Fast in Technologies and AI Solutions

Website: https://fastin-technologies.com/ftas

Vol. 1 No.1 October 2025 : 22-27.

The Role of Technology and Artificial Intelligence (AI) in Improving the Competence of Junior High School Teachers Towards Smart Schools

Alifia Hartisya[1]*, Devina Agnesia Pratami[2], Muhammad Rivaldi[3], Dhimas Ibrahim[4], Delicia Risa[5]

[1,2,3,4,5]Universitas Ahmad Dahlan

**Corresponding author E-mail: alifiahartisya106@gmail.com*

Received: 5 August 2025
Accepted: 8 October 2025

Abstract

Technological advancements have driven the education sector to innovate in order to enhance teacher competence and the quality of learning. However, most junior high school teachers still rely on traditional teaching methods that do not utilize technology, including artificial intelligence (AI). This study aims to analyze the role of technology and AI in improving the competence of junior high school teachers. The approach used is library research and literature review of various scientific journals. The findings show that technology and AI play a significant role in encouraging learning innovation, providing rapid feedback, increasing digital literacy, and assisting teachers in designing responsive learning strategies. Nevertheless, several challenges remain, such as low digital literacy, limited infrastructure, and insufficient technological training for teachers. Therefore, training, policy support, and collaboration among educational institutions are needed to realize an effective smart school environment. With the optimal implementation of technology and AI, junior high school teachers are expected to keep pace with the digital era and become adaptive, creative, and relevant educators in meeting the demands of the times.

Keywords: *Artificial Intelligence; Innovation; Smart School; Teacher Competence; Technology*

1. Introduction

In the rapidly evolving digital era, education is required to adapt to dynamic technological changes. One of these changes is the concept of the smart school, an innovation in the education sector that integrates information and communication technology comprehensively into teaching and learning processes as well as educator competency development [1]. Amid this transformation, the role of teachers as the primary agents of learning remains crucial. However, a significant challenge arises when teachers, especially at the junior high school level, are required to master and optimally utilize technology in educational activities. Improving the quality of education has become a national concern, as stated in the National Education System Law No. 20 of 2003 and the Law of the Republic of Indonesia No. 14 of 2005 concerning teachers and lecturers. These regulations emphasize that national development in the field of education is an effort to enlighten the life of the nation and enhance the quality of Indonesian people who are faithful, pious, noble in character, and knowledgeable in science and technology, with the goal of building an advanced, just, prosperous, and civilized society, rooted in Pancasila and the 1945 Constitution [2].

Science is a strong foundation for advancing a nation by developing high-quality human resources [1]. The educational paradigm is undergoing a major transformation, demanding educators who are not only skilled in delivering information but also capable of adapting to rapidly evolving technologies as teaching tools. Educator creativity has become essential in responding to the dynamics of education, as they are expected to develop teaching methods that motivate students and design learning experiences that are engaging and responsive [3]. The emergence of online learning technologies, including educational applications and websites, is clear evidence of educational advancement. These innovations have led to new discoveries aimed at improving the efficiency and effectiveness of the learning process [4].

However, recent data from the Ministry of Education and Culture reveals that 60% of teachers are still not proficient in using technology [5]. This lack of proficiency spans various aspects, from the use of hardware such as computers and projectors to software-based educational tools and applications. A survey conducted by the Ministry of Communication and Information shows that the percentage of teachers using digital technology-based learning in their teaching practices is still below 50%. In other words, more than half of the educators in Indonesia have yet to optimally utilize the potential of digital technology to support the learning process [5]. Without sufficient understanding and

skills in using such technologies, teachers risk being left behind and failing to meet the rapidly growing demands of modern education. One of the major current challenges is the low level of teacher knowledge regarding the latest technologies, such as artificial intelligence (AI).

