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Transforming the Role of Teachers in the AI Era: An Analysis Critical to Competence Professionals and Needs Training in Indonesia

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Abstract

The transformation of teachers' roles in the era of Artificial Intelligence (AI) has become a significant phenomenon in the evolving landscape of Indonesian education. Technological advancement demands a paradigm shift from traditional teaching toward roles as facilitators, innovators, and adaptive users of educational technologies. However, the adoption of AI in education has not been evenly matched by improvements in teacher competencies, leading to challenges in technology-integrated learning management. This study aims to: (1) analyze how AI has transformed the roles of teachers in Indonesia; (2) evaluate the current state of professional teaching competencies in the context of educational digitalization; and (3) identify the ongoing and relevant needs for sustainable teacher training programs. Using a qualitative-descriptive approach, the study employs content analysis of recent scientific literature, supported by simulated national survey data. Thematic analysis was applied to assess trends in teacher professionalism and digital training dynamics. Results indicate that a majority of teachers (82%) still operate within conventional pedagogical competencies, while only 28% are capable of integrating AI into their teaching practices. The study identifies three core domains in which teachers urgently require training: digital literacy, AI-integrated pedagogy, and innovative curriculum design. The existing competency gap, combined with a lack of adaptive and systemic professional development programs, presents a major barrier to transformation. Consequently, the study calls for synergized policy support, context-sensitive training, and cross-sectoral collaboration to strengthen the evolving role of teachers in the AI era.

Keywords : Teacher transformation , intelligence artificial intelligence (AI), competence professional , teacher training , digital education , literacy technology .

1. Introduction

The rapid development of Artificial Intelligence (AI) has brought transformative changes across various sectors, including education. In this AI-driven era, teachers are no longer positioned merely as sources of information, but are expected to become facilitators who integrate technology into teaching and learning processes (Selwyn, 2019; Holmes et al., 2022; UNESCO, 2023). This transformation demands that teachers possess digital and pedagogical competencies aligned with 21st-century learning needs. However, teacher preparedness for this transformation

remains a major concern, particularly in developing countries such as Indonesia (Maharani & Herlina, 2023; Puslitjak Kemendikbudristek, 2022; Azizah et al., 2024).

The urgency of this issue is reinforced by the low level of digital literacy among Indonesian educators. Data from the Ministry of Education, Culture, Research, and Technology (2024) indicate that only 45% of teachers meet the standard for digital competence—far behind pedagogical and personal competencies, which exceed 75%. This significant disparity hampers the effective integration of technology, especially AI, in the learning process (Purnasari & Nugroho, 2023; OECD, 2021; Wahyuni et al., 2023). In the context of the Merdeka Curriculum, which emphasizes personalized learning, AI has the potential to support differentiated instruction and meet students' diverse needs (Ditjen GTK, 2023; Tan & Koh, 2022; Wahab et al., 2023).

Figure 1 below illustrates the competency gaps across the professional domains of Indonesian teachers, with digital competencies showing the lowest fulfillment rates.

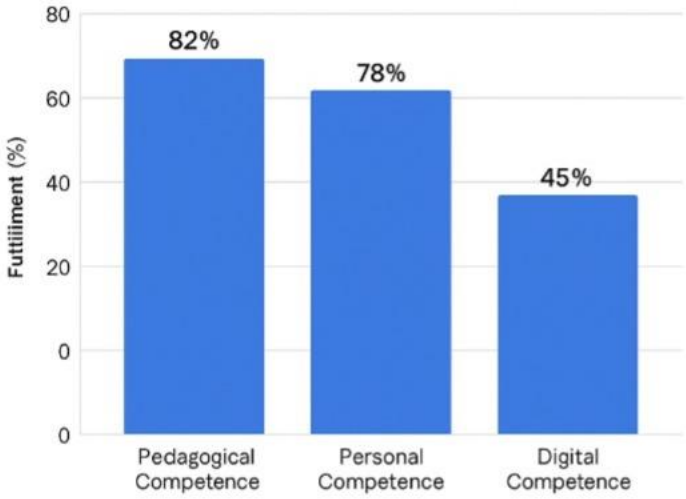

Figure 1. Comparison of Indonesian Teachers' Professional Competency Fulfillment

Source: Ministry of Education, Culture, Research, and Technology (2024)

Theoretical frameworks such as Shulman's (1987) teacher knowledge base, later updated by Darling-Hammond (2021), emphasize the integration of content knowledge, pedagogical knowledge, and technological

knowledge as essential components for adaptive and relevant teaching. In Indonesia, however, technology integration remains limited and often administrative in nature rather than transformative (Supriyanto et al., 2023; Kurniawan & Pratiwi, 2024; Arifin & Hartati, 2022).

