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OPTIMIZATION OF TEACHERS' DIGITAL COMPETENCE IN FACING ARTIFICIAL INTELLIGENCE (AI) BASED LEARNING TRANSFORMATION IN THE ERA OF SOCIETY 5.0

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Abstract. *Digital transformation demands the adaptation of the education system to prepare future generations who are able to compete in the era of technological disruption (Pesovski et al., 2024; Schwab & Samans, 2016; Singha & Singha, 2024). One of the digital technologies that has received great attention lately is AI. AI reflects significant progress in the world of technology, with efforts to imitate complex human cognitive processes (Patty, 2024). In the context of education, AI technology can be used to assist the learning process, such as adaptive teaching, automated assessment, virtual tutors, and learning data analysis (Popenici & Kerr, 2017). The research method used is qualitative with case study techniques. Data collection was carried out by conducting interviews with key informants (Principal, Vice Principal for Curriculum and Student Affairs and Facilities and Infrastructure , also the Director of Education). The results of the study were; digital literacy is a person who can access information effectively and efficiently, assess information critically, and use the information more. Then, the creativity of teachers in utilizing digital technology to make learning more interesting still needs to be improved. AI systems can act as virtual tutors that can help students understand difficult concepts (Khamparia & Pandey, 2017). One of the factors that provide obstacles for teachers is; limited knowledge and skills in using technology, minimal training available, and lack of infrastructure support (Nugraha, 2023) , where many teachers have not optimally utilized digital technology in the learning process (Nofianti et al., 2021). Furthermore, many teachers still have limited digital skills, so it requires intensive training to be able to integrate AI technology In learning, the application of AI technology requires adequate technological infrastructure, such as fast internet connection and device supporting hardware (Ridhawi et al., 2018), and the use of AI technology in learning also raises concerns regarding privacy student data and ethical issues in use of this technology (Huang, 2023).*

Keywords: *Artificial Intelligence (AI), Learning Transofrmation, Optimizing Teacher Digital Competence.*

1. INTRODUCTION

The era of society 5.0 is a state in which society can solve various challenges and social problems by utilizing various innovations that were born in the previous era, namely the era of the industrial revolution 4.0 such as the Internet On Thing (Internet for everything), Artificial Intelligence (artificial intelligence), Big Data (data in large quantities), and robots used to improve the quality of human life. Through this society 5.0, humans can develop their skills and abilities by utilizing various technologies that have developed. The development of technology is intended to increase efficiency and productivity in various sectors, as well as reduce negative impacts on the environment so that it can help achieve sustainable development (Zaki, 2024). The role of teachers in the era of society 5.0 is an important part of the education process, so teachers are required to know and understand how life develops in the era of society 5.0. Teachers must have the ability to optimize the use of technology in the learning process so that later they can help students in facing the era of society 5.0 (Zaki, 2024).

Teachers, as the spearhead of education, are required to have competence in integrating digital technology into daily learning practices (Rahmadi et al., 2021). In the rapidly developing digital era, technology integration in the learning process is key to improving the quality of education. Technology-based learning programs, such as ICT (Information and Communication Technology) or STEM (Science, Technology, Engineering, and Mathematics)-based learning, continue to be developed to improve technology mastery among teachers. The use of technology by teachers is not only aimed at attracting students' interest in learning, but also to facilitate better understanding of the subject matter (Hakim, 2022; Sadriani et al., 2023). One of the digital technologies that has received a lot of attention lately is AI. AI reflects significant progress in the world of technology, with efforts to imitate complex human cognitive processes (Patty, 2024).

This digital transformation demands an adaptation of the education system to prepare future generations who are able to compete in the era of technological disruption (Pesovski et al., 2024; Schwab & Samans, 2016; Singha & Singha, 2024). AI technology has developed rapidly in recent years and has begun to be integrated into various aspects of life, including education. Training in the use of AI technology in learning for elementary school teachers is very important to prepare them to face the digital transformation in the world of education. AI is a branch of computer science that involves the development of intelligent systems that can perform tasks that usually require human intelligence, such as vision, speech recognition, decision-making, and problem-solving (Russell & Norvig, 2016). In the context of education, AI technology can be used to assist the learning process, such as adaptive teaching, automated assessment, virtual tutoring, and learning data analysis (Popenici & Kerr, 2017).

