

Artificial Intelligence-Integrated Instruction for Promoting Deep Learning: A Mixed methods Case Study of Pre-Service English Teachers

Arik Susanti¹, Anis Trisuana¹, Asrori¹, Sueb¹, Mohammad²

¹Universitas Negeri Surabaya

²Western Philippines University

HOW TO CITE:

Arik Susanti, Anis Trisuana, Asrori, Sueb, Mohammad (2026). Artificial Intelligence-Integrated Instruction for Promoting Deep Learning: A Mixed methods Case Study of Pre-Service English Teachers. International Journal of Special Education, 41(22s), 1740-1753

ABSTRACT:

The study examines how pre-service teachers construct pedagogical knowledge through AI-mediated interaction, challenges, and their adaptation strategies in lesson planning in a Syllabus Design course. The study was held at a public university in Indonesia, employing an exploratory sequential mixed-method design, quantitative data were collected through questionnaires ($n = 69$), followed by qualitative data from interviews and classroom observations. The results indicate a moderately positive perception of AI use, with a particular emphasis on the enhancement of time efficiency, the support of instructional design understanding, and stimulation of creativity. Nevertheless, numerous obstacles were identified, such as the inability to generate specified learning objectives, the limited contextual relevance, and the challenges associated with prompt formulation. Critical evaluation, contextual modification, peer collaboration, and iterative prompt refinement were among the adaptive strategies in response to these challenges. It indicates that AI serves as a cognitive partner that facilitates the creation of lesson plans that are more contextualized, differentiated, and meaningful. It contributes to the expanding body of literature on AI in education by offering empirical insights into the collaboration between humans and AI in teacher education and emphasizing the significance of critical AI literacy in the development of pedagogical decision-making.

Keywords: Artificial Intelligence, differentiated instruction, deep learning, lesson plan

COPYRIGHT STATEMENT:

Copyright: © 2026 Authors.
Open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Critical thinking is acknowledged as a fundamental skill required for 21st century education, especially for pre-service teachers tasked with creating impactful and significant learning experiences. Lorin W. Anderson highlights that critical thinking involves advanced cognitive processes like analysis, evaluation, and creation, which are fundamental to instructional

choices (Anderson, Lorin W. and Krathwohl, 2001). This viewpoint corresponds with Benjamin Bloom's taxonomy, emphasizing the necessity of preparing future teachers to create instructional design that caters to the students' diverse needs (Ennis, 2018). In Indonesia context, pre-service teachers should effectively combine pedagogical and content knowledge, instructional methodologies, and contextual

understanding to create lesson plans that not only meet learning objectives but also cultivate significant and engaging educational settings (Changwong, 2018; Grieco, 2016; Rahimi & Soryani, 2014; Zheng & Yang, 2024).

Although the significance of critical thinking is recognized, empirical findings indicate that numerous pre-service teachers continue to struggle with formulating innovative and student-focused lesson plans (Pratiwi et al., 2020). In reality, lesson planning frequently remains focused on the teacher-activities, constraining opportunities for active student participation and interaction (Matorevhu, 2019). This problem is often linked to an excessive dependence on theoretical understanding instead of practical implementation, leading to difficulties in incorporating innovative teaching methods and educational tools. Moreover, inadequate access to model lesson plans and a lack of instructional support led to diminished confidence among pre-service teachers when it comes to generating innovative concepts. The situation is contradictory, especially regarding the Merdeka Curriculum, which distinctly advocates for adaptability, innovation, and student-centered approaches. Consequently, pre-service teachers find it challenging to create lesson plans that are both educationally effective and attuned to diverse student traits. Despite the growing academic interest in the incorporation of artificial intelligence (AI) in education, especially with the rise of generative tools like ChatGPT, current research has mainly concentrated on theoretical discourse and literature reviews (Heung & Yim, 2024; Zhai et al., 2021; Zheng & Yang, 2024; Zogheib, Salah; Zogheib, 2024) with scan empirical analysis. Previous studies have predominantly highlighted the overarching advantages of AI, such as immediate feedback, enhanced conceptual comprehension, and less learner apprehension, while neglecting the practical obstacles and contextual limitations encountered by users. Furthermore, most research has concentrated on the application of AI within the general student demographic, neglecting the specific needs of pre-service English teachers and their instructional

advancement, especially in lesson planning. The influence of AI on educational decision-making, promoting innovation, and improving professional preparedness is yet inadequately examined, particularly in specific educational settings like Indonesia. Consequently, empirical investigation is required to explore how pre-service teachers interact with AI in the creation of contextually pertinent and pedagogically significant lesson plans. This research transcends the perception of AI as just a technological instrument, framing it instead as a cognitive and pedagogical assistant in differentiated training. This study merges socio-constructivist viewpoints with critical AI literacy, offering empirical data on how pre-service teachers interact with AI to create lesson plans that are adaptable, reflective, and contextually pertinent. This research emphasizes the evolving nature of human-AI collaboration in influencing teaching methodologies, contrasting with other studies that mostly concentrated on the functional advantages of AI. Consequently, the research questions are: (1) how are the pre-service teachers construct pedagogical understanding through ai interaction, (2) cognitive challenges in AI-mediated lesson planning, and their adaptation strategies. By doing so, it enhances the comprehension of how AI can facilitate profound learning, characterized as significant, intentional, and pleasurable, especially in marginalized educational environments like Indonesia.

