

Designing Ai-Integrated Teaching Materials For Pre-Service English Teachers: A Lesson From Teachers Professional Education Practices

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Abstract

Lesson planning is a core professional skill for pre-service teachers, particularly within Indonesia's Kurikulum Merdeka, which emphasizes the development of Modul Ajar as flexible, creative, and learner-centered teaching modules. With the growing presence of Artificial Intelligence (AI) in education, this study investigates how pre-service English teachers integrate AI tools into Modul Ajar development, exploring their perceived benefits, challenges, and professional implications. Employing a qualitative descriptive design, data were collected from seven pre-service teachers enrolled in the Pendidikan Profesi Guru (PPG) program through lesson plan documents, reflection journals, and focus group discussions. Thematic analysis was used to examine patterns of AI use, perceptions, and reflections across data sources. Findings reveal that participants used a range of AI tools, such as ChatGPT, Grammarly, Quillbot, and Canva, to support lesson planning. These tools assisted in drafting objectives, generating activities, refining language, and creating visual materials, enabling participants to focus on higher-order pedagogical considerations. Reported benefits included efficiency, improved clarity, enhanced creativity, and support for differentiated instruction. However, participants also identified significant challenges, including over-reliance on AI outputs, contextual misalignment with the Indonesian curriculum, occasional inaccuracies, and the irreplaceable need for human judgment in adapting lessons to learners' needs. The study underscores that while AI can serve as both a scaffold and a catalyst for reflective practice, its effective integration requires critical evaluation, pedagogical guidelines, and professional judgment. Recommendations highlight the need for AI literacy training, context-sensitive frameworks, and further research on the long-term impact of AI integration on teaching competence and student outcomes.

Keywords: Artificial intelligence; Teaching materials, Lesson planning; Teacher education

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INTRODUCTION

Lesson planning is a fundamental professional competence for pre-service teachers because it shows how well they can transform theoretical knowledge of pedagogy, curriculum, assessment, and learner development into coherent classroom practice. In teacher education, lesson planning is not merely an administrative task; it is an intellectual and reflective process through which teachers make decisions about learning objectives, instructional strategies, materials, classroom interaction, assessment, and learner support. For pre-service teachers, this process is especially important because it allows them to bridge the gap between what they learn in coursework and what they experience in real classrooms. In the Indonesian context, this competence has become

increasingly significant with the implementation of the Kurikulum Merdeka, which encourages teachers to design learning experiences that are flexible, contextual, learner-centered, and responsive to students' diverse needs. One important component of this curriculum is the Modul Ajar, a teaching module that functions as a practical guide for organizing learning activities, selecting materials, integrating assessment, and ensuring that instruction aligns with curriculum goals. For pre-service English teachers enrolled in the Pendidikan Profesi Guru (PPG) program, developing a Modul Ajar is therefore not only a formal requirement but also a meaningful opportunity to demonstrate pedagogical reasoning, instructional creativity, and professional readiness.

During the Praktik Pengalaman Lapangan (PPL) practicum, the Modul Ajar becomes a central instrument that supports pre-service teachers in planning, implementing, and reflecting on classroom instruction. It helps them organize their ideas before teaching, anticipate possible classroom challenges, and evaluate whether their instructional decisions meet students' learning needs. In English language teaching, the development of Modul Ajar requires careful attention to language objectives, communicative activities, classroom interaction, differentiated learning, and assessment of language skills. Pre-service English teachers must design activities that are engaging, meaningful, and appropriate for learners' proficiency levels while also ensuring that their materials support the development of listening, speaking, reading, writing, vocabulary, grammar, and intercultural understanding. This task can be demanding because they are still developing their professional identity and may have limited experience in managing real classroom situations. As a result, the ability to design a high-quality Modul Ajar during PPL reflects not only technical planning skills but also the capacity to make informed pedagogical decisions in authentic teaching contexts.

The rapid development of educational technology has introduced new possibilities for supporting lesson planning and instructional design. Artificial Intelligence (AI) tools, including ChatGPT, Grammarly, Copilot, and other large language models (LLMs), are increasingly being used to assist teachers in generating ideas, improving language accuracy, designing classroom activities, preparing teaching materials, and developing assessment instruments. Previous studies have highlighted the potential of AI to enhance teachers' professional competence and support more efficient teaching preparation (Moorhouse et al., 2024; Kohnke et al., 2023; Woo et al., 2024). In the context of English language teaching, AI can be particularly useful because it can help teachers formulate learning objectives, create reading passages, design communicative tasks, provide grammar explanations, generate assessment rubrics, and revise instructional language. These affordances are relevant for pre-service teachers who often need support in managing the complexity of lesson planning while also maintaining the quality and accuracy of English-language materials. Therefore, AI has the potential to become a valuable pedagogical partner in the development of Modul Ajar, especially when used critically and responsibly.