In addition, AI technology has great potential to improve the quality of learning in elementary schools . Some of the benefits of using AI technology in learning in elementary schools include: a. AI technology can adjust learning materials and teaching strategies based on the abilities and learning styles of each student (Pardamean et al., 2022), b. AI can be used to automatically correct assignments and exams, providing fast and accurate feedback to students (Vittorini, 2020), c. AI systems can act as virtual tutors that can help students understand difficult concepts (Khamparia & Pandey, 2017), d. AI can analyze student learning data to identify patterns and provide recommendations to improve the teaching and learning process (Zawacki-Richter et al., 2019). In the context of education, the use of AI has shown great potential to improve the efficiency and effectiveness of learning. According to Manongga et al. (2023), AI can increase access to learning by making education easier, automating management and administrative operations in educational institutions, and increasing the effectiveness of teaching and education, based on empirical data. However, challenges related to AI literacy among teachers are still a major obstacle (Taruklimbong and Sihotang, 2023).

Although AI technology offers many benefits in learning, but its application in elementary school also faced some challenges, including: a. Many elementary school teachers still have limited digital skills, so it requires intensive training to be able to integrate AI technology in learning (Instefjord & Munthe, 2017), b. The application of AI technology requires adequate technological infrastructure, such as fast internet connection and device supporting hardware (Ridhawi et al., 2018), and c. Use of AI technology in learning also raises concerns regarding privacy student data and ethical issues in use of this technology (Huang, 2023).

A common problem faced by schools is the suboptimal digital literacy skills of students. The specific target of activities in this community is students. The main problems faced are: 1) Limited ability of students to utilize learning media, 2) Low digital literacy of students. Digital literacy skills for students are very important for students to have (Naila et al., 2021). Digital literacy is becoming increasingly important in the 21st century considering the rapid development of science and technology (Sahidillah & Miftahurrisqi, 2019). Through this digital literacy, students will have extraordinary

abilities to think, learn, communicate, collaborate, and create. Digital literacy that is important for 21st century students to have includes information literacy, media literacy, and Information and Communication Technology (ICT) literacy. Digital literacy skills possessed by students can be implemented in everyday life, both in the community, family, school, workplace and other environments. Through this digital literacy, someone can access information effectively and efficiently, assess information critically, and use the information more (Khasanah & Herina, 2019).

Thus, teachers are expected to not only understand the concept of AI but also be able to implement it to improve the effectiveness and interactivity of learning. For example, through the use of AI- based learning applications , teachers can adjust learning materials according to the needs of each student, so that the learning process becomes more personal and effective. To overcome these problems, systematic and continuous efforts are needed to improve teacher competence. One strategy that can be implemented is through holding a digitalization-based learning innovation workshop (Monoarfa et al., 2022). This workshop is expected to provide practical knowledge and skills to teachers in integrating digital technology into their teaching methods (Tumiran, Ependi, et al., 2022).

Although AI technology offers many benefits in learning, but its application at school also faced some challenges, including: a. Many elementary school teachers still have limited digital skills, so it requires intensive training to be able to integrate AI technology in learning (Instefjord & Munthe, 2017), b. The application of AI technology requires adequate technological infrastructure, such as fast internet connection and device supporting hardware (Ridhawi et al., 2018), and c. Use of AI technology in learning also raises concerns regarding privacy student data and ethical issues in use of this technology (Huang, 2023). However, the main challenge in implementing AI-integrated learning is the readiness of teachers to utilize this technology (Du & Chaaban, 2020; Ealangov & Jamaludin, 2024; Sartika et al., 2022). The digital divide and lack of understanding of the potential of AI in education are significant barriers that need to be addressed.

Therefore, teachers' understanding and abilities in digital literacy can also be one of the factors that influence the mastery of learning concepts (Saikkonen & Kaarakainen, 2021; Warno, 2020; Widana, 2020; Widana et al., 2020). The ability of teachers who only read printed textbooks and practice according to books is certainly different from teachers who also utilize digital technology and mastery of digital literacy. Digital literacy is one component of media literacy skills which are the skills of using computers, the Internet , telephones, PDAs and other digital equipment (Kurniawati J., 2016). Digital transformation is a radical/extraordinary process where the process involves existing resources including utilizing existing digital technology to produce output from the organization to provide new experiences (Hadiono , 2020). Improving teacher competence in developing teaching materials is important because teaching materials are media that teachers deliberately create to find and build concepts. Teachers must also be able to adapt to technological developments. Innovation in the development of AI-based teaching media is very much needed to support learning in the 4.0 era.