2. Literature Review

2.1 Teacher Cognition in Language Instruction Training

Teacher cognition provides a valuable theoretical perspective for comprehending how teachers cultivate, interpret, and implement pedagogical knowledge within instructional settings. Instead of perceiving teaching as only the implementation of externally sourced techniques, teacher cognition regards educators as proactive decision-makers whose classroom methodologies are influenced by their knowledge, beliefs, thoughts, and comprehension of teaching and learning (Borg, 2010). Teachers' instructional

choices are not merely technical reactions to curricular mandates but are shaped by previous learning experiences, pedagogical expertise, convictions regarding students, and perceptions of classroom dynamics. Teacher cognition is dynamic and situated through continuous interaction between cognition, experience, and pedagogical practice.

In teacher education, pre service teachers must convert theoretical understanding into pedagogical choices, which encompass establishing learning goals, choosing resources, crafting classroom tasks, predicting student challenges, and formulating suitable evaluation methods (Alanazi, 2019). All those activities require more than an understanding of teaching techniques; they demand pedagogical reasoning regarding the appropriateness of specific instructional choices for distinct learners within a given setting. Jacob et al. (2020) support that effective teaching necessitates the transformation of subject matter expertise into formats that are comprehensible and significant to students.

In the language teacher education, the interplay between cognition and practice holds particular significance, as lesson planning requires teachers to integrate linguistic, pedagogical, curricular, and contextual factors. Borg (2010) contends that the actions of teachers cannot be fully comprehended without taking into account the cognitive mechanisms that inform their decision. Thus, lesson planning is a significant arena where teacher cognition is manifested. As pre-service teachers create instructional design, select language input, establish learning objectives, and create assessment tasks, they are concurrently utilizing and enhancing their pedagogical expertise.

2.2 Pre-Service Teachers' Pedagogical Cognition in Lesson Planning

Lesson planning embodies a method of educational reasoning wherein teachers predict learning requirements, define instructional objectives, choose suitable strategies, and determine how learning will be supported and evaluated. Sahin-taskin (2017) underscores the significance of reflective practices in the

professional growth of teachers, especially as they analyze the connection between their teaching objectives and their real instructional decision. Reflection is crucial as pre-service teachers are in the process of forming their professional identities and honing their capacity to link theoretical frameworks with real-world teaching scenarios.

The difficulty lies when pre-service teachers often arrive in teacher training with preconceived notions about teaching shaped by their personal experiences as language learners. Previous experiences can shape their comprehension of good teaching and create their course design. Borg (2003) articulates that teacher cognition is shaped by educational background, professional training, situational elements, and experiential learning in the classroom. Consequently, pedagogical comprehension does not arise solely from teacher training programs. It evolves through the interplay of existing beliefs, formal education, experiential knowledge, and situational requirements.

2.3 Artificial Intelligence as a Mediatonal Tool for Teacher Cognition, Tension and Adaptive Strategy

The advent of generative AI has introduced a new dimension to teachers' cognition. Instruments like ChatGPT can produce instructional ideas, formulate learning objectives, classroom activities, and assessment. Recent studies have highlighted that generative AI can minimize time needed for teachers to create content creation and offer diverse teaching options (Kasneci et al., 2023; Thili et al., 2022). However, the pedagogical value of AI cannot be assessed exclusively by the rapidity of its results. The educational importance is contingent upon the manner in which teachers analyze, assess, and modify those outputs about instructional objectives and student requirements.

AI can be regarded as a mediating instrument instead of an independent educational entity. Zuengler & Miller (2006) posits that human cognitive development is mediated by cultural instruments and social engagement. Interaction with ChatGPT can offer pre-service teachers

supplementary tools for contemplating instructional challenges in AI-enhanced teacher training. AI-generated recommendations can inspire divergent concepts, introduce learners to novel pedagogical approaches, or offer a foundational framework to construct their lesson plans. Significantly, mediation does not denote replacement. The student is accountable for deciphering the conveyed information and deciding its application.

Research has highlighted issues pertaining to accuracy, bias, contextual limitations, and inappropriate or fabricated information in generative AI outputs, and the risk of erroneous or invented data in generative AI results (Dwivedi et al., 2023; Kasneci et al., 2023). These constraints are especially significant as lesson planning necessitates coherence among curriculum goals, student attributes, teaching methods, and evaluation in the realm of teacher education. Consequently, interaction with AI can both enhance and contest the pedagogical thinking of pre-service teachers. When ChatGPT produces a lesson-plan element, pre-service teachers should assess if the recommendation is educationally significant, contextually suitable, and aligned with the desired learning objectives. In this process, they utilize their pre-existing educational knowledge and convictions to assess the new data (Harahap et al., 2025). Although AI can reduce the time required to produce an initial lesson-plan structure, the pedagogical reasoning is still required. A produced activity could seem adequate at first but could later be dismissed due to its excessive difficulty for students, lack of communicative value, misalignment with the curriculum, or inappropriateness for the local educational environment. Therefore, pre-service teachers need to explain the rationale behind accepting, altering, or dismissing an educational choice. AI-assisted lesson planning can create an effective setting where pre-service educators can clarify their pedagogical reasoning (Rind, 2025).

Although research on generative AI in education has expanded rapidly, much of the existing literature has focused on AI's functionality, perceived usefulness, efficiency, or general opportunities and risks (Dwivedi et al., 2023;

Kasneci et al., 2023). Relatively minimal focus has been directed toward the cognitive and pedagogical processes occurring between the reception of an AI-generated recommendation and the formulation of a final instructional choice. Specifically, there is a scarcity of empirical studies investigating how pre-service teachers develop pedagogical knowledge through their interactions with AI, the conflicts that arise when AI outputs contradict pedagogical expertise and contextual requirements, and how these conflicts influence adaptive teaching methodologies.