AI integration is also important because pre-service teachers face multiple responsibilities during practicum. They must understand curriculum expectations, prepare lesson plans, teach in real classrooms, assess student learning, respond to mentor feedback, and reflect on their teaching performance. These responsibilities can create a heavy cognitive load, particularly for novice teachers who are still learning how to connect theory with classroom realities. AI may help reduce this burden by providing initial drafts, suggesting alternative activities, improving the clarity of instructions, and supporting the development of assessment tools. Studies have shown that pre-service teachers often perceive technology as a practical resource for managing planning, classroom activities, and assessment tasks (Gorospe, 2022; Squires et al., 2022). However,

the use of AI should not be understood as a replacement for teachers' professional judgment. Instead, AI should be viewed as a support system that requires teachers to evaluate, adapt, and contextualize its outputs. This distinction is important because effective lesson planning depends not only on producing teaching documents but also on making pedagogically sound decisions based on students' needs, classroom conditions, and curriculum demands.

Despite its potential, the use of AI in teacher education presents several challenges. One major concern is the accuracy and appropriateness of AI-generated content. AI tools can produce materials that appear fluent and well-organized but may contain factual inaccuracies, irrelevant activities, unsuitable language levels, or weak alignment with learning objectives (Kohnke et al., 2023). Pre-service teachers who rely on AI without sufficient critical evaluation may risk producing Modul Ajar that are technically polished but pedagogically limited. Another challenge is the variation in pre-service teachers' technical skills and AI literacy. Although digital literacy has generally improved after the COVID-19 pandemic, AI-specific competencies remain uneven and require further development (Moorhouse, 2023; Sartika et al., 2021). Teachers need to understand how to write effective prompts, assess AI-generated outputs, revise materials ethically, protect student data, and avoid overdependence on automated tools. These competencies are essential if AI is to be integrated into lesson planning in a way that strengthens, rather than weakens, professional decision-making.

Structured mentoring is also necessary to ensure that pre-service teachers use AI effectively during PPL. Without guidance from lecturers, mentor teachers, or supervisors, AI use may remain superficial, inconsistent, or ethically problematic. Previous research has emphasized the importance of mentoring in helping pre-service teachers connect pedagogical knowledge with classroom practice and develop professional confidence (Delgado et al., 2020; Jita & Munje, 2021; Orland-Barak & Wang, 2021; Tutyandari et al., 2022). In the context of AI-enhanced teacher education, mentoring can help pre-service teachers evaluate the quality of AI-generated lesson plans, adapt materials to local classroom contexts, and reflect on the implications of using AI in instructional decision-making. Recent discussions also suggest that teacher education programs need clearer frameworks for AI competencies, ethical use, and professional development (Getenet et al., 2024; Mali, 2024). Such frameworks are particularly important in the PPG program because pre-service teachers are expected to become professionally competent educators who can respond to changing educational demands.

Although existing studies have examined AI in education and teacher professional development, empirical research focusing specifically on how pre-service English teachers use AI to develop Modul Ajar during PPL remains limited. Much of the current discussion emphasizes general benefits, such as efficiency, creativity, and language support, but less attention has been given to the actual practices, challenges, and decision-making processes involved in AI-assisted lesson planning. This gap is important because the development of Modul Ajar under the Kurikulum Merdeka requires contextual sensitivity, curriculum alignment, and pedagogical reflection. Understanding how pre-service English teachers use AI in this process can provide valuable insights into whether AI supports meaningful instructional design or merely accelerates document production. It can also reveal the kinds of support, training, and mentoring needed to ensure that AI integration contributes to professional growth.

Therefore, this study investigates the use of AI by pre-service English teachers in developing Modul Ajar during the PPL practicum. The objectives of the study are to explore how pre-service English teachers use AI tools in the process of designing Modul Ajar, to identify the affordances and limitations they experience, and to examine how AI

influences their professional decision-making in lesson planning. Based on these objectives, the study addresses two research questions: (1) How do pre-service English teachers use AI tools in developing Modul Ajar during PPL? and (2) What affordances and challenges do pre-service English teachers experience when integrating AI into Modul Ajar development? The novelty of this study lies in its specific focus on AI-assisted Modul Ajar development within the Indonesian PPG and Kurikulum Merdeka context. By examining the intersection of AI, English teacher education, lesson planning, and practicum-based professional learning, this study offers context-specific evidence that can inform teacher education programs, mentoring practices, and responsible AI integration in future English language teaching.

RESEARCH METHOD

Research Design

This study employed a qualitative descriptive research design to investigate how pre-service English teachers integrated Artificial Intelligence (AI) tools into the development of *Modul Ajar* during their Teacher Professional Education Program (*Pendidikan Profesi Guru/PPG*). A qualitative descriptive design was considered appropriate because the study aimed to provide a detailed and context-based understanding of participants' actual experiences, perceptions, challenges, and reflections in using AI for lesson planning. Rather than testing a hypothesis or measuring the effectiveness of AI statistically, this research focused on describing how AI was used, what benefits and limitations were perceived, and how pre-service teachers made professional decisions when adapting AI-generated outputs into their teaching modules.

This design was suitable for addressing the research objectives because the study examined a relatively new phenomenon: AI-assisted *Modul Ajar* development in the context of English teacher preparation under the Indonesian *Kurikulum Merdeka*. Since pre-service teachers' experiences with AI involve personal judgment, contextual adaptation, professional reflection, and pedagogical reasoning, qualitative description allowed the researcher to capture these dimensions in participants' own words and practices. The design also enabled the researcher to analyze multiple forms of data, including teaching module documents, reflection journals, and focus group discussion responses, thereby producing a richer understanding of how AI supported or constrained the lesson-planning process.

