Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Educational Collaboration : Teachers and Artificial Intelligence

Mujiono
Educational Technology Study Program, Faculty of Teacher Training and Education, Universitas Terbuka
*****Corresponding Author. Email: mujiono.ut@ecampus.ut.ac.id

Abstract: This study aims to analyze the collaboration between teachers and Artificial Intelligence that can meet the needs and goals of better education. This study uses a qualitative descriptive method with a literature review research design by collecting information from reputable international journal articles indexed in Scopus over the last five years (2018-2023) using the Publish or Perish search tool. The process of meta-analysis in this research begins with formulating the research question, andthen collecting relevant literature data that aligns with the research question. Next, the data is prepared by evaluating the literature's relevance to the research topic. Afterwards, the data from the selected literature is analyzed and synthesized. The results show that collaboration between teachers and Artificial Intelligence can be a good solution to improve learning effectiveness and help students learn in a personalized way. Although Artificial Intelligence technology can assist teachers in the learning process, teachers still play an important role in guiding and inspiring students. Therefore, collaboration between teachers and Artificial Intelligence technology should also be done carefully and directed towards improving a better and more meaningful learning experience for students.

Article History
Received: 12-04-2023
Revised: 14-05-2023
Accepted: 29-05-2023
Published: 16-06-2023

Key Words:
Educational Collaboration; Teachers; Artificial Intelligence; Technology.

How to Cite: Mujiono, M. (2023). Educational Collaboration : Teachers and Artificial Intelligence. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran, 9*(2), 618-632. doi:https://doi.org/10.33394/jk.v9i2.7801

https://doi.org/10.33394/jk.v9i2.7801

Introduction

The development of science and technology, which initially focused on the development of machines and mechanical technology such as steam engines and cars, has increasingly expanded to various fields such as computers and telecommunications in the 20th century (S. P. Huang, 2018). In particular, the development of computer technology in the 1950s brought significant progress in the field of Artificial Intelligence (AI) (L. Chen et al., 2020; Cope et al., 2020). Computer programs created by scientists can mimic the human brain's ability to solve problems and make decisions (Cope et al., 2020). Since then, AI has continued to advance with the discovery of deep learning algorithms in 2012, which allows computers to process data more effectively and accurately (Gupta et al., 2021).

The development of AI has brought many benefits and applications in various fields, such as healthcare, industry, security systems, and education. In the healthcare field, AI can be used to assist in disease diagnosis, analyze data from medical tests to help doctors make more accurate diagnoses, or detect diseases at an early stage for more effective prevention measures (Kaur et al., 2016). In the industrial field, AI is used to improve efficiency and productivity, optimize supply chains, predict market demand, or perform automated quality control in production (Toorajipour et al., 2020). In security systems, AI can be used to detect security threats on computer networks, identify suspicious behavior in surveillance videos, or develop smarter and more adaptive security systems (Singh & Lee, 2021). The use of AI in education is still relatively new and has only recently begun, as most AI technologies have

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

been designed for application in business and personal communication rather than education (Yu, 2020).

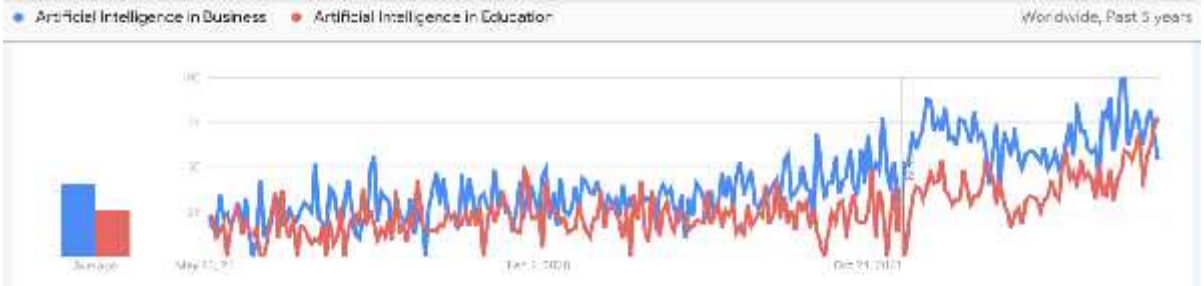

Figure 1. Interest in AI (Google Trends 2018-2023)

Although the concept and technology of AI have been around for decades, its use in education has only been widely applied in recent years. The use of AI in education can be said to be still relatively new because its application is still limited and has not been widely implemented (Chan et al., 2019). There are several factors that explain why the use of AI in education is still relatively new. First, education is a very complex and multidimensional issue that is related to not only cognitive aspects but also social, emotional, and physical aspects. Implementing AI technology in the educational context requires a deep understanding of this complexity and requires collaboration from various disciplines (Pedró, 2019). Second, the use of AI technology requires sufficient data to train AI models (Allen, 2020). However, educational data is often difficult to obtain, fragmented, and there are differences among educational institutions. This limits the use of AI technology in education. Third, the implementation of AI technology in education requires a significant amount of funding, especially for infrastructure, AI model development, and teacher training (Kuleto et al., 2021). In addition, the accessibility of AI technology is still limited, especially in remote areas or in underdeveloped countries.

The use of AI in education also often raises controversy and debate among academics (Williamson & Eynon, 2020). Some academics view it positively, while others view it negatively. On the one hand, academics believe that the use of AI can provide benefits in improving the efficiency and quality of learning (Vollmer et al., 2018). With the use of AI, students can learn at their own pace and learning style, and teachers can monitor and evaluate student learning outcomes in real time. The use of AI can also help teachers in preparing more adaptive and engaging curricula. On the other hand, some academics are concerned that the use of AI can worsen social and economic disparities in education (Vinuesa et al., 2020). The use of AI can also make students too reliant on technology and reduce interpersonal skills and creativity needed in the workplace. Furthermore, AI can also be misused due to bias in data and algorithms, which often undermines social cohesion, democratic principles, and human rights (Yang et al., 2021).