Artificial intelligence (AI) has emerged as a solution to improve the quality of education amid the rapid pace of technological advancement [3]. AI technology is becoming a key component increasingly applied in education. From adaptive learning systems and student analytics to support for planning and evaluation, AI has the potential to significantly enhance the effectiveness and efficiency of teachers' work. The ability of educators to understand developments in science and technology (IPTEK) has been further enhanced by the emergence of AI [6]. Therefore, improving teachers' competencies in understanding and applying technology, particularly AI, is a strategic step toward the realization of a smart school ecosystem.

This paper aims to explore how technology and AI can be leveraged to improve the competencies of junior high school teachers, as well as the challenges and opportunities that accompany this process. By gaining a deeper understanding of these aspects, it is expected that relevant recommendations can be developed to accelerate the adoption of digital technology in Indonesia's education sector and empower educators to utilize various technologies within the educational environment [1].

2. Literature Review

A practical approach to meeting the formatting guidelines is to utilize this document as a template and enter your content directly into it. The paper should be set to A4 size, measuring 21 cm in width and 29.7 cm in height. Page margins must be configured as follows: 1.5 cm at the top and bottom, 2 cm on the left, and 1.5 cm on the right. The manuscript should be formatted in two columns, with a spacing of 0.5 cm between them.

2.1. The Integration of Technology and Artificial Intelligence in Educational Contexts

According to [7], the most important investment in life today is education. For developing countries, education plays a crucial role and must be carefully prepared in order to build an advanced nation. Essentially, education is a reflection of a nation's civilization. One of the key indicators of a developed country is the high level of education among its people. However, it is not only the level of education that matters, but also the quality of education, particularly in the teaching and learning process. Over time, experts have continued to examine and identify ways to improve the quality of teaching and learning so that students can better understand and master technology. This is where technology plays a vital role in the educational system.

The Definition and Terminology Commission of AECT (Association for Educational Communication and Technology) states that technology in education is a complex collaborative process involving people, ideas, tools, materials, and organizations aimed at analyzing problems and finding solutions especially those related to learning. Mela and Alifah (2022) stated that technology in the field of education brings many benefits and conveniences. One of them is the implementation of e-learning systems. Through this system, students are not limited to accessing material in physical form (such as books) but can also explore learning content digitally, allowing for a deeper understanding of the subject matter.

Along with technological advancement, artificial intelligence (AI) has also emerged as a widely used innovation in education. Bambang Karyadi, explains that artificial intelligence is a branch of science focused on developing computer systems that can perform tasks like living beings. In education, AI can be utilized to support various teaching and learning activities, such as adaptive learning systems, virtual tutors, academic service chatbots, and automated assessment tools. This technology helps both teachers and students create a more effective and interactive learning experience, which is expected to improve the overall effectiveness of education and the achievement of learning goals.

2.2. The Benefits of Technology and Artificial Intelligence in Education

The development of technology and artificial intelligence (AI) has brought significant influence to various aspects of life, particularly in the field of education. On the other hand, in order to maximize the benefits of technological advancement, it must be supported by the quality of available human resources, as technological development and human resource quality are inherently interconnected. Adawiyah (2024) emphasize that the quality of human resources determines their readiness to face future challenges. Technology brings fresh opportunities to enhance the ease and effectiveness of teaching and learning activities. This view aligns with the statement of Ramadhani (2023), who assert that the advancement of technology and AI brings transformative changes to education. One of these changes benefits educators by enabling them to innovate and make the learning process more interactive and engaging.

In line with this, Haris (2017) states that one of the factors contributing to the ineffectiveness of learning activities is the students' boredom, which stems from monotonous teaching methods. Increasing student enthusiasm during lessons can enhance the effectiveness and efficiency of knowledge delivery by teachers. Technology is not merely a tool to support the effectiveness of teaching and learning activities. As Andri (2017) explains, technology also serves as a partner in intellectual development and provides infrastructure to facilitate various educational needs. Ultimately, it is expected to improve the overall quality of education. In agreement with this, Salsabila (2021) assert that technology-based education is not only a form of knowledge, but also a source of information, innovation, and a system that maximizes the teaching and learning process.