The use of qualitative description was also relevant because the study was conducted in a natural educational setting, namely the PPG program and school-based teaching practice (*Praktik Pengalaman Lapangan/PPL*). Participants were not placed in an experimental condition; instead, their existing practices in using AI tools such as ChatGPT, Grammarly, Quillbot, Canva, and other AI-supported platforms were examined as part of their authentic professional learning process. This allowed the study to explore AI integration as it occurred in real teacher education practice, particularly in relation to curriculum alignment, learning objective formulation, activity design, assessment preparation, language refinement, and visual material development.

However, several limitations and potential biases were associated with the chosen design. First, the small number of participants limited the generalizability of the findings. Since the study involved only seven pre-service English teachers from one PPG program, the findings may not represent all pre-service teachers in Indonesia. To address this limitation, the study emphasized depth rather than breadth by examining participants' documents, written reflections, and discussion responses in detail. Second, the study relied partly on self-reported data from reflection journals and FGDs, which may have been influenced by social desirability bias. Participants might have emphasized positive

experiences with AI or minimized difficulties because they were aware that AI integration was the focus of the study. To mitigate this issue, the researcher triangulated self-reported data with participants' *Modul Ajar* documents, enabling comparison between what participants said and how AI-supported planning appeared in their actual teaching materials.

Participants

The participants of this study were seven pre-service English teachers enrolled in the Teacher Professional Education Program (PPG) at IKIP Siliwangi in 2024. They were selected because they had completed the required PPG academic program and had participated in school-based teaching practice (PPL), which made them suitable informants for examining AI use in *Modul Ajar* development. As stated in the manuscript, the PPG program consisted of 38 credits (SKS) completed within one academic year, including core courses, selective courses, elective courses, and school-based teaching practice.

The sample size of seven participants was appropriate for a qualitative descriptive study because the purpose was not to produce statistical generalization but to obtain in-depth insights into participants' experiences and practices. The participants were chosen based on their relevance to the research focus. The selection criteria included: first, they were enrolled in the PPG program; second, they were pre-service English teachers; third, they had completed coursework related to pedagogical and professional teacher preparation; fourth, they had completed or were involved in PPL; and fifth, they had experience developing *Modul Ajar* with the support of AI tools.

The demographic profile of the participants showed variation in gender, age, and academic background. The group consisted of five female participants and two male participants. Their ages ranged from 24 to 29 years old, indicating that they were early-career or emerging professionals in the field of English education. Six participants held an S.Pd. in English Education, while one participant held an M.Pd. in English Education. All participants had completed the 38 SKS PPG program, including 12 SKS of PPL conducted over two semesters.

To protect participants' identities and ensure confidentiality, pseudonyms were used, namely P1, P2, P3, P4, P5, P6, and P7. The use of pseudonyms was important because participants shared personal experiences, challenges, and reflections related to AI use in their professional preparation. Their participation provided valuable data on how pre-service English teachers use AI tools to design learning objectives, develop instructional activities, refine language, prepare assessment components, and create visual teaching materials. Since all participants had both theoretical and practical exposure to teacher education, they were considered capable of providing informed reflections on the role of AI in *Modul Ajar* development.

Instruments

This study used three main research instruments: lesson plan document analysis, reflection journals, and Focus Group Discussion (FGD). These instruments were selected to obtain comprehensive data about participants' AI-assisted *Modul Ajar* development from different perspectives. The use of multiple instruments enabled the researcher to examine not only what participants reported about AI use but also how AI integration appeared in their actual teaching documents and reflective accounts. The first instrument was lesson plan document analysis. The documents analyzed were the participants' *Modul Ajar*, which were developed as part of their PPG and PPL activities. These documents were used to identify how AI tools contributed to the construction of learning objectives, teaching materials, classroom activities, assessment tasks, differentiation

strategies, and visual learning resources. The document analysis focused on whether the *Modul Ajar* showed evidence of AI-supported planning, curriculum alignment, pedagogical coherence, and adaptation to learners' needs. This instrument was important because it provided direct evidence of participants' instructional design practices rather than relying only on self-reported data.

The second instrument was the reflection journal. Participants were asked to document their experiences in using AI during the process of developing *Modul Ajar*. The journals encouraged participants to reflect on the AI tools they used, the reasons for using them, the benefits they experienced, the challenges they encountered, and the decisions they made when accepting, modifying, or rejecting AI-generated suggestions. The reflection journal was developed to capture participants' professional thinking and reflective practice. It helped reveal how participants understood AI not merely as a technical tool but as a source of ideas, feedback, and instructional support that still required human judgment.

The third instrument was the Focus Group Discussion (FGD). The FGD involved the seven participants and was conducted to obtain deeper information about their collective experiences and perspectives on AI integration. The discussion explored several key areas, including types of AI tools used, specific functions of AI in *Modul Ajar* development, perceived benefits, limitations, ethical concerns, contextual challenges, and recommendations for future teacher education practice. The FGD was useful because it allowed participants to compare experiences, respond to one another's ideas, and clarify issues that emerged from the lesson plan documents and reflection journals. The instruments were developed based on the research objectives and research questions. The document analysis guide was aligned with key components of *Modul Ajar*, such as learning objectives, instructional activities, assessment, differentiation, language use, and teaching materials. The reflection journal prompts were designed to elicit participants' personal experiences and professional reflections on AI use. Meanwhile, the FGD guide was developed to explore broader themes related to AI affordances, challenges, and professional implications.