Academics who hold a positive view also believe that the use of AI technology can improve the effectiveness of learning (Luckin & Cukurova, 2019). By utilizing AI technology, students can learn in a personalized and efficient manner, as well as gain a more interactive and engaging learning experience. The use of AI technology can help save costs, as some tasks such as assessment and feedback can be done automatically (Aguilar et al., 2021). This can help teachers to focus more on important aspects of learning such as giving directions and guiding students. The use of AI technology can also improve the accessibility of education, especially for students located in hard-to-reach areas or students with physical or learning disabilities. By utilizing AI technology, students can access the same learning content and resources as other students (Sun et al., 2020).

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Academics who hold negative views are concerned that the use of AI technology may bring new problems due to the lack of human interaction in the learning process (Wogu et al., 2019). In some cases, AI technology can replace the role of the teacher or reduce the interaction between students and teachers, which can affect the quality of learning. The use of AI technology in education also raises privacy issues, especially in terms of student data collection (Holmes et al., 2022). Some academics are concerned that excessive and detailed data collection can jeopardize student privacy. Issues of bias and discrimination can also arise in the use of AI technology in education. AI systems can be biased if the data used to train the model is uneven or does not reflect the diversity of the student population. As pointed out by Cope et al. (2020), we need to be aware of the intrinsic limitations of AI, which are the limits of transposing human meaning into numbers. Schiff (2020) also hopes to promote critical reflection on the development of AI in education. The conflicting views among groups of academics regarding the use of AI in education can hinder progress in the field of education. Therefore, a middle ground is needed to find solutions and agreements that can meet the needs and goals of better education. This study aims to analyze the collaboration between teachers and Artificial Intelligence that can meet the needs and goals of better education.

Research Method

This research uses a qualitative descriptive method with a type of systematic review of the literature (Pati & Lorusso, 2018), which is collecting information or scientific writings related to a literature review. The literature review involves analysis and synthesis of various sources of information or literature relevant to the research topic being studied (Ramdhani et al., 2014). This method aims to collect, review, and analyze literature related to the topic of AI usage in education, so as to help build a framework or basic concept in the research. In the literature review method, the researcher conducts a search and selection of literature from reputable international journal articles indexed in Scopus within the last five years (2018-2023) with the help of the Publish or Perish search tool. The process of meta-analysis in this research, as suggested by (Paul & Barari, 2022), begins with formulating the research question, andthen collecting relevant literature data that aligns with the research question. Next, the data is prepared by evaluating the literature's relevance to the research topic. Afterwards, the data from the selected literature is analyzed and synthesized. Finally, the findings are interpreted, and conclusions are drawn to answer the research question.

The initial stage of this research is to determine the problem formulation, which includes: 1) What is the concept of Artificial Intelligence; 2) How is Artificial Intelligence used in Education; and 3) How is the collaboration between teachers and Artificial Intelligence. Next is to gather, review, and analyze literature related to the research topic, with steps including: 1) identifying the research topic to be studied (Wang, 2017); 2) searching for relevant literature on the topic (Haddaway et al., 2015); 3) selecting the most relevant and high-quality literature to be used in the research (Dowd et al., 2018); 4) analyzing the selected literature (Cruz-Benito et al., 2018); 5) interpreting and synthesizing the results of the literature analysis (Pati & Lorusso, 2018). These results can be used to build a framework or basic concept for the research (Kamble et al., 2018).

Results and Discussion

Publish or Perish (macOS GUI Edition)

Search terms	Source	Papers	Cites	Cites/ye...	h	g	hI,norm	hI,annual
Artificial Intelligence Educatio...	Scopus	200	4.800	960,00	36	58	36	7,20

Figure 2. Publish or Perish Data Search Results (Scopus 2018-2023)

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index
Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

From the search process using the Publish or Perish search tool, 200 papers were obtained, consisting of 119 Articles, 1 Book, 7 Book Chapters, 32 Conference Papers, 8 Editorials, 1 Erratum, 1 Letter, 2 Notes, 1 Retraction, and 28 Reviews. Among the 10 types of data, primary data in the form of articles were selected, totalling 119 articles. Next, from the 119 articles, the most relevant titles related to the topic of AI in education were selected for analysis. The interpretation and synthesis of the results of the literature analysis are presented in the following sub-topics: 1) Artificial Intelligence, 2) Artificial Intelligence in Education, and 3) Teacher and Artificial Intelligence.

Table 1. Publish or Perish Data Search Results (Scopus 2018-2023)

No	Type	Amount
1	Article	119
2	Book	1
3	Book Chapter	7
4	Conference Paper	32
5	Editorial	8
6	Erratum	1
7	Letter	1
8	Note	2
9	Retracted	1
10	Review	28
	Total	**200**

1) Artificial Intelligence

Artificial Intelligence, commonly abbreviated as AI, is a technology that imitates human abilities to think, understand, learn, and perform actions that sometimes require human intelligence, such as speaking, language processing, recognizing images or sounds, and performing complex tasks (L. Chen et al., 2020). AI systems are designed using techniques such as machine learning, neural networks, natural language processing, computer vision, and decision trees.