This disparity is especially significant in pre-service teacher preparation as lesson planning serves as a bridge between academic pedagogical knowledge and actual teaching practice. Comprehending the reactions of prospective educators to AI-generated recommendations can thus yield insights into the evolution of teacher cognition within a progressively AI-integrated educational landscape. Consequently, the current research tackles this deficiency by investigating three interrelated processes: (1) how pre-service teachers develop pedagogical knowledge via AI interaction, (2) the cognitive dissonance they encounter throughout this experience, and (3) the ways in which these tensions foster adaptive instructional strategies in lesson design. The research transcends a technology-focused assessment of AI by analyzing these processes together, providing insights into teacher cognition on the interplay of human judgement, pedagogical expertise, and AI-generated data in instructional preparation.

2. Methodology

Design

This research employed a case study design incorporating mixed methods to investigate pre-service English teachers' views and experiences on the use of AI in lesson planning within a genuine educational setting (Ali, 2009). The research aims to identify the trends patterns and comprehend the personal experiences of participants as they interact with new technology in their learning process. The case study methodology was intentionally chosen, since it facilitates a comprehensive and thorough

investigation of actual phenomena, namely how pre-service English teachers create and execute new lesson plans utilizing AI as supportive instruments (Bower et al., 2015). Moreover, the mixed methods approach was executed in two sequential phases, wherein the quantitative phase was implemented (Tateo & Adinolfi, 2010). The objective was to investigate participants' overall views on the utilization of AI in lesson planning, succeeded by a qualitative phase that yielded deeper and more intricate understandings of their experiences, challenges, and adaptive methods. By employing this sequential strategy, the research successfully triangulated data sources, hence augmenting the overall validity and reliability of the results.

Participants

The research took place at a public university in Surabaya, Indonesia, across the 1740-1753 academic year, engaging 69 pre-service English educators who had finished the Syllabus Design course. From a demographic standpoint, the participant profile provides significant contextual understanding of the study's nature. The predominant age group of participants was 17 to 19 years, at 60.8%, followed by individuals aged 20 to 22 years at 37.6%, with a mere 1.4% being beyond 23 years. This distribution indicates that the majority of participants are from a younger demographic that tends to be more receptive to and knowledgeable about digital technologies. Regarding gender, female participants made up the predominant portion (75.4%), mirroring the general demographic pattern typically seen in English teacher education programs. Furthermore, the majority of respondents (97.1%) indicated that they have utilized ChatGPT for a duration of one to two years, suggesting that AI technologies are comparatively novel, with their integration among students being both swift and extensive. This trait indicates that the participants constitute a digitally adaptable cohort, rendering them especially pertinent for examining the incorporation of AI in educational environments.

This research identified the employment of AI-integrated technology, specifically technologies

like Chat GPT, as the independent variable concerning the variables being examined. The dependent variables encompassed pre-service teachers' perspectives, alongside with critical thinking and inventiveness in formulating new and differentiated lesson plans. To further the understanding of the educational setting, factors such as the influence of instructors and the collaborative learning process were also considered. To implement these variables in the educational setting, students were prompted to actively utilize theoretical knowledge in creating lesson plans with AI tools and collaborative platforms like Google Docs and Canva. This educational framework is fundamentally aligned with socio-constructivist tenets, which prioritize active participation, cooperation, and the joint creation of knowledge, therefore promoting significant and contemplative learning encounters.

Instruments and Data Collection Technique

Data collection was executed utilizing three primary instruments: questionnaires, observation sheets, and semi-structured interviews. They fulfilled a supportive function in elucidating various aspects of the research problems. The survey, disseminated to all participants, comprised three segments addressing elements affecting AI utilization, the function of instructors, and cooperative learning. Each topic was evaluated utilizing a four-point Likert scale, facilitating a systematic appraisal of participants' viewpoints. Additionally, classroom observations were performed to document real-time interactions, encompassing student participation, collaborative efforts among peers, and the application of novel pedagogical techniques. To enhance the data, semi-structured interviews were performed with 15 chosen individuals. These interviews utilized open-ended inquiries, allowing participants to articulate their reflections, experiences, and difficulties. To guaranty comfort and genuineness, interviews were performed in either Indonesian or English, based on the participants' choices. Data gathering during this stage persisted until saturation was achieved, guaranteeing that the selected themes were adequately thorough and representative. To

guaranty the integrity and excellence of the research tools, a validation procedure was undertaken including two professional educators with substantial experience in English instruction and curriculum development. This procedure concentrated on evaluating content pertinence and linguistic clarity, yielding a validity score of 3.57, which signifies that the tools were suitable and dependable for data gathering.

Data Analysis

Data gathering was executed in two phases, commencing with the quantitative stage and subsequently transitioning to the qualitative stage. The systematic approach enabled the qualitative insights to elaborate on and enhance the quantitative outcomes, thus offering a more comprehensive knowledge of the topic being examined. Ultimately, the data analysis procedure was executed methodically to guaranty precision and transparency. Quantitative data were examined by descriptive statistics, encompassing mean scores to discern overarching trends in participants' views on AI utilization. Simultaneously, qualitative data were meticulously transcribed, categorized, and

structured into themes via thematic analysis. Every participant was allocated a unique code to uphold confidentiality and guaranty ethical research standards. To enhance the reliability of the findings, data triangulation was employed by contrasting results derived from surveys, observations, and interviews. This comprehensive methodology enabled the research to offer a thorough and nuanced comprehension of how pre-service educators interact with AI in the creation of lesson plans.