To ensure validity and reliability, several steps were taken. First, the instruments were aligned with the objectives of the study, ensuring that each instrument generated data relevant to AI-assisted *Modul Ajar* development. Second, data were collected from three different sources, allowing triangulation across documents, journals, and FGD responses. Third, the use of repeated coding and comparison across data sources helped strengthen the consistency of interpretation. Fourth, representative excerpts from participants' journals and FGD responses were used to support the findings, ensuring that the analysis remained grounded in participants' actual experiences. These steps helped improve the credibility, dependability, and trustworthiness of the research instruments.

Data Analysis

The data were analyzed using thematic analysis, following the procedures commonly associated with qualitative research. Thematic analysis was appropriate because the study sought to identify recurring patterns, meanings, and themes across participants' lesson plan documents, reflection journals, and FGD responses. This analytical approach enabled the researcher to examine how pre-service English teachers used AI tools, what benefits they perceived, what challenges they encountered, and how AI influenced their professional decision-making in developing *Modul Ajar*. The analysis began with data familiarization. The researcher carefully read the participants' *Modul Ajar*, reflection journals, and FGD transcripts several times to gain an overall

understanding of the data. During this stage, the researcher noted initial impressions related to AI use, such as drafting learning objectives, generating classroom activities, editing language, designing visual materials, supporting differentiated instruction, and revising assessment components. This process helped the researcher identify meaningful units of data that were relevant to the research questions.

The next stage involved initial coding. Data from the three sources were coded according to recurring ideas and practices. For example, codes were assigned to references to “AI for generating ideas,” “AI for grammar correction,” “AI for visual design,” “AI for differentiation,” “over-reliance on AI,” “contextual mismatch,” “generic AI output,” and “teacher judgment.” These codes were then compared across participants and data sources to identify similarities and differences in AI use. Lesson plan documents were examined to see whether AI-supported components were visible in the structure of the *Modul Ajar*, while journals and FGD data were analyzed to understand participants’ reasoning, perceptions, and reflections. After coding, related codes were grouped into broader themes. The major themes included: forms of AI use in developing Modul Ajar, perceived benefits of AI integration, challenges and limitations of AI use, and professional implications for pre-service teacher development. These themes reflected the central focus of the study and were consistent with the findings presented in the attached manuscript, which reported participants’ use of ChatGPT, Grammarly, Quillbot, Canva, and other AI tools for lesson planning, language refinement, activity design, and visual material development.

Triangulation was used to strengthen the credibility of the analysis. Data from the *Modul Ajar* documents were compared with reflection journal entries and FGD responses. For instance, when participants reported that AI helped them generate differentiated activities, the researcher examined whether such differentiation appeared in their lesson plan documents. Similarly, when participants mentioned challenges such as contextual misalignment or generic AI outputs, these claims were compared with evidence from their journals and discussion responses. This triangulation helped ensure that the findings were not based on a single data source.

The final stage involved reviewing, refining, and interpreting the themes. The researcher examined whether each theme addressed the research questions and whether the themes were clearly supported by the data. The interpretation focused not only on describing AI use but also on explaining its pedagogical meaning. For example, AI was interpreted as a tool that supported efficiency and creativity, but also as a resource that required critical evaluation, contextual adaptation, and professional judgment. Through this analytical process, the study produced a comprehensive understanding of how pre-service English teachers integrated AI into *Modul Ajar* development and how this integration shaped their reflective and professional learning.

RESEARCH FINDINGS AND DISCUSSION

Research Findings

How do pre-service English teachers use AI tools in developing *Modul Ajar* during PPL?

The findings show that pre-service English teachers used AI tools as supportive resources in different stages of *Modul Ajar* development during PPL. Their use of AI was not limited to one function but covered several instructional design activities, including formulating learning objectives, generating classroom activities, editing instructional language, improving the clarity of teaching materials, creating visual media, and designing differentiated learning tasks. This indicates that AI functioned as a planning

assistant that helped participants manage the technical and creative demands of lesson preparation.

ChatGPT was mainly used to help participants draft learning objectives and generate classroom activities. Participants used it to obtain initial ideas for role-plays, project-based tasks, discussion activities, and other learning strategies that could be aligned with the objectives of English lessons. However, the AI-generated suggestions were not used directly without revision. Participants still needed to adjust the content to suit students' proficiency levels, the local syllabus, classroom conditions, and the expectations of *Kurikulum Merdeka*. This shows that AI supported the early drafting stage of *Modul Ajar*, but final pedagogical decisions remained under the control of the pre-service teachers. Grammarly and Quillbot were used primarily for language refinement. Since the participants were developing English teaching materials, accuracy, clarity, and readability were important aspects of their *Modul Ajar*. Grammarly helped them check grammar, sentence structure, and coherence, while Quillbot supported rephrasing and improving sentence flow. These tools were useful in helping participants produce clearer instructional instructions, learning steps, and assessment descriptions. In this sense, AI contributed to improving the linguistic quality of the lesson plan documents.