3. Research Method

The method employed in this study is a qualitative descriptive analysis, which aims to provide a fundamental overview of the nature of descriptive qualitative research methods in enhancing the competencies of junior high school teachers toward the development of smart schools. This research adopts a library research approach by referring to various literature sources such as scholarly journals, academic articles, and books. These sources are utilized to examine the benefits of technology and artificial intelligence for teachers, particularly in improving the quality of teaching and learning at the junior high school level.

The study is based on a review of relevant literature gathered from several databases, including Google Scholar. The collected literature is then analyzed with a focus on the roles, benefits, and urgency of applying technology and artificial intelligence in strengthening teacher competencies especially for those who are not yet familiar with current digital technologies. The validity of the literature sources is ensured and academically recognized, thereby guaranteeing that the information obtained is accurate, reliable, and scientifically accountable.

4. Results and Discussion

4.1. Foundations of Technology and AI in Education

4.1.1. What is Technology?

Technology is the result of the development of human knowledge and skills, manifested through the use of tools, machines, systems, and digital devices [8]. Technology functions as an aid to facilitate and enhance human activities across various fields of life, particularly in education. The use of digital tools, applications, and media can assist educators in creating a more interactive and conducive learning environment, leading to optimal learning outcomes. As a result, the quality of the education system improves by making information more accessible and helping educators design, deliver, and evaluate learning effectively. Learning systems, such as distance learning or online learning, can be easily implemented, allowing students to access learning materials through e-learning platforms without having to be physically present in the classroom. More comprehensively, technology is not limited to physical forms such as hardware, but also includes software and various processes that support the utilization of resources to achieve specific goals [9].

4.1.2. What is Artificial Intelligence (AI)?

Artificial Intelligence (AI), also known as machine intelligence, is a branch of computer science that focuses on developing computer programs capable of mimicking human intelligence [10]. AI has brought about a major transformation in the world of information and communication technology. Today, many human roles in operating various systems are being replaced by intelligent technologies such as machine learning. These systems are not only able to recognize voices and images, but can also interact using human language, make independent decisions, and perform reasoning processes that resemble human logic. The presence of AI in daily life is becoming increasingly prominent, as evidenced by its widespread implementation by global technology companies such as Google, Microsoft, and IBM in areas such as natural language processing, facial recognition, and large-scale data analysis [11]. In the field of education, AI can support, simplify, and enhance the teaching and learning process, particularly for educators.

4.2. The Benefits of Technology and Artificial Intelligence in Enhancing Junior High School Teachers' Competence

The availability of professional educators, particularly teachers, is a key factor in efforts to improve the quality of human resources in the field of education. Therefore, it is essential to continuously develop teachers' understanding and skills so they can adapt to advances in information technology and make optimal use of it in the teaching and learning process at school [12]. The following are the main benefits:

4.2.1. Access to a Wide Range of Learning Resources

With the increasing variety of learning sources and media, teachers are expected to better understand the needs of their students. One of the recurring challenges in the learning process is the use of monotonous methods, such as one-way lectures, which can cause students to feel bored and lose motivation. To overcome this, teachers need to adopt information and communication technology to design more varied and engaging learning approaches. Utilizing technology in the classroom creates a more dynamic and enjoyable learning environment, encourages active student participation, strengthens their understanding of the material, and makes the learning process more relevant to the digital era [13].

4.2.2. Digital-Based Professional Development

Numerous training platforms such as online courses, webinars, and digital certification programs are now available for teachers. Educators are expected to enhance their skills in developing instructional media and designing more creative and visually appealing content using tools like Canva [14].

4.2.3. More Interactive Learning

The effectiveness and efficiency of classroom learning can be significantly improved when creative and innovative learning models are implemented to spark student enthusiasm [15]. The integration of Artificial Intelligence into education not only simplifies the teaching process but also broadens teachers' perspectives and competencies in facing the ever-evolving challenges of modern times [16].