a) Machine learning is a technique that enables AI systems to learn from data without being explicitly programmed (Cope et al., 2020). In machine learning, the AI system will analyze data and identify patterns or trends that are hidden within it. The AI system can use this information to make predictions or decisions.
b) Neural network is a mathematical model that imitates the way the human brain works (Cope et al., 2020). The input data will be processed by a large number of neurons or processing units. Each neuron will receive input from other neurons and produce output that is sent to other neurons. In this process, the AI system can recognize complex patterns and make decisions based on available information.
c) Natural language processing (NLP) is a technique that enables AI systems to understand human language. The AI system will analyze human text or speech and try to understand the meaning behind the words. With the help of NLP, AI systems can perform tasks such as translation, sentiment analysis, and speech recognition (Guan et al., 2020).
d) Computer vision is a technique that allows AI systems to process images and videos, and recognize objects, faces, or actions within them (Ward et al., 2020). The AI system will analyze the visual features of the image or video, and compare them with existing databases. With the help of computer vision, the AI system can perform tasks such as facial recognition, object detection, and medical image analysis.
e) Decision tree is a technique that allows AI systems to make decisions based on a series of rules or conditions. The AI system will build a decision tree based on the available information. Each branch of the tree represents a condition or rule, and each leaf of the

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

tree represents a decision or action. With the help of decision tree, AI systems can perform tasks such as data classification or decision-making (Mahbooba et al., 2021).

AI works by using algorithms that are built into computer systems (Ouyang & Jiao, 2021). These algorithms can be programmed to make decisions, analyze data, and solve problems quickly and efficiently. AI requires input data to learn and understand the patterns and concepts necessary for the given tasks. The collected data is usually processed by the machine and processed by algorithms used to develop AI models (Wogu et al., 2019). The more data that is input into the system, the better the performance of AI in processing data and making more accurate decisions. Additionally, AI can also be integrated with other systems, such as the Internet of Things (IoT) and big data, to obtain more and more comprehensive data (Li et al., 2022).

AI has a significant impact on various aspects of life, including industry, healthcare, transportation, and education. Some impacts of AI include: increasing efficiency and productivity in various sectors; providing solutions to complex and complicated problems; providing ease in interacting and communicating with technology; improving the quality of life by assisting in healthcare and environmental fields; and causing changes in the job market and the need for job qualifications (Acemoglu & Restrepo, 2019).

The main goal of developing AI is to create technology that is smarter and more efficient in solving complex tasks, thereby helping humans to increase efficiency and productivity in various fields (Yang et al., 2021). In addition, another goal is to create technology that can learn and develop on its own, so that it can provide more accurate and effective solutions in various situations and problems faced. AI can also help address complex problems and support better innovation development in the future (Verganti et al., 2020).

2) Artificial Intelligence in Education

In this digital era, AI can be used to enhance students' learning experience, assist teachers in assessment, and provide recommendations to personalize learning (Chen, 2022).

a) Adaptive Learning

Adaptive learning is a learning technique that can be set up to adjust to students' level of understanding. In this case, AI can help create a more adaptive learning environment by using data analysis from students' responses (Guan et al., 2020). AI can read data from tests or assignments given and analyze students' answers automatically. Then, AI can provide recommendations or improvements for students who are struggling. Additionally, AI can personalize learning for each student by providing material that suits their level of understanding. AI can utilize data from students' learning experiences and analyze their abilities to recommend suitable material based on their needs and level of understanding (Zawacki-Richter et al., 2019). AI can also provide customized learning materials based on students' interests and preferences, thus increasing their motivation and interest in learning. In this case, AI can assist teachers in personalizing students' learning experiences and maximizing their learning potential. Therefore, learning can be more effective and efficient because students can learn in a more appropriate way for their needs (Lin et al., 2018).

b) Personalized Learning

Personalized learning is one of the positive impacts of AI in education. With AI technology, teachers can obtain data from students' learning activities and identify individual strengths and weaknesses (Ouyang & Jiao, 2021). Thus, teachers can provide more personalized and tailored learning to meet the needs of each student, which can enhance learning effectiveness. Moreover, AI can help offer relevant learning resources and materials that match students' needs, such as videos or articles related to specific topics (Chatterjee &

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Bhattacharjee, 2020). For instance, if a student is interested in the topic of World War II history, AI can recommend books, videos, or articles related to the topic, so that the student can expand their understanding of the topic more easily and effectively. This can help increase students' motivation and interest in learning (Sharma et al., 2020).

c) Automatic Assessment

AI can help teachers to assess students quickly and accurately (Nazari et al., 2021). AI can analyze student assignments or tests and provide automatic assessments, especially for structured tasks or tests that require definite answers. However, there are also AI technologies that can assess more complex tasks that require subjective assessments, such as script or presentation assessments. This allows teachers to focus more on student learning and improvement. With AI, student assessment can be done faster and more accurately. Additionally, AI can help reduce bias that may occur in student assessment (Akgun & Greenhow, 2022). By using this technology, student grades can be calculated objectively and provide immediate feedback, so that students can correct their mistakes more effectively.

d) Skills Development

AI can help students develop specific skills through simulations and exercises. AI can also help students develop workplace skills, such as project management skills or teamwork skills, through simulations and exercises that are tailored to specific situational contexts and scenarios (Porayska-Pomsta et al., 2018). The use of AI in learning can also help students develop information and communication technology (ICT) skills, which are increasingly important in the digital era (Hinojo-Lucena et al., 2019). By integrating AI into learning, students will become familiar with AI technology and be able to use it more effectively in the future (Chiu & Chai, 2020). The development of skills needed in this digital era is not only important for students, but also for companies and organizations in the future. Therefore, the use of AI in learning can help improve the quality and relevance of education to the needs of the constantly evolving industry and society (Pedró, 2019).