Participants also used Canva and other AI-supported visual tools to create teaching media such as slides, posters, and visual aids. These tools helped them make learning materials more attractive and accessible for students. In addition, AI activity generators were used to design differentiated learning activities, especially activities that could address students with different English proficiency levels. The use of these tools suggests that AI helped participants move beyond basic lesson planning toward more creative, multimodal, and learner-responsive instructional design. The use of AI in developing *Modul Ajar* during PPL can be understood as a scaffolded process. AI helped participants begin the planning process, enrich activity design, improve language quality, and create supporting materials. Nevertheless, participants still had to evaluate, revise, and contextualize AI-generated outputs. Therefore, AI did not replace teacher agency; instead, it supported pre-service teachers in becoming more reflective and efficient instructional designers.

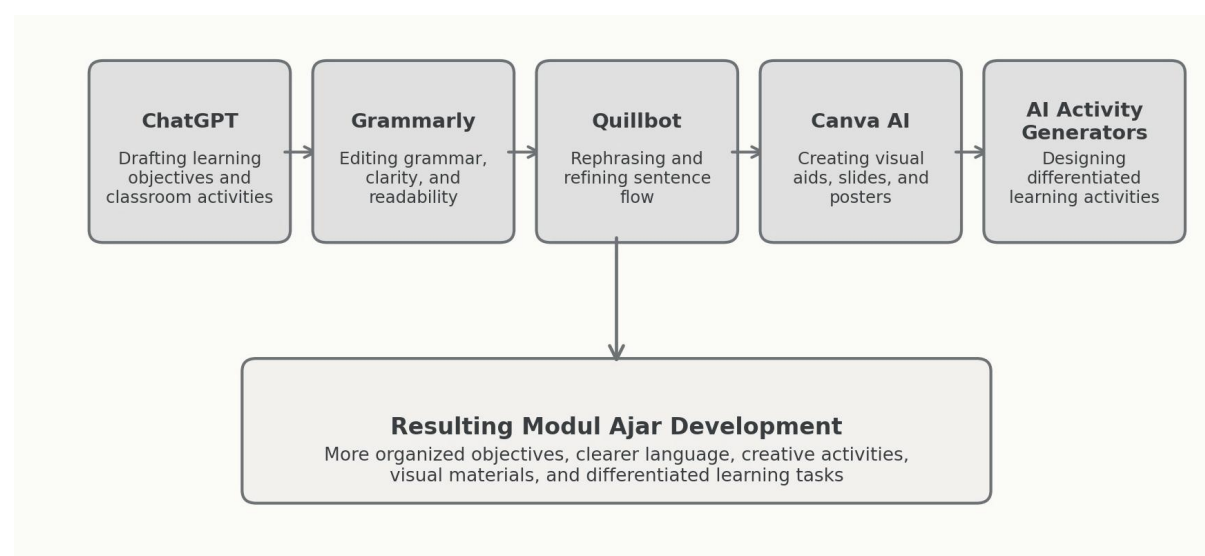


Figure 1. AI Tool Use in Developing Modul Ajar during PPL

Figure 1 illustrates how pre-service English teachers used different AI tools in a connected process of developing *Modul Ajar* during PPL. The chart shows that AI was not used as a single-purpose tool, but as a set of complementary supports for different stages of lesson planning. Each tool contributed to a specific part of the *Modul Ajar* development process, beginning with idea generation and continuing through language refinement, visual material creation, and differentiated activity design.

The first tool shown in the chart is ChatGPT, which was mainly used to draft learning objectives and generate classroom activities. This indicates that pre-service teachers relied on ChatGPT during the early planning stage, especially when they needed ideas for structuring lessons, designing role-plays, creating project-based tasks, or aligning activities with learning goals. However, the use of ChatGPT did not mean that participants accepted AI-generated content without revision. Instead, they used it as a starting point that still required adjustment based on curriculum demands, students' English proficiency, and classroom context.

The chart then shows the use of Grammarly and Quillbot as tools for improving the linguistic quality of the *Modul Ajar*. Grammarly supported participants in editing grammar, clarity, and readability, while Quillbot helped them rephrase sentences and refine sentence flow. This suggests that AI played an important role in helping pre-service English teachers produce clearer and more polished instructional documents. Since *Modul Ajar* includes learning objectives, teaching steps, assessment descriptions, and classroom instructions, language clarity is essential to ensure that the lesson plan is understandable and professionally written. The next stage in the chart highlights Canva AI, which was used to create visual aids, slides, and posters. This shows that AI integration was not limited to written lesson planning but also extended to the development of teaching media. By using Canva AI, participants could design more attractive and engaging visual materials to support classroom instruction. This is important in English language teaching because visual media can help students understand content more easily, increase motivation, and support communicative classroom activities.

The final tool category shown in the chart is AI activity generators, which were used to design differentiated learning activities. This indicates that pre-service teachers used AI to respond to students' diverse proficiency levels and learning needs. Differentiated activities are especially relevant in the context of *Kurikulum Merdeka*, which emphasizes learner-centered and flexible instruction. Through AI-generated suggestions, participants could design tiered exercises or alternative tasks for students with different levels of English ability. Figure 1 shows that AI supported *Modul Ajar* development in a sequential and integrated way. AI tools helped participants produce more organized learning objectives, clearer instructional language, creative classroom activities, visual teaching materials, and differentiated learning tasks. The chart also implies that AI functioned as a scaffold rather than a replacement for teacher judgment. Pre-service teachers still needed to evaluate, adapt, and contextualize AI-generated outputs so that the final *Modul Ajar* remained suitable for the curriculum, learners, and classroom realities.