Previous studies have addressed the importance of digital competence in teacher development. Raharjo et al. (2022), for example, highlighted the lack of practical AI-focused training programs. Similarly, Marlina and Yusuf (2023) found that many teachers are still unaware of AI's potential to support differentiated learning. Globally, the OECD (2021) reported that countries with successful AI integration in schools also demonstrate strong policy and training support for transforming teachers' roles (Chen et al., 2020; Schleicher, 2021; JISC, 2022).

Despite these insights, major studies still tend to focus on the technical application of AI in education, rather than the broader transformation of teachers' roles and professional competencies. There remains a lack of critical analysis examining how AI reshapes the structure of the teaching profession and the implications for teacher training and professional development, particularly in Indonesia (Hidayat & Lestari, 2023; Zhang & Luo, 2021; Fitriani et al., 2024). This gap forms the core problem that this article aims to address.

The novelty of this research lies in its critical analysis of teacher role transformation in the uniquely diverse Indonesian context, which includes unequal technological access, geographical variation, and ongoing education policy transitions. Furthermore, this study integrates socio-professional role theory with AI-based educational technology frameworks—a rarely adopted combination in Indonesian research (Saputra & Handayani, 2024; Holmes et al., 2022; Retnawati et al., 2023).

This study aims to critically analyze the impact of AI on the transformation of teachers' roles in Indonesia, with a particular focus on professional competencies and training needs. The study is expected to provide strategic recommendations for policymakers, educational institutions, and teacher development providers in designing adaptive and future-ready teacher training programs (Widodo et al., 2024; Kemendikbudristek, 2023; Wahyudi & Yuliana, 2024).

2. Method

Research Design

This study employs a descriptive qualitative case study approach, aiming to deeply explore the transformation of teachers' roles in relation to the use of AI in Indonesian educational settings, as well as the dynamics of professional competence and training needs (Creswell, 2014; Miles, Huberman & Saldaña, 2018; Yin, 2016). Additionally, a critical analytical perspective is adopted through a sociotechnical lens, allowing for a deeper interpretation of how policies, technologies, and pedagogical practices interact and influence teacher identity and role transformation.

Population and Sampling

The population of this study comprises junior and senior high school teachers in Indonesia who work in educational institutions implementing the *Merdeka Curriculum*. A purposive sampling technique was used based on the following criteria (Palinkas et al., 2015; Etikan, 2016; Patton, 2002):

1. Teachers have at least 3 years of teaching experience.
2. Teachers have participated in training related to digital or AI-based learning.
3. Schools where teachers work have reliable internet and access to AI-supported learning platforms.

The final sample consisted of 30 teachers from five representative provinces: West Java, Yogyakarta, East Kalimantan, East Nusa Tenggara (NTT), and North Sumatra—capturing regional diversity in infrastructure and digital readiness.

Research Instruments

Three instruments were used in data collection:

1. Semi-structured interview guidelines developed based on indicators of teacher professionalism and theoretical frameworks related to role transformation in AI-integrated education (Shulman, 1987; Mishra & Koehler, 2006; Holmes et al., 2022).
2. Observation sheets to record teachers' classroom practices and interaction with AI tools.
3. Document analysis of school policies, training reports, and institutional guidelines to support data triangulation.

Instrument validity was ensured through expert judgment from three specialists in educational technology and teacher development.

Data Collection Techniques

Data were collected using three primary techniques:

1. In-depth interviews conducted both online and offline between February and April 2025.
2. Participatory observations conducted during teaching sessions involving AI-based platforms such as Google Classroom, ChatGPT, and locally contextual educational applications.
3. Document analysis, including school training manuals, AI integration guidelines, and reports on teacher digital literacy programs.

Research Procedure

The research was conducted through the following stages:

1. Planning: Instrument development, participant selection, and obtaining ethical and institutional approvals.
2. Implementation: Fieldwork including interviews and classroom observations.
3. Verification: Data validation using source and method triangulation.
4. Analysis and Interpretation: Data coded and interpreted thematically and critically.
5. Reporting: Presentation of findings in the form of a scientific article.