e) Self-Learning

AI can be used in self-learning, where students can learn using AI applications and platforms without the presence of a teacher (Nazari et al., 2021). With the help of AI, students can obtain interactive and measurable learning experiences. This allows students to learn at their own pace and adjust their learning to their preferred learning style (S. P. Huang, 2018). In addition, AI can also provide automatic feedback and recommend appropriate learning materials to help students overcome difficulties encountered during self-learning. This can help students understand where they are in the learning process and quickly improve their weaknesses (Fahimirad, 2018).

f) Distance Learning

AI can help facilitate distance learning. AI can provide learning materials that can be accessed online and allow students to learn with virtual assistance due to its ability to process, analyze, and manage data automatically (Ouyang & Jiao, 2021). AI can also assist in developing online learning platforms that can adjust learning materials and methods to the needs and preferences of each student. With AI, students can access learning resources from anywhere and anytime, as well as receive virtual assistance to help them understand the material better. Furthermore, (Lin et al. (2018) argued that AI could help engage and connect students with each other and their instructors in asynchronous online environments that overcome spatiotemporal barriers to learning.

g) Curriculum Development

AI can assist educational institutions in developing a curriculum that meets the needs of students and industry (Knox, 2020). With data analysis, AI can determine trends and future

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

needs and help educational institutions prepare students for a better future. AI can assist educational institutions in monitoring and evaluating the effectiveness of the current curriculum. By examining learning data, AI can help identify areas where students are struggling and need improvement. This can help educational institutions continually improve the curriculum and ensure that students receive the best education (Chiu & Chai, 2020). In an ever-changing and evolving educational environment, AI's ability to adapt and adjust to these changes can assist educational institutions in staying relevant and providing the best education for students (Huang & Rust, 2018).

3) Teachers and Artificial Intelligence

Although AI can provide many benefits in education, there are some tasks that cannot be fully replaced by AI, thus requiring collaboration between teachers and AI.

a) Building Interpersonal Relationships

Although AI can provide responses and feedback on student performance, the interpersonal relationships and emotional connections between teachers and students remain important in helping students feel connected to their learning environment. Interpersonal relationships and emotional connections between teachers and students are essential aspects of education (Lameras & Arnab, 2022). Good teachers can be a source of inspiration, motivation, and support for students. In addition, good interpersonal relationships can help build students' trust in their teachers and make them feel more comfortable in the learning environment. Although AI can provide responses and feedback, AI cannot provide the same interpersonal experience as teachers (Seo et al., 2021). AI does not have the ability to form the emotional relationships and interpersonal connections required in education. Therefore, the role of teachers remains important in building interpersonal relationships with students and providing the emotional support needed by students (Tyson & Sauers, 2021).

b) Understand Students' Needs

Although AI can assist in monitoring student progress and suggesting learning strategies, understanding the unique needs and learning styles of each student requires direct observation and interaction by the teacher. AI can provide learning recommendations for each student based on the collected data (Bagunaid et al., 2022). To better understand individual student needs, teachers need to interact directly and observe each student, as well as build a personal relationship with them. In this way, teachers can understand the learning style, special needs, and preferences of each student in learning. This can help teachers prepare appropriate curricula and provide the necessary support for each student. In addition, personal relationships can also help improve student motivation and interest in learning, as well as help them feel accepted and valued as individuals in the learning environment (Hwang & Tu, 2021).

c) Teaching Social and Emotional Skills

Teaching social and emotional skills requires interaction between teachers and students who are trained to help students learn how to interact with others, manage their emotions, and build confidence. AI may be able to provide some resources to help teachers teach social and emotional skills, but it cannot fully replace the role of teachers in helping students understand and practice these skills (Joshi et al., 2021). Teaching social and emotional skills requires direct interaction between teachers and students, as well as requiring observation skills and a personal approach. For example, teaching students about empathy and building positive relationships with others requires communication skills and interpersonal interaction, which are difficult to simulate or learn through AI platforms. Therefore, the role of teachers is still very important in helping students learn social and emotional skills well (Malik et al., 2019).

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

d) Creativity

Teachers often have to use their creativity in teaching to make students interested and engaged in learning. This involves the ability to think outside the box, create engaging learning activities, and motivate students to learn. Although AI can provide some ideas or resources, it does not have the ability to generate creative ideas that are suitable for the situation and needs of the students. The creativity of teachers in teaching cannot be fully replaced by AI (Tao et al., 2019). Although AI can provide assistance in designing and compiling interesting teaching materials, it cannot mimic the uniqueness and intelligence possessed by each teacher. The ability of teachers to think creatively and generate new ideas is an important factor in creating an inspiring and effective learning environment. In addition, teachers can also pay attention to the individual needs of students in teaching creative skills, such as finding ways to solve problems and encouraging students to think critically (Chiu & Chai, 2020). Therefore, although AI can assist in some aspects of learning, teachers still have an important role in teaching creative skills and motivating students to learn better.

e) Assessing More Complex Skills

Some tasks that require more complex skill assessment, such as assessing writing or verbal skills, may not be accurately done by AI. Decision-making involving values and subjective assessment also requires the presence of a teacher (Chaturvedi et al., 2023). Although AI can assist in providing initial assessment or measurable evaluation in some specific aspects, such as analyzing grammar, spelling, or syntax, the ability to produce accurate and meaningful assessments in the broader context of learning is still a teacher's task. Teachers can have a deeper understanding of students' abilities, capture individual difficulties or needs, and provide specific and measurable input and feedback to help students improve their skills (Markauskaite et al., 2022).

f) Subjective Assessment

Although AI can provide objective assessment for some types of tasks, such as multiple-choice exams, AI cannot provide subjective or contextual assessment like in writing or presentation tasks (Baryannis et al., 2019). Subjective assessment requires deeper assessment and can be influenced by context, style, and individual preferences. Subjective assessment often involves considerations beyond simply right or wrong answers. Teachers can provide more holistic assessments, including quality and creativity of answers, and provide appropriate feedback to help students improve their skills. AI may be able to help in preparing or developing assessment criteria, but ultimately, subjective assessment still requires the involvement and wisdom of teachers (Ver Milyea et al., 2021).