What affordances and challenges do pre-service English teachers experience when integrating AI into *Modul Ajar* development?

The participants experienced several affordances when integrating AI into *Modul Ajar* development. The most prominent affordance was efficiency. According to the manuscript, 90% of participants perceived that AI helped them save time in brainstorming ideas and preparing lesson components. AI enabled them to generate

initial drafts, activity ideas, and teaching materials more quickly, allowing them to focus more on evaluating lesson quality and adapting materials to learners' needs. This was particularly helpful during PPL, when pre-service teachers had to balance lesson preparation, classroom teaching, assessment, mentor feedback, and reflection.

Another major affordance was improvement in language quality. The study reported that 85% of participants perceived AI as helpful in refining grammar, sentence structure, readability, and coherence. This benefit is highly relevant in English teacher education because pre-service teachers must prepare lesson documents and instructional materials in accurate and understandable English. AI tools such as Grammarly and Quillbot helped participants improve the clarity of their teaching instructions and written lesson components.

AI also supported creativity and innovation in lesson planning. The manuscript reports that 78% of participants perceived AI as useful for generating creative alternatives, such as interactive storytelling, role-plays, and other engaging activities. This suggests that AI helped participants expand their instructional imagination by offering ideas they might not have developed independently. In addition, 65% of participants perceived AI as helpful for differentiation because it suggested tiered activities for students with different proficiency levels. This affordance is important because *Kurikulum Merdeka* emphasizes flexible and learner-centered instruction. However, participants also experienced several challenges. The most significant challenge was over-reliance on AI, reported by 70% of participants. Some participants admitted that they depended too much on AI-generated suggestions, even when the suggestions were not fully suitable for their students. This challenge shows that AI use may weaken critical decision-making if pre-service teachers accept AI outputs without careful evaluation.

Contextual limitation was another important challenge, reported by 65% of participants. AI-generated suggestions did not always fit the Indonesian curriculum, local syllabus, students' age, or classroom context. This means that AI tools may produce technically correct materials but fail to address the specific realities of PPL classrooms. In addition, 60% of participants reported inaccuracies or generic outputs, such as sentences that were grammatically correct but sounded unnatural or activities that lacked contextual relevance. Finally, 55% of participants recognized that some aspects of teaching still required human judgment. AI could assist with planning, editing, and idea generation, but it could not fully predict classroom dynamics, student responses, emotional engagement, or the practical challenges of implementation. Therefore, participants needed to revise AI-generated materials based on their professional understanding of learners, curriculum goals, and classroom situations.