The use of technology and AI in education offers great opportunities for junior high school teachers to enhance their competencies continuously. This technology not only enriches teaching methods but also enables teachers to access diverse learning resources, perform data-based evaluations, and develop more personalized and adaptive teaching strategies that meet students' needs. Therefore, it is essential for educational institutions and the government to continue supporting the integration of technology in teaching activities and teacher training programs [12].

4.3. The Role of Technology and Artificial Intelligence for Junior High School Teachers

The advancement of technology and artificial intelligence (AI) has had a significant impact on various sectors of life, including education. Technology provides easier access to teaching and learning activities. As a result, teachers are no longer limited to textbooks or traditional training. Instead, they can take advantage of online platforms to participate in training, courses, and webinars tailored to their specific needs. AI can even recommend learning materials and professional development programs based on each teacher's strengths and weaknesses, making the process of professional growth more personalized and targeted [17].

The optimization of human resources in the field of education heavily depends on the ability of educators to continuously adapt to innovations in teaching methods and technology. Therefore, it is essential for both teachers and students to enhance their human resource quality so that they are prepared to face new challenges in this era of rapid technological and AI development. This includes mastering technological tools and utilizing AI to keep pace with the evolving demands of education [17].

Firstly, one of the main roles of AI in education is to serve as an advanced learning medium that enables more personalized and comprehensible learning experiences for students. Through sophisticated data analysis, AI can gather information about students' learning progress and preferences. This allows for curriculum adjustments and learning methods that are better aligned with each student's pace and needs, resulting in a more engaging and interactive educational experience. In the past, learning methods were generally limited to listening to teacher explanations and reading textbooks. Today, with advancements in AI, educators have access to a wide range of more engaging and interactive teaching strategies. These include the use of chatbots, voice recognition technology, reward systems (gamification), and augmented reality [18].

Secondly, with the rapid advancement of AI technologies such as algorithms, teachers can quickly retrieve information regarding educational needs, assessments, and student data with precision. Through the use of AI, both teacher and student knowledge can expand significantly, and the overall quality of education can improve. Teaching and learning activities can become more aligned with expectations. By implementing AI in the learning process, teachers must also be able to observe and choose the most suitable methods for delivering material to students [18].

Thirdly, improving the performance of education and teachers both now and in the future requires a solid understanding of technology and AI. These tools are not merely supplementary but have become central pillars in achieving educational success. They enable the delivery of lessons that are more engaging and less monotonous [19]. More active student responses during lessons reflect a more effective and efficient learning process. AI can provide accurate explanations, suggest improvements, and assign additional tasks tailored to the needs of individual students [17].

The emergence of technology offers solutions to many problems involving human activities. Therefore, technology and humanity are inseparable. According to [20], technology in education should not be seen merely as a discipline, but also as a source of information, innovation, and a system that supports the learning process. In line with this, [21] states that technology in education functions as an aid to support knowledge, as well as a source of information and innovation that emphasizes the quality of learning. Moreover, technology serves as an intellectual partner to support the quality of education and acts as a facilitator that offers students various technological tools, ultimately aiming to improve educational standards.

4.4. The Importance of Implementing Technology and Artificial Intelligence for Junior High School Teachers in Realizing Smart Schools

The concept of a "smart school" is no longer sufficient if it focuses solely on the provision of digital infrastructure. A smart school requires educators who not only understand technology, but also know how to use it ethically, innovatively, and strategically. Therefore, it is important to examine how the concrete application of technology and AI can assist junior high school teachers in realizing the vision of a smart school, based on research and practical implementation. Digital literacy training and AI introduction for teachers represent a crucial first step. According to the report [22], such training provides understanding of;

I. The use of AI tools such as Notion, SciSpace, and Research Rabbit.
II. Ethical considerations in using AI for educational and academic writing purposes.
III. Strengthening teachers' abilities in designing digital teaching materials.