2. LITERATURE REVIEW

2,1 Definition of Society 5.0 Era

Society 5.0 was born as a form of development of the industrial revolution 4.0 which is considered to have the potential to degrade the role of humans through sophisticated artificial intelligence (artificial intelligence) as the main innovation. The implementation of changes that occur in the era of society 5.0 in all aspects of life aims to create a society that is able to solve various challenges in its social life by incorporating innovations that occur in the 4.0 revolution such as big data, artificial intelligence (AI), robots and various economy to all aspects of industrial life and social. Application of the era of society 5.0 in life This society requires a wise attitude in to face this era, namely

by preparing yourself and utilizing everything existing opportunities. Therefore, there are several things that need to be considered. done to develop skills in facing the era of society 5.0; 1). Hone technological skills to be able to compete in a world of work that is increasingly dependent on technology. 2). Increase creativity because in The era of society 5.0 demands more creativity high especially must be creative in solving problems that occur, 3). Developing abilities in the learning process such as as well as learning how to use access information easily and wisely. In the process This learning in the era of society 5.0 can collaborative learning is implemented, project-based learning and technology as well learning that doesn't just focus on material or knowledge alone but This learning is able to hone these skills and learning are able to lasts a lifetime. 4). Develop social skills and keeping up with developments existing and last; 5). Able to improve his desire to continue learning new things because when we have a strong desire to keep learning then it will make it easier for us to more ready to face new things or challenges new, especially in the era of society 5.0, which is the era This requires us to be more creative, innovative, intelligent and wise (Zaki, 2024).

Digitalization and artificial intelligence dominate all human life, changing human civilization today in the Society 5.0 Era. The concept of Society 5.0 is a refinement of previous concepts, where Society 5.0 uses modern technology that relies on humans as its main component. Technology is part of humans, where the internet is not only for sharing information, but also for living today's life. There are many challenges that will be faced in the era of society 5.0, including in the field of education. Furthermore, teachers are trained to use technology and digital resources in compiling and presenting teaching modules. The current digital era offers various tools and platforms that can enrich the learning process and interaction in the classroom. According to Howson and Kingsbury (2023), the use of technology in education not only expands access to learning resources but also allows for personalization of learning that can adapt to the speed and learning styles of diverse students.

2.2 Education in the Era of Society 5.0

The era of society 5.0 demands that society is able to solve social challenges and problems through various technological innovations that have been carried out in the era of the industrial revolution 4.0. This makes the world of education have an important role in realizing quality human resources so that these human resources will be able to collaborate with technology that continues to develop to solve various social challenges and problems. To realize quality human resources and be able to collaborate with various technological innovations, schools as formal educational institutions have a very important role because schools are places where students can develop expertise in technology supported by creative, innovative, critical thinking skills, communication skills and collaboration skills so that students can contribute in facing challenges and social problems through the help of technology. The development of expertise and abilities in students in the era of society 5.0 requires teachers to know about the challenges that exist in the era of society 5.0 and the right steps in learning so that students are able to adapt and contribute in that era.

Currently, we have entered a new era called Society 5.0 where humans are expected to be able to become drivers and users of innovation and creativity that are developing in the Industrial 4.0 era (Alhamuddin, 2019). This is a challenge that must be faced by the whole world, especially Indonesian education, in order to compete in science and technology, as well as for Islamic boarding schools. If Islamic boarding schools continue to maintain the traditional learning system without integrating science and technology that continues to develop, then it is likely that these Islamic boarding schools will not be able to compete and face every challenge related to information and technology (Mudemar A rasyidi, nd). However, if Islamic boarding schools are able to combine the two, they will produce a generation that is intelligent, has character, and is ready to face every challenge in the field of science and technology (Nastiti et al., 2022).

The world of education in Indonesia also faces challenges to be able to transform in meeting the need for superior human resources. As an effort to face the era of society 5.0, education in Indonesia as a whole needs to adapt to the culture of society 5.0. This cannot be separated from the development of the generation known as the baby boomers . Baby boomers here are related to the high birth rate of several generations starting from generation X to generation α which caused the transformation of human civilization. Therefore, the answer to the challenges of society 5.0 is innovation and creativity, especially educational products, namely superior human resources. This is closely related to the function and purpose of education itself, where education is one of the main gateways to human empowerment with all the potential they have.

2.3 Teacher Digital Skills

Digital literacy skills, knowledge, and understanding are becoming very important along with the increasing digital culture among young people and children (Setiani & Barokah, 2021). Digital literacy skills for students are very important for students to have (Naila et al., 2021). Digital literacy is becoming increasingly important in the 21st century considering the very rapid development of science and technology (Sahidillah & Miftahurrisqi, 2019). Through this digital literacy, students will have extraordinary abilities to think, learn, communicate, collaborate, and create. Digital literacies that are important for 21st century students to have include information literacy, media literacy, and Information and Communication Technology (ICT) literacy. The digital literacy skills possessed by students can be implemented in everyday life, both in the community, family, school, workplace and other environments. Through digital literacy, a person can access information effectively and efficiently, assess information critically, and use the information more usefully (Khasanah & Herina, 2019).