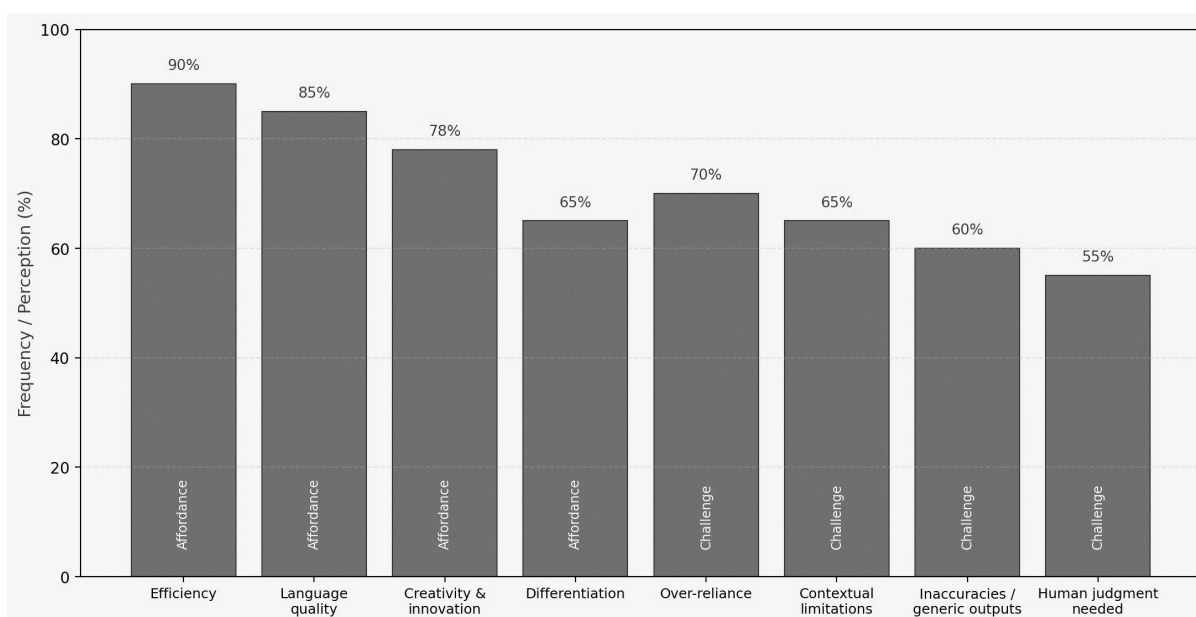


Figure 2. Summary of Affordances and Challenges in AI Integration

Discussion

The findings of this study indicate that pre-service English teachers used AI tools as practical, creative, and reflective supports in developing *Modul Ajar* during PPL. Based on the lesson plan documents, reflection journals, and FGD data, participants employed AI tools such as ChatGPT, Grammarly, Quillbot, Canva, and AI activity generators to assist different stages of lesson planning, including drafting learning objectives, generating classroom activities, refining language, designing visual materials, and developing differentiated learning tasks. This finding confirms previous studies which argue that AI has become increasingly relevant in language education because it can assist teachers in preparing instructional content, improving language quality, and expanding pedagogical ideas (Kohnke et al., 2023; Woo et al., 2024). In this study, AI was not used as a replacement for teachers' pedagogical responsibility, but as a supportive tool that helped participants initiate, revise, and enrich their lesson plans. This supports Moorhouse et al. (2024), who explain that generative AI can contribute to teacher professional development when it is used as a resource for reflection and instructional improvement rather than as an automatic producer of final teaching materials.

One important finding is that ChatGPT was mainly used in the early stage of *Modul Ajar* development, particularly for formulating learning objectives and generating classroom activities. Participants used ChatGPT to obtain ideas for role-plays, project-based learning, discussions, and other communicative activities that could support English language learning. This finding is consistent with Kohnke et al. (2023), who found that ChatGPT can provide useful assistance in English language learning and teaching by generating examples, explanations, and activity ideas. Similarly, Woo et al. (2024) emphasize that generative AI can support language educators by offering flexible and immediate instructional suggestions. However, the present study extends these findings by showing how ChatGPT was used specifically in the Indonesian PPG context for developing *Modul Ajar* under *Kurikulum Merdeka*. Unlike general AI use in language teaching, the participants' use of ChatGPT was shaped by curriculum requirements, student proficiency levels, and classroom realities encountered during PPL. Thus, this study contributes a more context-specific understanding of AI-assisted lesson planning in teacher professional education.

The findings also reveal that Grammarly and Quillbot played an important role in improving the linguistic quality of the participants' *Modul Ajar*. Participants used these tools to revise grammar, sentence structure, clarity, coherence, and readability. This supports Li and Ni (2022), who note that AI-powered tools in second language education can assist users in improving language accuracy and written expression. In the context of English teacher education, this affordance is particularly important because pre-service teachers are expected to produce instructional documents that are not only pedagogically appropriate but also linguistically accurate. The participants' reliance on Grammarly and Quillbot suggests that AI helped reduce the burden of language editing, allowing them to concentrate more on the pedagogical substance of their lesson plans. This finding confirms Gorospe's (2022) argument that AI can reduce workload and support teacher candidates in handling multiple academic and practical responsibilities. However, the finding also extends previous studies by showing that language-focused AI tools contributed not only to surface-level correction but also to the professional presentation of teaching documents.

Another significant finding concerns the use of Canva and other AI-supported visual tools to design teaching media. Participants used Canva AI to create slides, posters, and visual aids that could make classroom activities more attractive and accessible. This result aligns with Delgado et al. (2020), who argue that educational technology can improve student learning experiences when it supports instructional clarity and engagement. It also confirms Holmes et al. (2021), who suggest that AI can enhance creativity and provide new possibilities for teaching and learning. In the present study, visual design tools supported pre-service teachers in transforming lesson ideas into concrete teaching resources. This is important in English language classrooms because visual materials can support comprehension, stimulate interaction, and help learners engage with language tasks. The finding suggests that AI integration in lesson planning should not be limited to text generation; it also includes multimodal teaching material development. Therefore, this study extends the discussion of AI in language education by highlighting its contribution to visual and multimodal aspects of *Modul Ajar* design.

The study also found that AI supported differentiated instruction. Participants reported that AI activity generators helped them design tiered exercises and alternative tasks for students with different levels of English proficiency. This finding is relevant to the principles of *Kurikulum Merdeka*, which emphasizes flexible, learner-centered, and contextual instruction. It also supports Tutyandari et al. (2022), who emphasize the importance of lesson planning in implementing *Kurikulum Merdeka* because teachers need to design learning activities that respond to students' needs. The present study confirms that AI can assist pre-service teachers in imagining differentiated activities more efficiently. However, the finding also shows that AI-generated differentiation still required human evaluation. Participants needed to determine whether the suggested activities matched the students' actual abilities, interests, and classroom conditions. This reinforces the idea that AI can support inclusive planning, but it cannot independently understand the full complexity of learners' needs.

The affordances identified in this study include efficiency, improved language quality, creativity, innovation, and differentiation. The manuscript reports that 90% of participants perceived AI as useful for efficiency, 85% for language quality, 78% for creativity and innovation, and 65% for differentiation. These findings confirm earlier studies suggesting that AI can increase productivity, support creativity, and assist teachers in designing learning materials (Holmes et al., 2021; Moorhouse, 2023; Moorhouse et al., 2024). In particular, efficiency emerged as the most dominant affordance because AI helped participants generate ideas and prepare lesson components

more quickly. This finding is understandable in the PPL context, where pre-service teachers must manage teaching practice, lesson preparation, assessment, mentor feedback, and reflection at the same time. The finding supports Squires et al. (2022), who note that AI is often perceived as useful because it helps users manage complex academic tasks. In this study, AI functioned as a time-saving tool that allowed participants to allocate more attention to higher-order planning, such as adapting activities and aligning lesson components.

