discussions, and provide guidance when students get stuck in understanding philosophical material. The presence of AI Tutors is not intended to replace the role of lecturers, but rather to expand student learning opportunities, especially outside of face-to-face hours through Socratic interactions that foster critical thinking and metacognitive skills.

Furthermore, advanced learning analytics are needed that can present granular data on student progress. This system can analyze learning behavior, access time, material navigation patterns, and the quality of student responses to reflective assignments or discussions. With these analytics, lecturers can more accurately map student learning needs, while students can reflect on their own development through informative progress visualizations.

Furthermore, ethical dilemma simulations are an important feature to strengthen teacher professionalism. Ethical dilemmas are an integral part of teaching practice, so students need to be trained to make decisions that consider values, rules, policies, and context. Through adaptive AI-based simulations, students are confronted with complex and dynamic situations and then provided with feedback on moral considerations and their consequences. This feature is highly relevant in philosophy learning, which focuses on character building and professional ethics.

Another component is Natural Language Processing (NLP)-based reflection assessment. In philosophy courses, reflection is a crucial tool for measuring the depth of students' philosophical understanding and awareness. NLP can automatically analyze the quality of argumentation, logical structure, and consistency of ideas. With NLP, lecturers can quickly obtain an overview of students' reflection achievements, while students receive instant feedback that encourages continuous self-improvement.

Another feature is the individual development dashboard, a visual display that allows students to independently monitor their learning progress. This dashboard displays not only grades but also competency development, level of material mastery, reflection achievements, and recommendations for future learning. This function reinforces the principle of self-regulated learning.

Furthermore, an adaptive LMS must support flexible multimodal learning modules, such as videos, infographics, animations, interactive text, and simulations. Philosophy learning often requires simultaneous abstract and concrete representations to help students better understand concepts. Multimodal modules allow students to choose a learning format that suits their style and preferences. Finally, the automated content recommendation feature is a crucial element that enables an LMS to function as an intelligent mentor. Based on student performance and learning behavior, the system can recommend relevant articles, videos, philosophical readings, or activities to enrich students' understanding of educational philosophy and the teaching profession.

Learning management, but has evolved into an intelligent learning ecosystem that supports deep learning. Through personalization, interactivity, analytical intelligence, and reflective support, this LMS equips PPG students with philosophical thinking skills, professional competence, and the ability to solve educational problems ethically, all of which are the main foundations in forming future professional teachers (Asadullah, 2021).

This research makes important contributions in three main areas of study: theoretical, practical, and contextual, which collectively enrich the discourse on learning development in teacher professional education in the digital era. First, in the theoretical realm, this research integrates three disciplines that have rarely been studied together: Indonesian educational philosophy, adaptive artificial intelligence, and deep learning approaches in the context of higher education. This integration produces a new theoretical framework that positions AI not merely as a technological tool, but as a pedagogical entity capable of expanding the space for philosophical dialogue and supporting the process of developing students' critical awareness. Thus, this research enriches the generally normative study of educational philosophy by incorporating a technological perspective that functions to mediate reflective, contextual, and transformative learning experiences in accordance with the values of Ki Hadjar Dewantara and the principles of humanization of education.

Second, in its practical contribution, this research produces an AI-based adaptive content development model that can be directly implemented in the PPG SPs UM LMS ecosystem. This model includes key features such as an adaptive learning engine, AI Tutor, advanced learning analytics, NLP-based reflective assessment, and ethical dilemma simulations. All these features are designed to address the real needs of lecturers and students, ensuring that research products are not limited to the conceptual level but are readily adapted to learning practices. This model provides systematic guidance from needs assessment, content design, technology integration, and expert validation, enabling it to be replicated in other courses or educational institutions developing adaptive learning.

Third, this research provides a contextual contribution relevant to the needs of future teachers in Indonesia. As a program tasked with producing professional educators, PPG requires learning that is not only informative but also transformative, adaptive, and rooted in national educational values. This research offers an innovative philosophy learning approach that bridges the gap between theory and practice, particularly in developing prospective teachers' reflective, ethical, and critical skills. By utilizing AI, students can understand the concepts of educational philosophy in a more vivid, contextual, and applicable way, enabling them to internalize Pancasila values, develop metacognitive skills, and make ethically based professional decisions. This model emphasizes that technology is not a threat to humanities education, but rather a strategic tool for strengthening the identity and professional competence of Indonesian teachers in the digital era.

Overall, this research's contribution enriches academic discourse, provides a concrete implementation model, and presents learning innovations relevant to the demands of the times and the needs of national education. This research demonstrates that the integration of philosophy, AI, and adaptive learning can work harmoniously, mutually reinforcingly, and provide a new foundation for the development of teacher professional education.

Conclusion

This research confirms that the development of an adaptive Artificial Intelligence-based LMS for PPG SPs UM is urgently needed to address the challenges of learning the Indonesian Educational Philosophy, which has so far been monologic and lacking context. Lecturers need media capable of facilitating in-depth reflection, learning analytics, and argumentative assessment, while students require a learning experience that is personalized, multimodal, dialogic, and relevant to the teaching profession. The integration of features such as an adaptive learning engine, AI Tutor, NLP-based reflective assessment, ethical dilemma simulations, and automatic content recommendations enables the learning process to be more humanistic, critical, and responsive to student heterogeneity. Thus, learning becomes more effective in fostering reflective, ethical, and professional thinking competencies, as well as strengthening the principle of learner-centered learning that aligns with the Indonesian educational philosophy and the demands of 21st-century education.

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