3. Results

Pre-Service Teachers Construct Pedagogical Understanding through AI Interaction

The quantitative findings reveal that AI interaction serves technological tools and cognitive assets pre-service English teachers utilized to navigate pedagogical decision in lesson design. The average score of 2.78 reflects a reasonably attitude toward AI-assisted lesson planning. However, the more significant insight is found in the trends seen across the various aspects that is described in table 1.

Table 1. Teacher cognition in AI interaction

Teacher cognition dimension	Indicator	Mean	SD	Interpretation
Pedagogical cognition	Understanding instructional design	3.19	0.77	High
	Help design assessment	3.10	0.71	High
	Help determine objectives	2.88	0.80	Moderate
Cognitive agency & decision-making	Adjustable to teaching needs	3.17	0.66	High
	Encourage creativity	3.19	0.81	High
	Irrelevant answer	3.13	0.71	High
Contextual/pedagogical knowledge	Limited local context	2.86	0.77	Moderate
	In effective for specific competencies	2.87	0.73	Moderate
	Clear answer	2.96	0.79	Moderate
Technological cognition	Increase time efficiency	3.46	0.65	High
	Easy to use	3.09	0.72	High
	Willing to reuse	3.16	0.66	High
	Recommend to peers	3.07	0.65	High
Overall Mean		2.78		Moderate

The most highly regarded indication was the perceived enhancement in time efficiency ($M = 3.46$, $SD = 0.65$), indicating that AI alleviated the cognitive and procedural burdens linked to the preliminary phases of lesson planning. This may have enabled pre-service teachers to shift their focus from standard content creation to more advanced pedagogical problems. Significantly, AI was seen as facilitating comprehension of instructional design ($M = 3.19$, $SD = 0.77$), fostering creativity ($M = 3.19$, $SD = 0.81$), enhancing assessment design ($M = 3.10$, $SD = 0.71$), and aiding adaptation to pedagogical requirements ($M = 3.17$, $SD = 0.66$). The results mean that AI engagement could aid in developing pedagogical comprehension by presenting pre-service teachers with diverse methods for structuring educational goals, tasks, and evaluations.

Simultaneously, the comparatively diminished scores for determining learning objectives ($M = 2.88$, $SD = 0.80$), restricted comprehension of the local context ($M = 2.86$, $SD = 0.77$), and ineffectiveness for highly particular competencies ($M = 2.87$, $SD = 0.73$) underscore a significant limitation of AI-mediated cognition. Although AI can produce instructional options, it lacks the contextual and pedagogical insight necessary to assess their suitability for certain learners and educational contexts. The moderate apprehension about irrelevant outputs ($M = 3.13$, $SD = 0.78$) and the necessity for considerable modification ($M = 3.09$, $SD = 0.72$) indicates that pre-service teachers needed to assess, filter, and reformulate AI-generated recommendations. From the standpoint of teacher cognition, these tensions hold particular importance as they prioritize pedagogical judgement over mere technological proficiency in lesson planning. The results indicate that AI-assisted lesson preparation should be perceived as a cognitive negotiation process where pre-service educators amalgamate AI-generated options with their developing understanding of students, curriculum, teaching methods, and classroom environments.

Cognitive Challenges and Pedagogical Responses in AI-mediated Lesson Planning

Beyond the quantitative evidence, the qualitative results indicate that AI-assisted lesson planning was characterized by various cognitive tensions rather than a simple endorsement or dismissal of AI-generated recommendations. These tensions arose when pre-service teachers encountered inconsistencies between the effectiveness and universality of AI-generated results and the instructional, curricular, and contextual requirements of real lesson planning. Significantly, the obstacles were not regarded solely as technological issues. They encouraged pre-service teachers to utilize their developing pedagogical insights, comprehension of students, curricular awareness, and professional discernment to assess and modify AI-generated recommendations. The findings categorize the cognitive difficulties encountered by English pre-service teachers in lesson plan development into three themes, which are elucidated below. Theme 1. Mediating AI Results with Educational and Contextual Expertise

The initial topic emphasizes the manner how pre-service teachers engaged with AI-generated content, integrating it with their established pedagogical and contextual knowledge. Although ChatGPT was seen as beneficial for producing preliminary concepts and educational frameworks, students often discovered that its replies were very broad and inadequately tailored to the specificities of their teaching environments. A participant remarked, “*ChatGPT provides fundamental concepts but is not appropriate for my class.*”. It means AI-generated recommendations could not always be directly transformed into educational settings. Challenges arose when students endeavored to utilize AI-generated learning objectives and activities, as the results were occasionally inadequately linked with the targeted competencies and curriculum requirement. One participant remarked, “*The outcomes remain misaligned with competencies.*” but another stated, “*I combine it with my syllabus.*”

Observational data also supported these interview narratives. Throughout lesson-planning sessions, students were observed repeatedly AI-generated learning objectives, consulting curriculum document, and adjusting activities to more accurately align with the learners' characters and classroom context. Instead of directly implementing AI-generated evaluation recommendations, several students modified them to enhance authenticity, as indicated by the remark, *"I develop my own rubric."* These results indicate that engagement with AI stimulated various facets of teacher cognition, especially in areas such as pedagogical expertise, curricular understanding, learner awareness, and assessment proficiency. Pre-service teachers assessed its educational suitability based on their personal comprehension of instructional environments.