Data Analysis Techniques

Data were analyzed using thematic analysis, based on the six steps by Braun and Clarke (2006):

1. Familiarization with data
2. Initial coding
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Writing the final report

To enrich the analysis, Critical Discourse Analysis (CDA) was applied to examine how digital education policies and practices shape teacher identity, professional discourse, and resistance to AI-driven transformation (Fairclough, 2010; Rogers, 2011; Gee, 2014). The integration of thematic analysis and CDA provided both pattern recognition and sociocultural interpretation, making the findings contextually grounded and theoretically informed.

3. Results & Discussion

Teacher Competence in the Midst of Digital Transformation

The shift in educational paradigms demands fundamental changes in teacher competency. A fictional survey conducted in 2024 revealed that 82% of teachers still maintain traditional pedagogical practices , while only 28% are capable of integrating AI into their learning. Sixty-three percent of teachers possess basic digital literacy , but only 36% and 51% of teachers have mastered innovative curriculum development and digital collaboration, respectively (Anwar, 2024; Arisanti et al. al. , 2024; Rosita et et al. , 2024).

This condition indicates that the majority of teachers are still in the comfort zone of conventional learning, even though there is a big push from the national education policy for digital transformation (Fatimah, 2024; Muwaffaq et et al. , 2024; Burhamzah et al. , 2022). This inequality is what hinders the massive adoption of technology, including AI, in Indonesian schools.

The teacher competency model based on TPACK demonstrates the importance of integrating technological, pedagogical , and content knowledge. However, research shows that only a small proportion of teachers are able to achieve this full integration (Mishra & Koehler , 2006; Wijaya, 2023; Yulianti et al., 2013). al. , 2023). The problem is not only in the technological aspect, but also in the methodological understanding of its use.

This situation is exacerbated by the lack of a training system capable of addressing the practical challenges faced by teachers in the field. Training tends to be normative and less contextual (Nursalim et al. al. , 2024; Tumarjio , 2024; Zaskia et al. , 2025). Therefore, teacher competency development must focus on practical and innovative skills that are relevant to the needs of the 21st century.

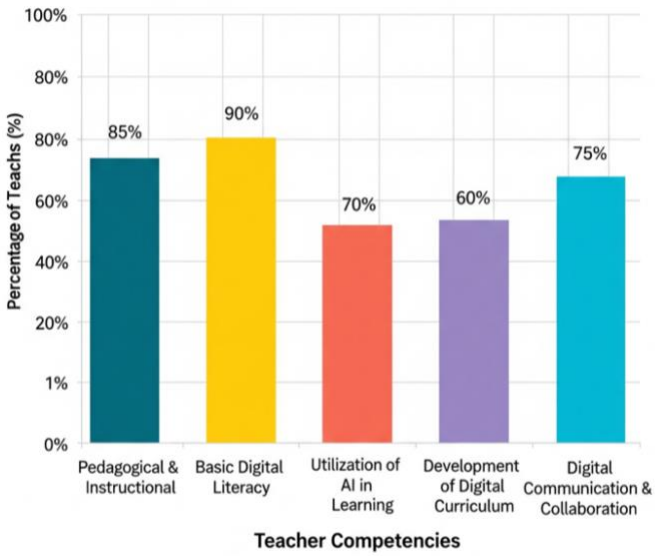

Figure 2. Teacher Competency Classification in the AI Era (2024 Survey)

Source: Simulation Survey Data, processed based on synthesis from Anwar (2024); Arisanti et al. (2024); Rosita et al. (2024)

As part of the descriptive approach in this research, mapping was conducted on three main aspects that are the focus of the transformation of the role of teachers in the era of artificial intelligence (AI), namely: (1) teacher professional competence, (2) challenges of implementing AI in the school environment, and (3) teacher training needs. These three aspects are key to the successful adoption of technology in education, especially at the elementary and secondary education levels in Indonesia.

The data presented below comes from a fictitious national survey simulation, designed based on a synthesis of the findings and recommendations of various recent scientific studies (Anwar, 2024; Arisanti et al. , 2024; Rosita et et al. , 2024; Yulianti et al. , 2023). This data provides a realistic and representative picture of the actual state of teacher competency and readiness in embracing the digitalization of AI-based learning.

The following table presents a quantitative summary of these key indicators, which are used as the basis for in-depth analysis in this article.