However, the findings also reveal several challenges that confirm concerns raised in previous studies. The most frequently reported challenge was over-reliance on AI, experienced by 70% of participants. This finding supports Luckin's (2017) argument that AI-based systems may create risks when users depend too heavily on automated outputs without sufficient critical judgment. It also aligns with Kohnke et al. (2023), who warn that AI-generated content may appear convincing but still require careful evaluation. In this study, some participants acknowledged that they sometimes depended too much on AI suggestions, even when those suggestions were not fully suitable for their students. This finding suggests that AI literacy should include not only technical skills in using AI tools but also critical skills in evaluating, modifying, and rejecting AI-generated content. Without such critical awareness, AI may reduce rather than strengthen pedagogical thinking.

Another challenge was contextual limitation. Participants reported that AI-generated outputs did not always align with the Indonesian curriculum, local syllabus, students' age, classroom context, or cultural setting. This finding confirms Getenet et al. (2024), who emphasize that teachers recognize both benefits and challenges in AI use, especially when AI tools fail to address specific educational contexts. It also supports Mali (2024), who highlights the need to understand ChatGPT use from the perspective of Indonesian EFL teachers because local teaching contexts shape how AI outputs are interpreted and applied. In the present study, AI could generate lesson ideas, but those ideas were sometimes too general, culturally neutral, or disconnected from the requirements of *Kurikulum Merdeka*. This finding extends previous research by demonstrating that context-sensitive adaptation is crucial in AI-assisted *Modul Ajar* development. AI may provide useful suggestions, but pre-service teachers must still localize and pedagogically filter those suggestions.

The findings further show that AI sometimes produced inaccurate, generic, or unnatural outputs. Sixty percent of participants reported inaccuracies or generic responses, while 55% emphasized that some teaching decisions still required human judgment. This confirms Zawacki-Richter et al. (2019), who argue that AI in higher education has often been discussed from technological perspectives while the role of educators remains underexplored. The present study reinforces the importance of the teacher's role by showing that AI cannot fully predict classroom dynamics, student emotions, interaction patterns, or spontaneous learning difficulties. AI may help design activities, but teachers must decide whether those activities are feasible, meaningful, and appropriate for real classroom implementation. This finding also resonates with Schön's (1983) concept of the reflective practitioner. The participants acted reflectively when they evaluated AI suggestions, considered classroom conditions, and revised lesson components based on professional judgment.

This study confirms previous research showing that AI can support language teaching, lesson planning, teacher productivity, and professional development. At the same time, it extends the existing body of knowledge by focusing specifically on AI-assisted *Modul Ajar* development among pre-service English teachers in the Indonesian PPG and PPL context. The findings show that AI integration is most valuable when it is

combined with reflection, contextual adaptation, and pedagogical decision-making. The study also highlights the need for AI literacy training in teacher education programs. Such training should help pre-service teachers formulate effective prompts, evaluate AI outputs, address ethical concerns, protect learner data, and align AI-generated materials with curriculum standards. Therefore, AI should be positioned not as an independent authority in lesson planning, but as a pedagogical scaffold that supports teacher agency, creativity, and reflective professionalism.

CONCLUSION

This study concludes that AI tools play a significant role in supporting pre-service English teachers in developing *Modul Ajar* during PPL. The findings show that participants used various AI tools, including ChatGPT, Grammarly, Quillbot, Canva, and AI activity generators, to assist different aspects of lesson planning. ChatGPT supported the drafting of learning objectives and classroom activities, Grammarly and Quillbot improved language accuracy and readability, Canva helped create visual teaching materials, and AI activity generators supported differentiated learning tasks. These uses indicate that AI can function as a practical scaffold for pre-service teachers, particularly when they are required to manage the complex demands of lesson preparation, teaching practice, assessment, and reflection. The study also demonstrates that AI can improve efficiency, enhance linguistic quality, stimulate creativity, and support learner-centered instruction. In this respect, AI integration contributes positively to teacher professional education by helping pre-service teachers produce more organized, creative, and responsive *Modul Ajar*.

However, this study also concludes that the effective use of AI in *Modul Ajar* development depends strongly on human judgment, critical reflection, and contextual adaptation. Although AI offered useful suggestions, participants still encountered challenges such as over-reliance, contextual mismatch, inaccurate or generic outputs, and the inability of AI to fully understand classroom dynamics. These challenges show that AI cannot replace the professional role of teachers in interpreting curriculum demands, understanding learners' needs, and making instructional decisions. Therefore, teacher education programs should not only introduce AI tools but also provide systematic AI literacy training, ethical guidelines, mentoring, and reflective activities. Pre-service teachers need to be trained to evaluate, revise, and contextualize AI-generated materials so that AI use strengthens rather than weakens pedagogical decision-making. Future studies may examine the long-term influence of AI-assisted lesson planning on pre-service teachers' teaching competence and investigate how AI-supported *Modul Ajar* affects student engagement and learning outcomes in real classroom settings.

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DECLARATION OF USING AI TOOLS

The authors declare that AI tools were used to assist in the preparation of this manuscript, particularly for language refinement, organization of ideas, and improvement of clarity. All AI-generated suggestions were reviewed, revised, and validated by the authors to ensure accuracy, originality, academic integrity, and alignment with the research findings.

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