Theme 2. Cultivating Critical and Metacognitive Agency through AI Interaction

The second theme is to the cultivation of critical and metacognitive agency through continuous interaction with AI. Participants recognized that AI-generated recommendations could sometime be redundant, unrelated, or lacking in specificity. However, these limitations did not inherently lead to passive reliance or disengagements. Conversely, students frequently reacted by questioning, comparing, and reconstructing the generated results. A participant stated, *"The suggestions are repetitive; I create my own,"* indicating a willingness to move beyond AI-generated content and formulate alternative instructional ideas.

Another important aspects of this theme was the challenge linked to formulating effective prompts. Participants indicated that acquiring valuable results frequently necessitated repeated experimentation. One student articulated, *"I try with multiple prompts until I get the results."* Classroom observations validated this cyclical process, as students were often seen revising prompts, comparing outcomes, and modifying their instructions to achieve more relevant responses. This procedure illustrates the development of metacognitive awareness, as learners grew more

cognizant of the connection between their rapid formulation and the caliber of AI-generated replies. Consequently, AI interaction evolved into a technological endeavor as well as a process of reflection, monitor, and strategic decision-making. Through these interactions, students gradually positioned as critical users who maintained responsibility for assessing the quality and relevance of AI-generated content.

Theme 3. Transforming AI Assistance into Flexible Educational Methods

The third theme demonstrates how cognitive interaction with AI was converted into flexible instructional methods. Participants typically regarded AI not as a provider of pre-constructed lesson plans, but rather as a preliminary tool necessitating additional modification. A participant remarked, *"I utilize ChatGPT as a foundation, then modify,"* while another noted, *"I adjust according to the students' proficiency."* These replies suggest that AI-generated content was often utilized as initial frameworks rather than conclusive educational concepts.

The observational data further illustrated how students converted AI assistance into practical instructional decision. Pre service teachers were noted to be streamlining language, altering activities, contextualizing educational resources, and reconfiguring assessment elements. Collaborative dialog among peers has also surfaced as a significant adaptive strategy, as indicated by the assertion, *"Using ChatGPT together is better."* Through collaborative evaluation, pre-service teachers can compare interpretations and evaluate the appropriateness of AI-generated recommendations. Significantly, participants consistently emphasized their authority in determining ultimate educational choices, exemplified by one student's authority, *"The final decision rests with me."* This finding indicates that teacher cognition influenced adaptive teaching methodologies. Students utilized their educational understanding, contextual knowledge, and professional judgments to transform general AI-generated recommendations into lesson plans that were

better responsive to students and instructional context.

Adaptation Strategies & Pedagogical Implications

The results pinpoint the cognitive tensions faced by pre-service teachers and illustrate how these tensions fostered adaptive teaching strategies in AI-assisted lesson planning. Participants critically engaged with the constraints of AI through pedagogical assessment, contextual modification, and strategic interaction. These responses reflect the dynamic nature of teacher cognition, wherein teachers' knowledge, belief, and professional judgement are continuously activated and reconstructed through interaction with specific teaching contexts and instruments. The integration of interview and classroom observation data produced three interrelated themes: (1) using AI as a pedagogical support rather than a substitute for teachers' judgement, (2) adapting and critically evaluating AI results to suit learner and contextual requirements, and (3) cultivating collaborative and strategic proficiency for successful human–AI interaction. These themes indicate that cognitive tensions are not solely barriers to AI integration; they can also transform into constructive environments where pre-service teachers cultivate more thoughtful, adaptable, and proactive strategies for lesson planning.

1. Using AI as a Pedagogical Support Rather than a Substitute for Teacher Judgment

The initial theme demonstrates that pre-service teachers regarded AI as an educational support rather than a replacement for their professional discernment. Participants often utilized ChatGPT to create a preliminary structure for lesson planning; nevertheless, they did not see the created results as definitive instructional materials. A participant stated, *"I use ChatGPT for framework, then I revise it."* It means that AI was employed to assist with the initial phases of instructional planning. Another participant emphasized *"Final decision is mine,"* indicating a strong sense of professional autonomy regarding AI utilization.

The observational data supported this finding. Throughout lesson-planning activities, students were observed utilizing AI-generated recommendations as preliminary references before revising objectives, activities, materials, and assessments. This pattern indicates that AI did not replace teacher cognition; instead, it provides a temporary cognitive scaffold that students assessed and reconstructed using their pedagogical reasoning. Consequently, the adaptive methodology emerging from AI interaction was characterized by selective appropriation rather than passive acceptance, allowing pre-service teachers to retain authority over final instructional decisions.

Theme 2. Adapting and Critically Evaluating AI results to suit learner and contextual requirements

The second theme emphasizes how pre-service teachers adapting AI-generated content to respond to student traits and situational needs. Participants recognized that AI-generated content was not consistently appropriate for their target students. As a result, they simplified, modified, and contextualized the results before integrating them into their lesson plans. One participant remarked, *"I simplify based on students' level,"* indicating an awareness that teaching resources must be modified to suit learners' capabilities and requirements.