g) Creating a Safe and Inclusive Learning Environment

Although AI can assist in facilitating online learning, teachers still have an important role in creating a safe and inclusive learning environment for all students (Ilić et al., 2021). Teachers help build a positive learning culture and stimulate student growth, as well as manage relationships between students. AI cannot fully replace the role of teachers in creating a safe and inclusive learning environment (De Bruyn et al., 2020). Teachers have an important role in building and maintaining positive relationships between students and helping students understand and appreciate diversity. In addition, teachers play a crucial role in reinforcing students' ethics and morals, as well as helping students understand their responsibilities to themselves and society. All of these require direct interaction and interpersonal relationships that cannot be fully replaced by technology (Chatterjee & Bhattacharjee, 2020).

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

4) Collaboration of Teachers and Artificial Intelligence

The collaboration between teachers and AI can make a significant contribution to the progress of education in the future. There are several ways in which teachers can utilize AI technology to create better learning experiences.

a) Personalized Learning

AI technology can assist teachers in identifying the individual needs and learning pace of each student more effectively (Kim et al., 2022). AI can analyze data on students' academic progress, offer customized learning support recommendations based on students' characteristics and needs, and provide real-time feedback on students' work. This can help teachers optimize students' learning experiences and ensure they gain a deep understanding of each subject taught.

b) Adaptive Teaching

AI technology can help teachers create adaptive learning where the content and teaching methods can be adjusted to the abilities and learning styles of each student (Kabudi et al., 2021). AI can analyze students' learning outcomes, identify students' weaknesses and strengths, and provide appropriate materials and assignments tailored to students' characteristics and needs. As a result, teachers can provide better guidance and avoid learning gaps among students.

c) Learning Resources

AI technology can assist teachers in accessing better and more relevant learning resources aligned with the established learning goals (Allal-Chérif et al., 2021; Fahimirad, 2018). With AI technology, teachers can discover and select various online learning materials, curricula, and educational resources. AI can also recommend materials that suit students' needs and interests, enabling better access to relevant and up-to-date information sources.

d) Assessment and Feedback

AI technology can assist teachers in providing faster and more effective assessment and feedback (Fahimirad, 2018). With AI algorithms, teachers can analyze students' work quickly and objectively, identify students' strengths and weaknesses, and provide targeted individual feedback. This allows teachers to provide more specific guidance and support students in improving their performance.

e) Monitoring and Intervention

AI technology can assist teachers in monitoring students' progress in real-time and identifying any learning problems or difficulties at an early stage (Holstein et al., 2019). AI can provide alerts to teachers when a student is struggling or requires additional intervention during the learning process. This allows for preventive actions and timely guidance to help students overcome any learning obstacles they may encounter.

However, it is important to note that the collaboration between teachers and AI should still uphold the essence of education. Teachers remain the key actors in teaching and guiding students (Nemorin et al., 2023). AI should serve as a tool to assist and support teachers, not to replace them. In this collaboration, teachers should maintain their roles in providing deep conceptual understanding, supporting students' social and emotional development, and providing ethical and moral guidance to students. Teachers are responsible for creating an inclusive learning environment, providing motivation, and facilitating social interactions in the classroom (Akgun & Greenhow, 2022).

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Conclusion

Collaboration between teachers and AI technology can be a good solution to enhance the effectiveness of learning and assist students in personalized learning. In such a collaboration, AI can be used as a tool to help teachers monitor and evaluate students' progress individually and provide relevant feedback. This can help teachers to adjust learning strategies according to students' needs and abilities. Additionally, AI can also help teachers in preparing and managing learning curriculums. By utilizing AI technology, teachers can create more effective and efficient learning plans, ensuring that students get a learning experience that fits their needs. Teachers can help students to understand the material better and provide more meaningful and significant learning experiences. Additionally, teachers can assist students in developing important social and emotional skills for everyday life. Although AI technology can help teachers in the learning process, teachers still have an important role in guiding and inspiring students.

Recommendation

The government should provide adequate training and support to teachers in order to understand and integrate AI technology into education. Teachers need to learn how to use AI tools and applications to optimize students' learning experiences and personalize instruction according to individual needs. Additionally, the government and teachers need to work together to build awareness and trust among the public regarding the use of AI technology in education, as parents, students, and the general public need to gain an understanding of the benefits and potential of AI technology to eliminate any controversies.

References

Acemoglu, D., & Restrepo, P. (2019). Artificial Intelligence, Automation, and Work. In *The Economics of Artificial Intelligence: An Agenda* (pp. 197–236).

Aguilar, J., Garces-Jimenez, A., R-Moreno, M. D., & García, R. (2021). A systematic literature review on the use of artificial intelligence in energy self-management in smart buildings. *Renewable and Sustainable Energy Reviews*, *151*, 1–16. https://doi.org/10.1016/j.rser.2021.111530

Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*, *2*(3), 431–440. https://doi.org/10.1007/s43681-021-00096-7

Allal-Chérif, O., Aránega, A. Y., & Sánchez, R. C. (2021). Intelligent recruitment: How to identify, select, and retain talents from around the world using artificial intelligence. *Technological Forecasting & Social Change*, *169*, 1–11. https://doi.org/10.1016/j.techfore.2021.120822

Allen, G. (2020). *Understanding AI Technology A concise, practical, and readable overview of Artificial Intelligence and Machine Learning technology designed for non-technical managers, officers, and executives April 2020*. https://www.linkedin.com/company/dod-joint-artificial-intelligence-center/

Bagunaid, W., Chilamkurti, N., & Veeraraghavan, P. (2022). AISAR: Artificial Intelligence-Based Student Assessment and Recommendation System for E-Learning in Big Data. *Sustainability (Switzerland)*, *14*(17), 1–22. https://doi.org/10.3390/su141710551

Barrios Tao, H., Diaz, V. R., & Guerra, Y. M. (2019). ARTIFICIAL INTELLIGENCE AND EDUCATIONChallenges and disadvantagesfor the teacher. *ARTIC JOURNAL*, *72*(12), 30–50.

