

ADAPTIVE AI TEACHING ASSISTANT (AATA) AS AN INNOVATION TO STRENGTHEN THE COMPETENCE OF CERTIFIED AND NON-CERTIFIED TEACHERS IN THE DIGITAL ERA

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Abstract. Technological developments have shifted the educational paradigm from teacher-centered learning to student-centered learning. This transformation requires teachers to possess 21st-century competencies, including modern pedagogical skills, digital literacy, creativity, communication, collaboration, and critical thinking. In the context of Indonesian education, the Teacher Professional Education Program (PPG) is a strategic effort to improve teacher professionalism by strengthening pedagogical and professional competencies. However, there are still teachers who have not participated in PPG and may be experiencing a competency gap compared to certified teachers. This article aims to analyze differences in competency between certified and non-certified teachers through a literature review. It proposes the Adaptive AI Teaching Assistant (AATA) as an artificial intelligence-based conceptual innovation to support teacher competency development. The research uses a literature review with a qualitative descriptive approach, drawing on reputable international journal articles. The results of the study indicate that certified teachers have advantages in differentiated learning, authentic assessment, technology integration, and learning reflection. Based on these findings, the AATA concept was designed as a digital assistant to help teachers design learning, develop assessments, obtain pedagogical recommendations, and engage in continuous learning reflection. This innovation is expected to be an alternative solution to support teacher professional development and accelerate educational transformation in the technological era.

Keywords: teacher competency, teacher professional education, artificial intelligence, 21st-century learning

INTRODUCTION

Technological developments have brought significant changes to various aspects of life, including education in Indonesia (Kiong, 2022). The presence of digital technology, in the form of artificial intelligence (AI), and various modern learning platforms has changed the way students obtain information and build knowledge (Kiong, 2022). This condition encourages efforts to reorganize the education system to be more adaptive to technological developments and, at the same time, be able to produce competent, creative, and globally competitive human resources (Suhartono et al., 2024). In the 21st century, educational success is no longer measured solely by mastery of academic knowledge, but also by students' ability to think critically, communicate, collaborate, innovate, and utilize technology productively (Almazroa & Alotaibi, 2023). Therefore, teachers, as the main actors in the learning process, are required to possess competencies that support the development of these skills (Sunandar et al., 2023).

In the Indonesian education system, improving teacher professionalism is achieved through various programs, including the Teacher Professional Education (PPG). This program is designed to develop professional teachers with pedagogical, professional, social, and personality competencies in accordance with national education standards (Chang et al., 2024). However, not

all teachers have had the opportunity to participate in the PPG program. As a result, there is a difference in the level of competency mastery between certified and non-certified teachers. Various studies have shown that certified teachers tend to be better prepared to implement student-centered learning. In the PPG process, prospective certified teachers are taught to master pedagogical, professional, social, and personality competencies in accordance with national education standards. Meanwhile, some non-certified teachers still face challenges in adapting to the latest competencies in implementing learning practices that align with the demands of 21st-century education (Bahri et al., 2024).

On the other hand, the development of AI opens up new opportunities for teacher professional development. Artificial intelligence technology can be used not only as a learning tool but also as a professional companion that helps teachers improve their competencies independently and more effectively (Rochmad et al., 2025). Based on these conditions, this article analyzes the competency gap between certified and non-certified teachers. It proposes the Adaptive AI Teaching Assistant (AATA) as a conceptual innovation to support teacher competency development in the information technology era. AATA was created to assist non-certified teachers in adapting learning in accordance with applicable regulations. Several features available in AATA are easily accessible to all teachers throughout Indonesia. Simply by typing the desired keywords, non-certified teachers can implement pedagogical skills with differentiated learning. This is expected to help balance competencies between certified and non-certified teachers.

METHODS

This research employed a literature review with a qualitative descriptive approach. This method was used to gain a deep understanding of the competencies of certified and non-certified teachers in meeting the demands of 21st-century education and the opportunities to utilize artificial intelligence in teacher professional development (Rasmitadila et al., 2025).

The data analysis process was conducted through several stages: source identification, literature selection, and theme grouping. The analysis focused on three main aspects: the competency characteristics of certified and non-certified teachers, and the professional development needs of teachers in the information technology era. The results of the literature synthesis were then used to formulate the conceptual design of the AATA, the innovation proposed in this article (Malik & Shah, 2025).