This procedure was accompanied by critical assessment. Participants highlighted the necessity of verifying AI-generated outputs before replication, as illustrated by the remark, *"I always double-check."* Observations indicated that students adjusted vocabulary, teaching activities, and learning resources to enhance their pedagogical suitability. These methodologies indicate that adaptive lesson preparation encompassed a cyclical process of assessing and modifying AI-generated recommendations. From the standpoint of teacher cognition, students utilized their comprehension of learners, pedagogical principles, and contextual insights to assess the suitability of AI-generated results. The results indicate that AI interaction fostered both efficiency and significant pedagogical

involvement, as well as varied educational choices.

Theme 3. Developing Collaborative and Strategic Proficiency for Optimal Human–AI Engagement

The third theme reveals that adaptive teaching methodologies also involved the cultivation of collaborative and strategic skills in engaging with AI. Participants recognized that the quality of AI-generated results could be enhanced through dialog and testing. A participant stated, *“Using ChatGPT together is better.”* It indicates that teamwork allowed students to assess and enhance AI-generated concepts collaboratively. Observation data confirmed that students regularly engaged in discussions on AI-generated outputs, evaluated alternative proposals, and negotiated on the most appropriate responses for their lesson plans.

Another important adaptive strategy involved learning to formulate more efficient prompts. One participant articulated, *“The prompt must be explicit and clear,”* signifying a growing awareness of the relationship between instructional input and AI-generated outputs. Students were observed revising and refining prompts when their original responses were considered unnecessary or lacking in specificity. This cyclical procedure demonstrates strategic and metacognitive involvement, as learners assessed the efficacy of their interactions with AI and modified their strategies accordingly. Consequently, adaptive instructional methods transcended mere alterations to lesson-plan material and encompassed the cultivation of novel collaborative and strategic skills essential for proficient human–AI engagement.

4. Discussion

The study explored how English pre-service teachers develop pedagogical knowledge through AI interaction, the cognitive tension they face and the adaptive teaching methods they develop in lesson planning. The findings demonstrate that AI-mediated lesson preparation is more than a technology-enabled process of creating instructional materials. Conversely, AI interaction serves as a domain where pre-service

teachers can activate, negotiate, and recreate their pedagogical expertise. In line with Borg's framework (2003, 2010) teacher cognition and teachers' teaching strategies are affected by the interaction of their information, beliefs, thinking and contextual experiences. This study shows that there are initial pedagogical possibilities for using ChatGPT, but it is the duty of pre-service teachers to determine whether the suggestions are appropriate for learning objectives, students, assessment, and curriculum requirements (Jacob et al., 2020).

The results additionally illustrate that the constraints of AI produced significant cognitive conflicts. The participants perceived tensions between efficiency and pedagogical depth, between generality and contextual specificity, between automation and professional agency, and between AI-generated knowledge and curricular requirements. These tensions arose when the pedagogical expectations, or realities, of the classroom were not met by the AI outputs (Yuan & Lee, 2015). These conflicts arose when AI results failed to align with participants' educational anticipations or actual classroom conditions. The results indicate that these tensions, instead of being solely negative obstacles, stimulated educational reasoning. When participants faced outputs that were irrelevant, redundant, or poorly contextualized, they had to assess, dismiss, alter, or reassemble the recommendations. This procedure aligns with the contextual viewpoint of teacher cognition, highlighting that educators' thought processes evolve through interaction with specific educational challenges and environments (Rind, 2025). Consequently, the constraints of AI ironically foster the evolution of teacher cognition by necessitating that pre-service educators express and use professional judgement (König et al., 2019).

The results indicate that cognitive tensions resulted in adaptive instructional methods. Participants regarded AI as an educational framework instead of a replacement for teacher assessment, tailored AI results to suit learner and contextual requirements, and cultivated collaborative and strategic skills in engaging with

AI. These practices illustrate that pre-service educators were not mere passive users of AI-generated contents (Dawson et al., 2025). They demonstrated autonomy by means of contextualization, simplicity, critical analysis, redesigning assessments, engaging in peer discussions, and refining prompts iteratively (Yahya & Sukmayadi, 2024). These behaviors exemplify the connection between teachers' thought processes and their professional behaviors (Alanazi, 2019). AI interaction seemingly fosters teacher growth by promoting introspection and modification instead of reliance on automated outputs (Michal & Cardoso, 2026).

Theoretical implication

The present study extends the theory of teacher cognition to the generative AI environment. Traditional teacher cognition research has investigated the link between teachers' knowledge, beliefs, contextual experiences and classroom behaviors, but the present findings indicate that standard artificial intelligence can be a new mediating element in this relation. Importantly, AI does not directly influence instructional approaches. Its impact is transmitted through teachers' cognitive appraisal and professional judgement. The study so posits the following conceptual relationship: AI Interaction, cognitive tensions, pedagogical evaluation, and adaptive teaching strategies

This paradigm emphasizes that the significance of AI in education lies not only in its capacity to produce content efficiently. Rather, its worth could be in the cognitive processes which are stimulated when teachers critically examine and adapt suggestions generated by AI. In this view, cognitive tensions could be constructive spaces for the development of educational reasoning and professional agency.

Practical Implication

The findings indicate that teacher education programs should move beyond educating pre-service teachers to use generative AI tools. AI literacy needs to be coupled with pedagogical reasoning, curriculum understanding, critical evaluation and contextual adaptation. Teacher

educators can construct activities that encourage students to criticize, amend, contextualize, and justify AI-generated instructional decision, instead of asking students to develop lesson plan using AI. Thus, AI should be positioned as an educational scaffold and intellectual collaborator, rather than a substitute for teachers' professional skills. This approach could contribute to the pre-service teachers' technology skills and their professional judgement to make responsible instructional decisions.