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Baryannis, G., Validi, S., Dani, S., & Antoniou, G. (2019). Supply chain risk management and artificial intelligence: state of the art and future research directions. *International Journal of Production Research*, *57*(7), 2179–2202. https://doi.org/10.1080/00207543.2018.1530476

Chan, L., Morgan, I., Simon, H., Alshabanat, F., Ober, D., Gentry, J., Min, D., & Cao, R. (2019). Survey of AI in Cybersecurity for Information Technology Management. *IEEE Technology & Engineering Management Conference (TEMSCON)*.

Chatterjee, S., & Bhattacharjee, K. K. (2020). Adoption of artificial intelligence in higher education: a quantitative analysis using structural equation modelling. *Education and Information Technologies*, *25*(5), 3443–3463. https://doi.org/10.1007/s10639-020-10159-7

Chaturvedi, I., Cambria, E., & Welsch, R. E. (2023). Teaching Simulations Supported by Artificial Intelligence in the Real World. *Education Sciences*, *13*(2). https://doi.org/10.3390/educsci13020187

Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access*, *8*, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Chen, Z. (2022). Artificial Intelligence-Virtual Trainer: Innovative Didactics Aimed at Personalized Training Needs. *Journal of the Knowledge Economy*. https://doi.org/10.1007/s13132-022-00985-0

Chiu, T. K. F., & Chai, C. S. (2020). Sustainable Curriculum Planning for Artificial Intelligence Education: A Self-determination Theory Perspective. *Sustainability (Switzerland)*, *12*(14), 1–18. https://doi.org/10.3390/su12145568

Cope, B., Kalantzis, M., & Searsmith, D. (2020). Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. *Educational Philosophy and Theory*, *53*(12), 1–17. https://doi.org/10.1080/00131857.2020.1728732

Cruz-Benito, J., García-Peñalvo, F. J., & Therón, R. (2018). Analyzing the software architectures supporting HCI/HMI processes through a systematic review of the literature. *Telematics and Informatics*, 1–15. https://doi.org/10.1016/j.tele.2018.09.006

De Bruyn, A., Viswanathan, V., Beh, Y. S., Brock, J. K. U., & von Wangenheim, F. (2020). Artificial Intelligence and Marketing: Pitfalls and Opportunities. *Journal of Interactive Marketing*, *51*, 91–105. https://doi.org/10.1016/j.intmar.2020.04.007

Dowd, K. P., Szeklicki, R., Minetto, M. A., Murphy, M. H., Polito, A., Ghigo, E., van der Ploeg, H., Ekelund, U., Maciaszek, J., Stemplewski, R., Tomczak, M., & Donnelly, A. E. (2018). A systematic literature review of reviews on techniques for physical activity measurement in adults: A DEDIPAC study. *International Journal of Behavioral Nutrition and Physical Activity*, *15*(1), 1–33. https://doi.org/10.1186/s12966-017-0636-2

Fahimirad, M. (2018). A Review on Application of Artificial Intelligence in Teaching and Learning in Educational Contexts. *International Journal of Learning and Development*, *8*(4), 106–118. https://doi.org/10.5296/ijld.v8i4.14057

Guan, C., Mou, J., & Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. *International Journal of Innovation Studies*, *4*(4), 134–147. https://doi.org/10.1016/j.ijis.2020.09.001

Gupta, R., Srivastava, D., Sahu, M., Tiwari, S., Ambasta, R. K., & Kumar, P. (2021). Artificial intelligence to deep learning: machine intelligence approach for drug

discovery. *Molecular Diversity*, *25*(3), 1315–1360. https://doi.org/10.1007/s11030-021-10217-3

Haddaway, N. R., Collins, A. M., Coughlin, D., & Kirk, S. (2015). The Role of Google Scholar in Evidence Reviews and Its Applicability to Grey Literature Searching. *PLoS ONE*, *10*(9), 1–17. https://doi.org/10.1371/journal.pone.0138237

Hinojo-Lucena, F. J., Aznar-Díaz, I., Cáceres-Reche, M. P., & Romero-Rodríguez, J. M. (2019). Artificial Intelligence in Higher Education: A Bibliometric Study on its Impact in the Scientific Literature. *Education Sciences*, *9*(1), 1–9. https://doi.org/10.3390/educsci9010051

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2022). Ethics of AI in Education: Towards a Community-Wide Framework. *International Journal of Artificial Intelligence in Education*, *32*(3), 504–526. https://doi.org/10.1007/s40593-021-00239-1

Holstein, K., McLaren, B. M., & Aleven, V. (2019). Co-designing a Real-time Classroom Orchestration Tool to Support Teacher-AI Complementarity. *Journal of Learning Analytics*, *6*(2), 27–52. https://doi.org/10.18608/jla.2019.62.3

Huang, M. H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, *21*(2), 155–172. https://doi.org/10.1177/1094670517752459

Huang, S. P. (2018). Effects of Using Artificial Intelligence Teaching System for Environmental Education on Environmental Knowledge and Attitude. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(7), 3277–3284. https://doi.org/10.29333/ejmste/91248