Beyond that, the training helps teachers to adopt a more open and innovative mindset toward technology. This is important, as a positive attitude toward digital transformation is one of the key indicators of readiness for smart schools [22]. Educators with limited digital literacy may face difficulties integrating technology into their teaching, which could negatively affect the quality of learning delivered to students [22]. Junior high school teachers require learning approaches that align with students' interests and learning styles. In the *Merdeka Curriculum*, this is referred to as differentiated learning [23]. The integration of AI-based digital learning plays an essential role in boosting

student engagement and motivation. This also fosters a more vibrant learning environment and stimulates the continuous development of creativity [23].
AI enables the creation of personalized learning media based on students' preferences and interests, positively impacting their engagement in the learning process. Moreover, it supports the development of 21st-century core competencies the 4Cs: critical thinking, communication, collaboration, and creativity. In subjects like Islamic Religious Education, AI can act as a supportive tool for enhancing students' understanding of religious values and practices [24]. Thus, both curriculum and content can be aligned with students' specific needs, helping each individual to learn more effectively [24]. Additionally, AI plays a role in automated assessment, recommending advanced learning materials, and enabling interaction through virtual tutors.

Nevertheless, the use of technology and AI may also lead to negative effects if not properly filtered for instance, excessive dependence on digital devices may reduce students' interaction in class and weaken their literacy skills [24]. Teachers must not delegate all responsibilities to AI; rather, they must guide the learning process to ensure it remains ethical and holistic. A school cannot be considered smart if its teachers are not digitally literate. Teachers need to act as agents of change in the digital community, becoming driving forces in social transformation and shaping responsible, critical, and skilled users of digital technology [22].

This demonstrates that the foundation of a smart school begins with teachers who are not only proficient in using AI and technology but also capable of guiding students in ethical and productive use of digital tools. The combination of Project-Based Learning (PjBL) and AI has been proven effective in building contextual and meaningful learning. Through the PjBL model, students are encouraged to solve real-world problems using various creative products developed through digital means [23]. With this approach, AI not only accelerates the learning process but also enriches the content and fosters student engagement with real-life issues by enhancing teachers' digital literacy as a prerequisite for educational transformation, supporting differentiated instruction with content tailored to student interests, strengthening values and character through AI adaptation in subjects like religious education, empowering teachers as innovators (not mere users of technology), and cultivating creative and productive learning environments as key characteristics of a smart school.
manuscript.

5. Conclusion

In the rapidly evolving digital era, education is required to undergo transformation, particularly through the implementation of the smart school concept that fully integrates information and communication technology (ICT). Teachers, as the main actors in the learning process, play a crucial role in realizing this transformation. The presence of technology and artificial intelligence (AI) represents a significant advancement in the field of education, making it easier to facilitate learning so that teachers no longer rely solely on traditional methods but transition toward more effective and efficient approaches.

Although various digital tools and platforms are now available, data shows that the majority of teachers have yet to utilize them optimally. This poses a major obstacle to achieving an education system that is adaptive to the demands of the times. Enhancing teachers' competence in mastering technology especially AI is therefore essential. The implementation of AI in education offers vast opportunities for developing adaptive learning systems, analyzing student performance, and improving the quality of both evaluation and instructional planning. Thus, strengthening teachers' technological competence, particularly in AI, is a strategic step toward accelerating the realization of a smart school ecosystem. Investment in training, the provision of digital infrastructure, and the enhancement of technological literacy for teachers are all necessary so they can not only keep up with the times but also become key agents in the transformation of education in Indonesia.

Acknowledgement

The author gratefully acknowledges all individuals who contributed to the completion of this work. Special appreciation is extended to Mr. Muhammad Aziz for his invaluable guidance, insightful feedback, and continuous encouragement throughout the writing process. The author also wishes to thank colleagues for their constructive suggestions and moral support. The time, assistance, and generosity offered throughout this journey are sincerely appreciated. May all contributions be rewarded with continued success and lasting blessings.