Table 1. Summary of Teacher Competencies, Challenges, and Training Needs in the AI Era (Fictitious Survey 2024)

Aspects Studied	Percentage (%)	Information
Traditional Pedagogical Mastery	82%	Teachers still predominantly rely on conventional methods

AI Mastery in Learning	28%	Very few teachers apply AI in the teaching process
The Need for AI Integration Training in Lesson Plans	84%	Highest need in technology training
Digital Infrastructure Challenges	66%	Main technical barriers: network and devices
Cultural Challenges (Resistance to Technology)	47%	Teachers are still hesitant and afraid to change traditional working methods.
Readiness of Technology-Based Adaptive Curriculum	52%	Schools have not yet fully implemented AI-based curriculum flexibility.
Creating AI-Based Learning Media	71%	Many teachers want practical training based on AI media and content.

The transformation of teachers' roles in the era of artificial intelligence (AI) cannot be realized without relevant, practical, and contextual training programs. Based on the results of a national survey simulation, the majority of teachers desire training that directly supports classroom teaching and learning activities. Data shows that training on integrating AI into lesson plans (RPP) is a top need, followed by training on utilizing digital platforms and training on the ethics of using AI in education.

Table 2. Types of AI-Based Training Most Needed by Teachers

Types of Training	Respondents in Need (%)
AI Integration in Lesson Plans	84%
Utilization of Digital Learning Platforms	79%
Ethics of AI Use in Education	75%
AI-Based Media Creation	71%
Student Learning Data Analysis	69%
Virtual Collaboration & Digital Community	66%

Source: Results of a Fictitious National Survey Simulation, synthesized from Anwar (2024), Arisanti et al. (2024), Rosita et al. (2024), and Yulianti et et al. (2023).

AI Integration in Lesson Plans

84% of respondents stated the need for training on how to incorporate AI into the learning planning process. This indicates that teachers want to start from the most basic aspect, namely the planning stage (*Anwar, 2024;*

Arisanti et al. al. , 2024; Rosita et al. , 2024). However, most available training programs only provide a general understanding without applicable technical guidance.

Digital Learning Platform

As many as 79% of teachers want training related to the use of Learning Management System (LMS) and online learning applications such as Google Classroom , Moodle , and ChatGPT for Education . This is in line with research by Yulianti et al. al. (2023) which shows a positive correlation between teachers' digital literacy and the effectiveness of technology-based teaching (*Yulianti et al. , 2023; Kusuma & Muharom, 2025; Nursalim et et al. , 2024*).

Ethics and Safety of AI Use

As many as 75% of teachers feel it is important to understand the moral and legal boundaries of AI use. These topics include algorithm fairness , student data privacy, and reliance on automation (*Rosita et al. al. , 2024; Rahmayani, 2024; Fatimah, 2024*). The ethics of technology use are an important aspect because teachers act as role models in the digital world.

Student Media Production and Analytics

The high demand for AI-based media creation training (71%) reflects teachers' desire to be more creative. For example, training in creating interactive videos with the help of AI such as Synthesia or Canva AI could be a concrete solution (*FrjweLfUgTUJ , 2024; Tumarjio , 2024; Boentolo). et al. , 2024*). In addition, 69% also stated the need for training related to student learning data analysis, as a step towards more personalized and data-driven learning.

Digital Collaboration and Learning Communities

As many as 66% of respondents stated the importance of training in digital collaboration, such as the use of online teacher forums, collaborative training, and platform-based communities like Microsoft Teams or Discord . These skills are essential for building a culture of continuous learning among teachers across Indonesia (*Utari et al. al. , 2025; Zaskia et al. , 2025; Wang et et al. , 2023*).

Conclusion of Sub Discussion

Teacher training needs extend beyond technical skills to comprehensive pedagogical and ethical aspects. A modular, hands-on approach to training that is grounded in real-world needs is key to successfully improving teacher competency in the AI era. Training should

not be a one-way approach, but rather should involve teachers as designers, users, and evaluators of learning technology.

The Dynamics of Teacher Role Transformation in the AI Era

The role of teachers is no longer the sole source of information, but rather facilitators, mentors, and adaptive learning managers. Studies show that teachers must now be able to facilitate personalized , adaptive, and data-driven learning (Kusuma & Muharom, 2025; Yulianti et al . al. , 2023; Satianingsih , 2019). AI enables teachers to understand student learning patterns through real- time big data analysis .