Hwang, G. J., & Tu, Y. F. (2021). Roles and Research Trends of Artificial Intelligence in Mathematics Education: A Bibliometric Mapping Analysis and Systematic Review. In *Mathematics* (Vol. 9, Issue 6, pp. 1–19). MDPI AG. https://doi.org/10.3390/math9060584

Ilić, M. P., Păun, D., Šević, N. P., Hadžić, A., & Jianu, A. (2021). Needs and performance analysis for changes in higher education and implementation of artificial intelligence, machine learning, and extended reality. *Education Sciences*, *11*(10). https://doi.org/10.3390/educsci11100568

Joshi, S., Rambola, R. K., & Churi, P. (2021). Evaluating Artificial Intelligence in Education for Next Generation. *Journal of Physics: Conference Series*, *1714*(1), 1–13. https://doi.org/10.1088/1742-6596/1714/1/012039

Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. *Computers and Education: Artificial Intelligence*, *2*, 1–12. https://doi.org/10.1016/j.caeai.2021.100017

Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2018). Sustainable Industry 4.0 framework: A systematic literature review identifying the current trends and future perspectives. *Process Safety and Environmental Protection*, *117*, 408–425. https://doi.org/10.1016/j.psep.2018.05.009

Kaur, S., Singla, J., Nkenyereye, L., Jha, S., Prashar, D., Joshi, G. P., El-Sappagh, S., Islam, M. S., & Riazul Islam, S. M. (2016). Medical Diagnostic Systems Using Artificial Intelligence (AI) Algorithms: Principles and Perspectives. *IEEE Access*, *4*, 1–23. https://doi.org/10.1109/ACCESS.2020.3042273

Kim, J., Lee, H., & Cho, Y. H. (2022). Learning design to support student-AI collaboration: perspectives of leading teachers for AI in education. *Education and Information Technologies*, *27*(5), 6069–6104. https://doi.org/10.1007/s10639-021-10831-6

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Knox, J. (2020). Artificial intelligence and education in China. *Learning, Media and Technology*, *45*(3), 1–14. https://doi.org/10.1080/17439884.2020.1754236

Kuleto, V., Ilić, M., Dumangiu, M., Ranković, M., Martins, O. M. D., Păun, D., & Mihoreanu, L. (2021). Exploring Opportunities and Challenges of Artificial Intelligence and Machine Learning in Higher Education Institutions. *Sustainability (Switzerland)*, *13*(18), 1–16. https://doi.org/10.3390/su131810424

Lameras, P., & Arnab, S. (2022). Power to the Teachers: An Exploratory Review on Artificial Intelligence in Education. *Information (Switzerland)*, *13*(1), 1–38. https://doi.org/10.3390/info13010014

Li, J., Herdem, M. S., Nathwani, J., & Wen, J. Z. (2022). Methods and applications for Artificial Intelligence, Big Data, Internet of Things, and Blockchain in smart energy management. *Energy and AI*, *11*, 1–18. https://doi.org/10.1016/j.egyai.2022.100208

Lin, P. H., Wooders, A., Wang, J. T. Y., & Yuan, W. M. (2018). Artificial Intelligence, the Missing Piece of Online Education? *IEEE Engineering Management Review*, *46*(3), 25–28. https://doi.org/10.1109/EMR.2018.2868068

Luckin, R., & Cukurova, M. (2019). Designing educational technologies in the age of AI: A learning sciences-driven approach. *British Journal of Educational Technology*, 1–15. https://doi.org/10.1111/bjet.12861

Mahbooba, B., Timilsina, M., Sahal, R., & Serrano, M. (2021). Explainable Artificial Intelligence (XAI) to Enhance Trust Management in Intrusion Detection Systems Using Decision Tree Model. *Complexity*, *2021*, 1–11. https://doi.org/10.1155/2021/6634811

Malik, G., Tayal, D. K., & Vij, S. (2019). An analysis of the role of artificial intelligence in education and teaching. In *Advances in Intelligent Systems and Computing* (Vol. 707, pp. 407–417). Springer Verlag. https://doi.org/10.1007/978-981-10-8639-7_42

Markauskaite, L., Marrone, R., Poquet, O., Knight, S., Martinez-Maldonado, R., Howard, S., Tondeur, J., De Laat, M., Buckingham Shum, S., Gašević, D., & Siemens, G. (2022). Rethinking the entwinement between artificial intelligence and human learning: What capabilities do learners need for a world with AI? *Computers and Education: Artificial Intelligence*, *3*. https://doi.org/10.1016/j.caeai.2022.100056

Nazari, N., Shabbir, M. S., & Setiawan, R. (2021). Application of Artificial Intelligence powered digital writing assistant in higher education: randomized controlled trial. *Heliyon*, *7*(5), 1–9. https://doi.org/10.1016/j.heliyon.2021.e07014

Nemorin, S., Vlachidis, A., Ayerakwa, H. M., & Andriotis, P. (2023). AI hyped? A horizon scan of discourse on artificial intelligence in education (AIED) and development. *Learning, Media and Technology*, *48*(1), 38–51. https://doi.org/10.1080/17439884.2022.2095568

Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Computers and Education: Artificial Intelligence*, *2*, 1–6. https://doi.org/10.1016/j.caeai.2021.10002

Pati, D., & Lorusso, L. N. (2018). How to Write a Systematic Review of the Literature. *Health Environments Research and Design Journal*, *11*(1), 1–16. https://doi.org/10.1177/193758671774738

Paul, J., & Barari, M. (2022). Meta-analysis and traditional systematic literature reviews—What, why, when, where, and how? In *Psychology and Marketing* (Vol. 39, Issue 6, pp. 1099–1115). John Wiley and Sons Inc. https://doi.org/10.1002/mar.21657