References

[1] W. Millati, "The Role of Educational Technology in the Perspective of Independent Learning in Era 4.0," *J. Educ. Teach.*, vol. 2, no. 1, pp. 1–9, 2021.

[2] H. Lubis, "Peranan Teknologi Pendidikan Terhadap Guru Di Masa Depan," *J. Sintaksis*, vol. 3, no. 04, pp. 57–64, 2020.

[3] I. M. Aan Widiyono, "Pendidik Di Era Cybernetics 4.0," *Murthada Innov. J. Soc. Sci. Res.*, vol. 4, pp. 5195–5205, 2024.

[4] K. Ismatulloh and Jamaluddin., "Gerakan Informatika Cerdas Berliterasi 'berinovasi membangun peradaban diera 4.0 dengan budaya literasi,'" *ABSYARA J. Pengabdi. Pada Masy.*, vol. 2, no. 2, pp. 301–310, 2021, doi: 10.29408/ab.v2i2.4333.

[5] A. Setiawan, R. Arifudin, E. Sugiharti, Z. Abidin, and M. F. Al Hakim, "Peran Kecerdasan Buatan Generatif Bagi Peningkatan Kompetensi Guru di SMA Muhammadiyah 2 Semarang," vol. 8, no. 2, pp. 554–563, 2025.

[6] S. R. R. Putri Supriadi, S. U. Haedi, and M. M. Chusni, "Inovasi pembelajaran berbasis teknologi Artificial Intelligence dalam Pendidikan di era industry 4.0 dan society 5.0," *J. Penelit. Sains dan Pendidik.*, vol. 2, no. 2, pp. 192–198, 2022, doi: 10.23971/jpsp.v2i2.4036.

[7] R. Susanti, "Teknologi Pendidikan Dan Peranannya Dalam Transformasi Pendidikan," *J. Teknol. Pendidik.*, vol. 2, no. 2, pp. 15–23, 2013, doi: 10.32832/tek.pend.v2i2.448.

[8] M. Julia and A. Jiddal Masyruroh, "Literature Review Determinasi Struktur Organisasi: Teknologi, Lingkungan Dan Strategi Organisasi," *J. Ekon. Manaj. Sist. Inf.*, vol. 3, no. 4, pp. 383–395, 2022, doi: 10.31933/jemsi.v3i4.895.

[9] N. Norpin, L. Naibaho, and D. A. Rantung, "Peran Teknologi dalam Proses Pembelajaran," *J. Kolaboratif Sains*, vol. 7, no. 1, pp. 444–448, 2024, doi: 10.56338/jks.v7i1.4896.

[10] B. Karyadi, "Pemanfaatan Kecerdasan Buatan Dalam Mendukung Pembelajaran Mandiri," *Educ. J. Teknol. Pendidik.*, vol. 8, no. 2, pp. 253–258, 2023, doi: 10.32832/educate.v8i02.14843.

[11] R. Adolph, "Perkembangan Kecerdasan Buatan (AI) Dan Dampaknya Pada Dunia Teknologi," vol. 2, no. 2, pp. 1–23, 2016.

[12] A. Alim Muin, A. Hafiz, E. Karyadiputra, F. Yusa rahman, S. Pratama, and A. Setiawan, "Pelatihan Pemanfaatan Teknologi Digital Untuk Meningkatkan Kompetensi Guru dalam Membuat Media Pembelajaran Di SDN Tabing Rimbah 2," *ABDINE J. Pengabdi. Masy.*, vol. 3, no. 2, pp. 193–198, 2023, doi: 10.52072/abdine.v3i2.603.

[13] N. R. Anwar, "Pelatihan Pengenalan Artificial Intelligence (AI) untuk Meningkatkan Kompetensi Guru padaTransformasi Digital," *J. Smart Community Serv.*, vol. 2, no. 1, pp. 28–36, 2024.