RESULTS AND DISCUSSION

Certified Teacher Competencies in 21st-Century Education. A literature review shows that teachers who have participated in PPG have more systematic competencies in implementing 21st-century learning (Kurniadi, 2025). These competencies encompass not only mastery of learning materials but also the ability to design learning processes that optimally develop students' potential. One prominent competency is the ability to implement differentiated learning. Certified teachers can adapt learning strategies to students' needs, learning readiness, interests, and characteristics (Isnaini, 2025). This way, the learning process becomes more inclusive and provides equal opportunities for every student to achieve learning objectives. Furthermore, certified teachers are better equipped to implement authentic assessments. Assessments are conducted not only through written tests but also through projects, presentations, and other performance assessments that more realistically reflect students' abilities. This approach allows teachers to obtain more accurate information regarding student learning progress. In terms of technology, certified teachers tend to be better prepared to integrate digital technology into the learning process. Technology is used not

only as a medium for conveying information but also as a means of collaboration, exploration, and fostering student creativity (Wijaya et al., 2023).

Non-certified teachers have diverse experiences and backgrounds in implementing learning. Some teachers can develop their competencies independently through training, learning communities, and teaching experience (Mighwar & Nopaulita, 2023). However, various studies show that non-certified teachers still exhibit lower mastery of modern pedagogical competencies than certified teachers (Kingma et al., 2024). In teaching practice, some non-certified teachers still employ a teacher-centered approach. Learning often focuses on delivering material and mastering concepts, while active student engagement remains a primary focus. This can limit students' opportunities to develop higher-order thinking skills. In terms of assessment, written tests remain the dominant method. Project-based, portfolio-based, and performance assessments have not been optimally implemented. Furthermore, the use of technology in teaching is often limited to simple presentation media, with little deeper integration into the learning process (Ghaleb, 2024).

Based on the literature, the competency gap between certified and non-certified teachers lies in four key areas: differentiated learning, authentic assessment, technology integration, and learning reflection. These differences indicate that teacher professional development remains an urgent need. Amidst rapid technological development, innovations are needed to help teachers develop their competencies in a flexible, sustainable, and accessible manner.

In response to this need, this article proposes the Adaptive AI Teaching Assistant (AATA), an AI-based innovation that serves as a professional companion for teachers. AATA is not just AI, but a platform for transferring competency from certified teachers to non-certified teachers through an AI-based system and a digital professional community. AATA is a digital platform designed to assist teachers across various aspects of learning through four key features.

A. Pedagogical Coach

This feature serves as a teacher administration homepage, storing documents such as teaching modules, teaching media, assessment rubrics, and sample evaluation questions, which can be uploaded or downloaded. This preparation helps teachers prepare for classroom needs before lessons begin.

B. Smart Lesson Designer

This feature helps teachers automatically create learning materials based on subject matter, learning objectives, student characteristics, and desired learning outcomes. The system generates lesson plans that integrate differentiated learning principles. The results are derived from documents uploaded by several certified teachers.