Pedró, F. (2019). *Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development*. https://en.unesco.org/themes/education-policy-

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Porayska-Pomsta, K., Alcorn, A. M., Avramides, K., Beale, S., Bernardini, S., Foster, M. E., Frauenberger, C., Good, J., Guldberg, K., Keay-Bright, W., Kossyvaki, L., Lemon, O., Mademtzi, M., Menzies, R., Pain, H., Rajendran, G., Waller, A., Wass, S., & Smith, T. J. (2018). Blending Human and Artificial Intelligence to Support Autistic Children's Social Communication Skills. *ACM Transactions on Computer-Human Interaction*, *25*(6), 1–35. https://doi.org/10.1145/3271484

Ramdhani, A., Ramdhani, M. A., & Amin, A. S. (2014). Writing a Literature Review Research Paper: A step-by-step approach. *International Journal of Basic and Applied Science*, *03*(01), 47–56. www.insikapub.com

Schiff, D. (2020). Out of the laboratory and into the classroom: the future of artificial intelligence in education. *AI and Society*, *36*(1), 331–348. https://doi.org/10.1007/s00146-020-01033-8

Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. *International Journal of Educational Technology in Higher Education*, *18*(1), 1–23. https://doi.org/10.1186/s41239-021-00292-9

Sharma, K., Giannakos, M., & Dillenbourg, P. (2020). Eye-tracking and artificial intelligence to enhance motivation and learning. *Smart Learning Environments*, *7*(13), 1–19. https://doi.org/10.1186/s40561-020-00122-x

Singh, I., & Lee, S. W. (2021). Self-adaptive and secure mechanism for IoT based multimedia services: a survey. *Multimedia Tools and Applications*, *81*(19), 26685–26720. https://doi.org/10.1007/s11042-020-10493-5

Sun, Z., Anbarasan, M., & Praveen Kumar, D. (2020). Design of online intelligent English teaching platform based on artificial intelligence techniques. *Computational Intelligence*, *37*(3), 1–15. https://doi.org/10.1111/coin.12351

Toorajipour, R., Sohrabpour, V., Nazarpour, A., Oghazi, P., & Fischl, M. (2020). Artificial intelligence in supply chain management: A systematic literature review. *Journal of Business Research*, *122*, 502–517. https://doi.org/10.1016/j.jbusres.2020.09.009

Tyson, M. M., & Sauers, N. J. (2021). School leaders' adoption and implementation of artificial intelligence. *Journal of Educational Administration*, *59*(3), 271–285. https://doi.org/10.1108/JEA-10-2020-0221

Ver Milyea, M., Hall, J. M. M., Diakiw, S. M., Johnston, A., Nguyen, T., Perugini, D., Miller, A., Picou, A., Murphy, A. P., & Perugini, M. (2021). Development of an artificial intelligence-based assessment model for prediction of embryo viability using static images captured by optical light microscopy during IVF. *Human Reproduction*, *35*(4), 770–784. https://doi.org/10.1093/HUMREP/DEAA01

Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and Design in the Age of Artificial Intelligence. *Journal of Product Innovation Management*, *37*(3), 212–227. https://doi.org/10.1111/jpim.12523

Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S. D., Tegmark, M., & Fuso Nerini, F. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature Communications*, *11*(1), 1–10. https://doi.org/10.1038/s41467-019-14108-y

Vollmer, S., Mateen, B. A., Mbbs, P., Bohner, G., Franz, B. S., Király, J., Ghani, R., Jonsson, P., Cumbers, S., Jonas, A., Mcallister, K. S. L., Myles, P., Granger, D., Birse, M., Branson, R., Karel, M., Moons, G. M., Collins, G. S., Ioannidis, J. P. A., … Harry, P. (2018). *Machine learning and AI research for Patient Benefit: 20 Critical Questions on Transparency, Replicability, Ethics and Effectiveness*.

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 618-632
Email: jklppm@undikma.ac.id

Wang, Q. (2017). A Bibliometric Model for Identifying Emerging Research Topics. *Journal of the Association for Information Science and Technology*, *69*(2), 1–15. https://doi.org/10.1002/asi.23930

Ward, T. M., Mascagni, P., Ban, Y., Rosman, G., Padoy, N., Meireles, O., & Hashimoto, D. A. (2020). Computer vision in surgery. *Surgery*, *169*(5), 1–4. https://doi.org/10.1016/j.surg.2020.10.039

Williamson, B., & Eynon, R. (2020). Historical threads, missing links, and future directions in AI in education. *Learning, Media and Technology*, *45*(3), 223–235. https://doi.org/10.1080/17439884.2020.1798995

Wogu, I. A. P., Misra, S., Assibong, P. A., Olu-Owolabi, E. F., Maskeliūnas, R., & Damasevicius, R. (2019). Artificial intelligence, smart classrooms and online education in the 21st century: Implications for human development. *Journal of Cases on Information Technology*, *21*(3), 66–79. https://doi.org/10.4018/JCIT.2019070105

Yang, S. J. H., Ogata, H., Matsui, T., & Chen, N. S. (2021). Human-centered artificial intelligence in education: Seeing the invisible through the visible. *Computers and Education: Artificial Intelligence*, *2*, 1–5. https://doi.org/10.1016/j.caeai.2021.100008

Yu, Z. (2020). Visualizing Artificial Intelligence Used in Education Over Two Decades. *Journal of Information Technology Research*, *13*(4), 32–46. https://doi.org/10.4018/JITR.2020100103

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? In *International Journal of Educational Technology in Higher Education* (Vol. 16, Issue 1, pp. 1–27). Springer Netherlands. https://doi.org/10.1186/s41239-019-0171-0