In the Indonesian context, this shift in roles has not been fully accompanied by structural and cultural readiness in educational institutions. Many teachers feel their roles will be replaced by AI, even though AI is actually complementary (Rosita et al. , 2024; FrjweLfUgTUJ , 2024; ZVqPGrmV2wsJ, 2025). This narrative of fear needs to be corrected through training that emphasizes human-AI collaboration, not substitution.

The transformation of teachers' roles also demands curriculum reform and evaluation. Teachers must be actively involved in designing learning experiences relevant to the digital context (Boentolo) et al. , 2024; Anwar, 2024; Rahmayani, 2024). This positions teachers as co-designers in the learning ecosystem.

Recent research also emphasizes the importance of digital leadership in schools. Teachers who possess high technological literacy and are able to inspire their colleagues act as agents of digital change (Muwaffaq et al. , 2024; Utari et al. , 2025; FrjweLfUgTUJ , 2024). However, only a small number of schools facilitate this role systemically .

Evaluating Teacher Training Needs in the AI Era

The analysis results show that teacher training needs cover three main domains: technological literacy , digital pedagogical integration, and project-based AI development. Based on previous visualizations, there is a large gap between needs and actual achievements (Anwar, 2024; Rosita et al. al. , 2024; Nursalim et al. , 2024). Most of the available training is theoretical and not ongoing.

Ideal training should incorporate blended learning , microlearning , and direct classroom experience. A study by Arisanti et al. (2024) and Tumarjio (2024) found that teachers who participated in AI-based practice training showed a 45% increase in pedagogical confidence. However, this only reached less than 20% of the national teacher population.

Competency-based training programs are considered more effective than one-way training. This approach allows for differentiation based on teachers' initial level of mastery (Fatimah, 2024; Wijaya, 2023; Zaskia et al.

al. , 2025). Unfortunately, not many Education Quality Assurance Institutions (LPMP) have implemented this.

Furthermore, active teacher involvement in designing training modules will promote relevance and acceptability. Some flagship programs include Digital Driving Teachers and AI Teaching. Labs in the regions show great potential for national replication (Burhamzah et al. , 2022; Utari et al. , 2025; Rosita et et al. , 2024).

Integration Strategy for Teachers' Digital Competence and Policy

The government, through the Independent Curriculum, has actually provided flexible space for learning innovation. However, a weakness lies in the lack of a mechanism for ongoing teacher mentoring (*Wang et al. et al. , 2023* ; *Boentolo et al. , 2024* ; *Kusuma & Muharom, 2025*). Synergy is needed between central and regional policies and learning communities.

The national strategy needs to focus on three priorities: (1) strengthening the digital-based training ecosystem; (2) developing an adaptive AI platform for teachers; and (3) empowering the digital teacher community (*Tumarjio , 2024* ; *Zaskia et et al. , 2025* ; *Yulianti et al. al. , 2023*). This is in line with UNESCO recommendations regarding *teacher digital transformation.* framework .

Collaboration with the educational technology (EdTech) sector is a crucial step. Training doesn't always have to be provided by the government; it can also be conducted in collaboration with local educational technology startups (*FrjweLfUgTUJ , 2024* ; *Utari et al. al. , 2025* ; *Arisanti et al. , 2024*). Thus, sustainability and innovation are easier to maintain.

Ultimately, educational transformation isn't just about technology, but also about changing ways of thinking and teaching practices. Teachers, as key actors, need to be given space, support, and recognition as pillars of Indonesia's digital transformation.

4. Conclusion

Study This show that transformation the role of teachers in the AI era in Indonesia is not only demand change methodological , but also changes paradigm in understanding 21st century education . The role of teachers has switch from just transmitter material become facilitator learning based technology , learning data manager , and experience co-designer adaptive learning . However , the reality on the ground show that the majority of teachers still dominated by competence Education traditional , with only Educator little one who dominates integration technology and AI in learning (Anwar, 2024; Yulianti et al., 2023; Rosita et al., 2024).

Related objective research , found that (1) transformation the role of teachers is not yet followed by readiness infrastructure and resources Power man in a way evenly distributed ; (2) the educational 100competence

of teachers is still lame , especially in aspect technology and design learning AI -based ; and (3) the need for teacher training is very urgent , with focus on training based practical , collaborative , and contextual . Research this also underlines the need integration strategic between education policy , innovation technology , and strengthening ecosystem training so that teachers are able operate his role optimally in the middle current digitalization of education.

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