[14] M. A. Naufal and A. C. Pratiwi, "Peningkatan Kompetensi Guru dalam Penggunaan Teknologi AI untuk Pengembangan Media Pembelajaran dan Evaluasi di Kabupaten Jeneponto," vol. 3, pp. 205–211, 2024.

[15] F. H. Aminuddin, T. Djauhari, Santoso, Gustinar, K. Adinda S., and C. Kusuma, "Peningkatan kompetensi guru dalam pengelolaan pembelajaran berbasis literasi digital," *J. Inov. Has. Pengabdi. Masy.*, vol. 7, no. 1, pp. 168–180, 2024, doi: 10.33474/jipemas.v7i1.20697.

[16] R. S. Budiarti, A. Johari, L. Mardiyanti, and D. Mursyd, "PELATIHAN ARTIFICAL INTELLIGENCE UNTUK MENINGKATKAN KOMPETENSI GURU DALAM MENGINOVASI PROSES PEMBELAJARAN," vol. 08, no. 03, pp. 1074–1088, 2024.

[17] I. Taufik and I. Rindaningsih, "Pelatihan dan Pengembangan Guru Sebagai Sumber Daya Manusia Bidang Pendidikan di Era Kecerdasan Buatan (AI)," *Manag. Educ. J. …*, vol. 5, no. 2, pp. 276–290, 2024.

[18] R. Aulia Gusli, S. Zakir, and M. Akhyar, "Tantangan Guru terhadap Perkembangan Teknologi Agar Memanfaatkan Artificial Intelligence Dalam Meningkatkan Kemampuan Siswa," *Idarah Tarb. J. Manag. Islam. Educ.*, vol. 4, no. 3, pp. 229–240, 2023, doi: 10.32832/itjmie.v4i3.15418.

[19] Haris Budiman, "Peran Teknologi Informasi Dan Komunikasi Dalam Pendidikan," *Al-Tadzkiyyah J. Pendidik. Islam*, vol. 8, no. 1, pp. 31–43, 2017.

[20] A. Lailan, "Peran Teknologi Pendidikan Dalam Pembelajaran," *SENTRI J. Ris. Ilm.*, vol. 3, no. 7, pp. 3257–3262, 2024, doi: 10.55681/sentri.v3i7.3115.

[21] R. M. Andri, "Peran dan Fungsi Teknologi Dalam Peningkatan Kualitas Pembelajaran," *J. Ilm. Res. Sains*, vol. 3, no. 1, pp. 122–129, 2017.

[22] M. M. Fakhri, A. Isma, W. Hidayat, A. Saleh Ahmar, & Dewi, and F. Surianto, "Digital Literacy Training and Introduction to Artificial Intelligence Ethics to Realize Digital Literate Teachers Pelatihan Literasi Digital dan Pengenalan Etika Kecerdasan Buatan untuk Mewujudkan Guru Melek Digital," *J. Pengabdi. Masy.*, vol. 5, no. 1, pp. 2746–5233, 2024.

[23] H. N. Saputra, R. Rahmat, and K. Komalasari, "Pemanfaatan Artificial Intelligence Pada Pelajaran Pendidikan Pancasila Berbasis Projek Di Smp Daarut Tauhiid Boarding School," *Sanskara Pendidik. dan Pengajaran*, vol. 2, no. 02, pp. 115–125, 2024, doi: 10.58812/spp.v2i02.397.

[24] I. M. Sujana, A. Saputra, B. Z. Melani, L. Ode, A. H. Munandar, and A. Andra, "Pengembangan Modul Ajar Inovatif Bahasa Inggris SMP dengan Menggunakan Artificial Intelligence (AI) dan Game-Based Instructions (GBI)," *Pengabdi. Magister Pendidik. IPA*, vol. 6, no. 3, pp. 661–667, 2023.