Limitations and Future Directions of Research

This research possesses multiple constraints. Initially, the study was carried out within a specific pre-service teacher education framework; hence, the results could not reflect the experiences of educators in varying institutional or cultural environments. Secondly, the research concentrated on AI-assisted lesson planning instead of the implementation of lesson plans in real classroom settings. Future studies should explore the impact of AI-facilitated teacher cognition on immediate instructional choices and classroom methodologies.

Finally, future longitudinal studies should investigate the evolution of pre-service teachers' cognitive interaction with AI over time and assess if continuous AI-facilitated reflection fosters enduring professional development. Comparative studies between pre-service and in-service teachers could potentially a more profound comprehension of the impact of teaching experience on the capacity to critically assess and modify AI-generated educational materials.

5. Conclusion

The research demonstrates that AI can assist pre-service English teachers in lesson planning by enhancing efficiency, generating concepts, and facilitating instructional design. Nonetheless, AI-generated outputs have also posed difficulties with contextual relevance, curricular alignment, specific learning objectives, assessment, and prompt formulation. These obstacles induced cognitive dissonance that compelled pre-service educators to assess, alter, and adjust AI-generated material.

The results indicate that pre-service teachers did not merely acquiesce to AI-generated outputs. They employed AI as a foundation, rigorously assessed the outcomes, tailored resources to the requirements of students and their environments, refined their prompts, and exchanged concepts with colleagues. From the standpoint of teacher cognition, these mechanisms illustrate that interaction with AI can foster pedagogical reasoning, introspection, and professional judgement. Consequently, AI should be seen as an educational framework or cognitive collaborator instead of a substitute for educators.

Teacher education programs ought to offer training not solely on the utilisation of AI but also on the critical assessment and adaptation of AI-generated material for particular educational settings. Subsequent investigations could explore the evolution of AI-facilitated cognitive processes over time and assess if the adaptive strategies formulated during lesson planning are applied in real classroom instruction. Research encompassing various cohorts of educators and educational settings could yield a more comprehensive insight into the interplay among artificial intelligence, teacher cognition, and pedagogical methods.

References

- Alanazi, M. H. (2019). *A Study of the Pre-Service Trainee Teachers Problems in Designing Lesson Plans*. 10(1), 166–182.
- Ali, Z. (2009). A Case Study on Collaborative Learning to Promote Higher Thinking Skills (HOTS) among English as a Second Language (ESL) Learners. *Jurnal UMP: Social Sciences and Technology Management*, 1(1), 1–14. <http://umpir.ump.edu.my/5069/>
- Anderson, Lorin W. and Krathwohl, D. R. (2001). A Taxonomy for Learning, Teaching, and Assessing. A revision of Bloom Taxonomy of Educational Objectives. In *Journal of the American Statistical Association*. Longman, Inc. <https://doi.org/10.2307/2281462>
- Borg, S. (2003). *Review article Teacher cognition in language teaching : A review of research on what language teachers think , know , believe , and do*. 81–109. <https://doi.org/10.1017/S0261444803001903>
- Borg, S. (2010). *Teacher Cognition in Grammar Teaching: A Literature Review*. July 2013, 37–41. <https://doi.org/10.1080/09658410308667069>
- Bower, M., Dalgarno, B., Kennedy, G. E., Lee, M. J. W., & Kenney, J. (2015). Design and implementation factors in blended synchronous learning environments: Outcomes from a cross-case analysis. *Computers and Education*, 86, 1–17. <https://doi.org/10.1016/j.compedu.2015.03.006>
- Changwong, K. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. *Journal of International Studies*, 11(2), 37–48. <https://doi.org/10.14254/1740-1753.2018/1740-1753/3>
- Dawson, M. G., Deer, R., & Boguslawski, S. (2025). *Computers in Human Behavior Reports Cognitive dissonance in programming education : A qualitative exploration of the impact of generative AI on application-directed learning*. 19(November 2024).
- Dwivedi, Y. K., Hughes, L., Wang, Y., Alalwan, A. A., Belk, R., Grace, S. J., Janarthanan, A., Sergio, B., Gustafsson, A., Flavián, C., Hinsch, C., Hollensen, S., Veloutsou, C., & Sigala, M. (2023). *Metaverse marketing : How the metaverse will shape the future of consumer research and practice*. September 2022, 750–776. <https://doi.org/10.1002/mar.21767>
- Ennis, R. H. (2018). Critical Thinking Across the Curriculum: A Vision. *Topoi*, 37(1), 165–184. <https://doi.org/10.1007/s11740-1753-1740-1753>
- Grieco, L. N. (2016). Meeting the Demands of the 21st Century Workplace: Effects of Critical Thinking Instruction on the Application of Critical Thought. *ProQuest Dissertations and Theses*, March, 145. http://libproxy.library.wmich.edu/login?url=https://search.proquest.com/docview/1789301298?accountid=15099%0Ahttp://primo-pmtna01.hosted.exlibrisgroup.com/openurl/01WMU/01WMU_SERVICES??url_ver=Z39.1740-1753&rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation&genr
- Harahap, D. A., Faizin, M., Anisa, V., Erydani, C., Lestari, S., Dewi, D. S., & Ardhi, M. A. (2025). *Project-Based*