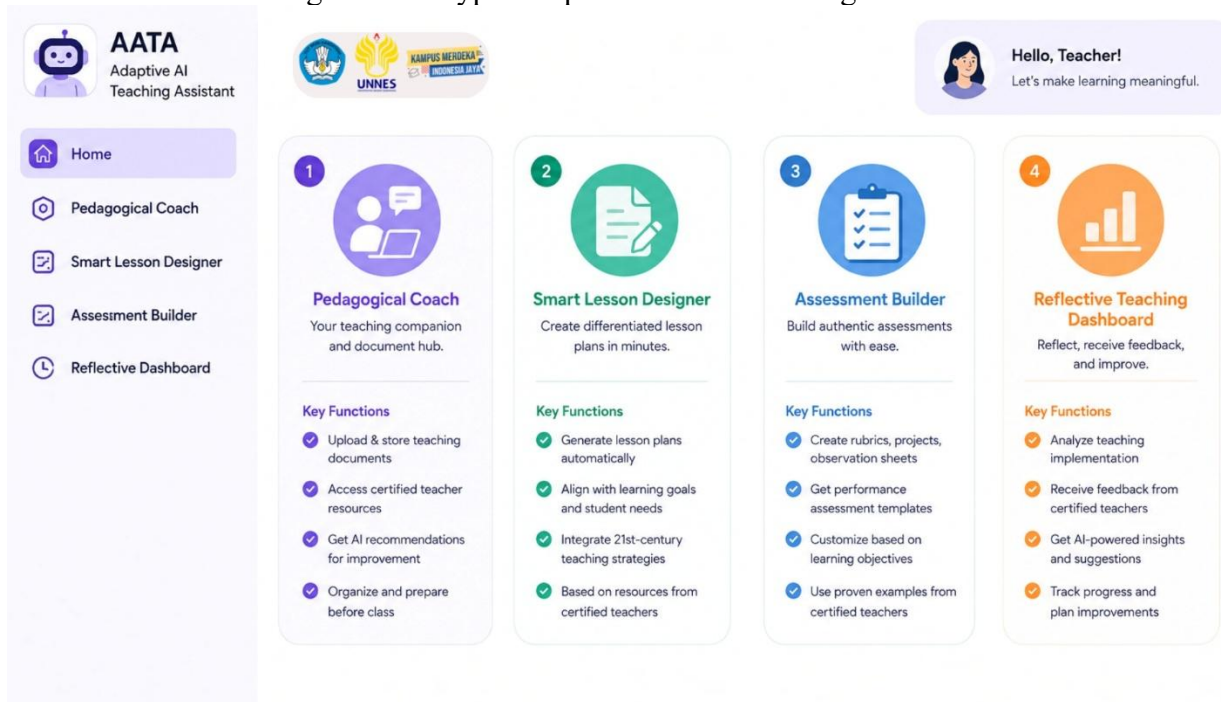
C. Assessment Builder

This feature helps teachers automatically develop authentic assessments. Teachers can access sample project rubrics, observation sheets, performance assessment instruments, and portfolios aligned with learning objectives established by other teachers.

D. Reflective Teaching Dashboard

This feature helps teachers reflect on their own learning by analyzing the implementation of non-certified teachers' learning. The system will provide recommendations to improve learning quality in subsequent sessions, based on reviews from certified teachers.

Figure 1. Prototype Adaptation of AI Teaching Assistant



The transformation of education in the technological era requires a paradigm shift in the development of teacher competency. Strengthening competence can no longer rely on monotonous, conventional training but requires a continuous, easily accessible mentoring system.

The AATA concept offers a new approach to teacher professional development using artificial intelligence. Unlike formal training, which requires significant time and expense, AATA allows teachers to receive direct professional support in designing, implementing, and evaluating learning. AATA's presence also aligns with the concept of Reimagining Education and Human Development, which positions technology as a means to improve the quality of education and develop human resources. Through artificial intelligence, teachers can access professional pedagogical practices that have traditionally been acquired through professional education or specialized training.

CONCLUSION

Technological developments have brought significant changes to the world of education, particularly in the competency requirements for teachers. In the 21st century, teachers are no longer merely transmitters of information but rather facilitators of learning, capable of developing students' critical thinking, creativity, collaboration, communication, and digital literacy skills. A literature review shows that teachers who have participated in the PPG (Community Development Program) and obtained competency certification are generally better prepared to meet these demands. This is evident in their ability to implement differentiated learning, develop authentic assessments, integrate technology into learning, and conduct systematic and ongoing reflection on learning.

Conversely, non-certified teachers have diverse teaching experiences, with some still focusing on teacher-centered learning approaches and using conventional assessments that emphasize mastery of material. This situation indicates a competency gap that could affect the quality of the

learning process and outcomes. Therefore, innovations are needed to support teacher competency development in a sustainable, flexible, and accessible manner, without relying entirely on formal training or certification programs.

In an effort to address these challenges, this article describes AATA as an artificial intelligence-based conceptual innovation designed to be a professional companion for teachers. AATA assists teachers in designing learner-centered learning, developing authentic assessments, obtaining pedagogical strategy recommendations appropriate to learner characteristics, and conducting continuous learning reflection. The presence of AATA is expected to expand teachers' access to widely disseminated professional pedagogical practices through the PPG program. Thus, the use of artificial intelligence is not only a form of technological transformation in education but also a strategy to accelerate improvements in teacher quality and to support the development of superior, adaptive, and competitive human resources in the technological era.

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