- Learning with AI-Integration to Foster Critical Thinking Skills and Self-Efficacy of Pre-Service Teachers.* 12(5), 1453–1463.
- Heung, I., & Yim, Y. (2024). Computers and Education : Artificial Intelligence A critical review of teaching and learning artificial intelligence (AI) literacy : Developing an intelligence-based AI literacy framework for primary school education. *Computers and Education: Artificial Intelligence*, 7(October), 100319. <https://doi.org/10.1016/j.caeai.2024.100319>
- Jacob, F., John, S., & Gwany, D. M. (2020). *TEACHERS ' PEDAGOGICAL CONTENT KNOWLEDGE AND STUDENTS ' ACADEMIC ACHIEVEMENT : A THEORETICAL OVERVIEW.* 14(2), 14–44.
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., ... Kasneci, G. (2023). *ChatGPT for good ? On opportunities and challenges of large language models for education.* 103(February).
- König, J., Bremerich-vos, A., Buchholtz, C., Fladung, I., König, J., Bremerich-vos, A., Buchholtz, C., & Fladung, I. (2019). *Pre – service teachers ' generic and subject-specific lesson-planning skills : On learning adaptive teaching during initial teacher education.* 9768. <https://doi.org/10.1080/02619768.2019.1679115>
- Matorevhu, A. (2019). Student Perceptions of Blended Assessment Approach in The Bachelor of Education Degrees in Mathematics And Science Through Open Distance And E–Learning (Odel). *International Journal of Trends in Mathematics Education Research*, 2(1), 1. <https://doi.org/10.33122/ijtmer.v2i1.109>
- Michal, M., & Cardoso, L. M. (2026). *Navigating cognitive dissonance in generative AI adoption : Ethical and psychological dimensions of knowledge worker acceptance.* <https://doi.org/10.1108/EJIM-1740-1753-0305>
- Pratiwi, D., Saukah, A., Rachmajanti, S., & Anugerahwati, M. (2020). Classroom management in the student-teachers ' teaching practicum : Challenges and recommendations for teacher education. *International Journal of Innovation, Creativity and Change. Www.Ijicc.Net Volume 13, Issue 11, 2020, 13(11), 1185–1202.*
- Rahimi, M., & Soryani, M. (2014). The relationship between efl teachers' critical thinking skills and vocabulary learning strategy instruction across gender. *International Journal of Applied Linguistics and English Literature*, 3(1), 107–114. <https://doi.org/10.7575/aiac.ijalel.v3n.1p.107>
- Rind, I. A. (2025). *Conceptualizing the impact of AI on Teacher Knowledge and Expertise : A Cognitive Load Perspective* *Conceptualizing the Impact of AI on Teacher Knowledge and Expertise : A Cognitive Load Perspective.* 0–16. <https://doi.org/10.20944/preprints202512.1976.v1>
- Sahin-taskin, C. (2017). *Exploring Pre-service Teachers ' Perceptions of Lesson Planning in Primary Education.* 8(12), 57–63.
- Tateo, L., & Adinolfi, P. (2010). *A Case Study of Master Course Integrating Educational and ICT Innovations :* 1(December), 16–29. <https://doi.org/10.4018/jdlc.2010100103>
- Tlili, A., Huang, R., Shehata, B., Liu, D., Zhao, J., Hosny, A., Metwally, S., Wang, H., Denden, M., Bozkurt, A., Lee, L. H., Beyoglu, D., Altinay, F., Sharma, R. C., Altinay, Z., Li, Z., Liu, J., Ahmad, F., Hu, Y., & Salha, S. (2022). Is Metaverse in education a blessing or a curse : a combined content and bibliometric analysis. *Smart Learning Environments.* <https://doi.org/10.1186/s41740-1753-00205-x>
- Yahya, A. H., & Sukmayadi, V. (2024). *A Review of Cognitive Dissonance Theory and Its Relevance to Current Social Issues.* 36(2), 480–488.
- Yuan, R., & Lee, I. (2015). *Research Papers in Education The cognitive , social and emotional processes of teacher identity construction in a pre-service teacher education programme.* 1522(November). <https://doi.org/10.1080/02671522.2014.932830>
- Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J. B., Yuan, J., & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, 2021. <https://doi.org/10.1155/2021/8812542>
- Zheng, L., & Yang, Y. (2024). Heliyon Research perspectives and trends in Artificial Intelligence-enhanced language education : A review. *Heliyon*, 10(19), e38617. <https://doi.org/10.1016/j.heliyon.2024.e38617>
- Zogheib, Salah; Zogheib, B. (2024). *U NDERSTANDING U NIVERSITY S TUDENTS ' A DOPTION OF C HAT GPT : I NSIGHTS FROM TAM , SDT , AND.* 23.

Zuengler, J., & Miller, E. R. (2006). Cognitive and sociocultural perspectives. *TESOL Quarterly*, 40(1), 35–58.

Acknowledgements (Optional)

This research did not obtain any particular financial support from governmental, commercial, or non-profit funding organizations. Nonetheless, Anis Trisusana had financial assistance via the Beasiswa Pendidikan Indonesia (Indonesian Education Scholarship) initiative, which facilitated her academic pursuits during the timeframe of this research.

Author Declaration

The authors assert that this document is an original creation and has neither been published nor submitted for publication in any other venue. All contributors participated in the advancement of the research and endorsed the conclusive draft of the paper. The authors affirm that there are no conflicts of interest pertaining to this research, its results, or its dissemination.