The implementation of learning by utilizing technology can immediately run smoothly, but there are still problems that arise. One of these problems is that both teachers and students must be able to adjust the use of technology in the learning process so that the learning process can run conducively and learning objectives are achieved (Juliya & Herlambang, 2021; Verawati et al., 2022). The dominant response is the obstacles faced by teachers and students related to mastery of technology and different conditions in each region (Muiz & Sumarni, 2020). Although digital technology is developing rapidly and supports the online learning process carried out by teachers, it still takes time to adapt. Several studies have revealed that the information, communication, and technology competencies of teachers and students in Indonesia are not evenly distributed in all fields (Latip, 2020; Adisel & Prananosa, 2020; Batubara, 2018). In addition, there are still gaps in infrastructure and quality of education in various regions in Indonesia (Subroto et al., 2023). This condition is in line with that experienced by the target partner students who stated that the existence of rapidly developing technology is not directly proportional to students' ability to utilize digital technology for learning. However, students still mostly use technology to play games and social media, and rarely use it as a learning medium.

3. RESEARCH METHODS

This research will be conducted at SMP Islam Mentari Indonesia. In addition, SMP Mentari Indonesia is an IT-based school in the school management system. Research on Optimizing Teacher Digital Competence at SMP Islam Mentari Indonesia was conducted using a qualitative approach. Denzin and Lincoln formulated that qualitative research is research that uses a natural setting, with the intention of interpreting the phenomena that occur and is carried out by involving various existing methods. The purpose of qualitative research is to find answers to a phenomenon or question through a systematic scientific application procedure using a qualitative approach (Citriadin Yudin, 2020). To understand the increase in the capacity of teachers' digital competence in integrating the use of AI in the learning process with students, the

research subjects who meet these criteria are the Principal, School Treasurer, Vice Principal for Curriculum, Director of Education, Subject Teachers, especially Informatics Teachers (Representation of Junior High School Teachers Classes VII, VIII, and IX) and the Deputy for Facilities and Infrastructure and Student Representatives. The data collection techniques used were observation, interviews and documentation studies regarding the progress of teacher competence in applying AI to learning.

4. RESULTS AND DISCUSSION

The development of Artificial Intelligence (AI) technology has become one of the main milestones in the ongoing digital revolution today (Alkhairi et al., 2024; Mahendra et al., 2024; Rahman et al., 2024). AI has not only brought significant changes in various industrial sectors but also opened up new opportunities in education (Marlin et al., 2023). Digital literacy, which includes the ability to understand, use, and critique digital technology, is becoming increasingly important as AI is integrated into everyday life (Simonigar et al., 2023). This AI technology has great potential to be applied in the field of education (Al Ka'bi, 2023; Alqahtani et al., 2023; Chaudhry & Kazim, 2022; Owan et al., 2023; Su & Zhong, 2022), including for analyzing student data (Jaboob et al., 2024), personalizing learning (Pratama et al., 2023), and automating administrative tasks (Parycek et al., 2023). However, many teachers are not yet familiar with this technology, so special training is needed to equip them with the right knowledge and skills (Celik, 2023), in other words, this shows an urgent need to improve teachers' skills and knowledge regarding artificial intelligence (AI) and its application in learning (Anas, 2024; Chiu et al., 2023; Kim & Kwon, 2023; Susetyo & Fatqurhohman, 2024; Velander et al., 2024).

In the context of education, problems often arise related to teaching methods. and learning strategies that are not yet fully comprehensive. Students and students often have difficulty in understanding the material being taught, which should not be considered as an error by educators or students. Therefore, innovation is needed which can improve the quality of understanding and competence, as well as reduce errors. interpretation. Thus, this can have a positive impact on the level of success in achieving the goal of higher quality education. One of the solutions potential is to utilize artificial intelligence technology or Artificial Intelligence (AI). Artificial intelligence (AI) is a subdiscipline of computer science that focuses on development of machines that are able to think and behave like humans, such as speech recognition, problem solving, learning, and planning (Agama et al., 2020).

Artificial Intelligence can analyze data on students' understanding and provide learning content that is appropriate to their level of understanding (Amanda et al., 2023). Further motivation for focusing on group processes is related to changes in society that emphasize the need to learn to work collaboratively with others inside and outside of school, especially in an increasingly globalized world, driven by internet technology and changes in authority structures at the societal level that allow students' voices to be heard in the classroom (Baker, 2015). Teachers, as the main agents in the learning process, need to follow these developments and improve their professional competence to face the challenges in this digital era. The implementation of innovative learning models is one approach that can help teachers improve their professional competence both in schools and in society (Ariani et al., 2020). These models are designed to create interactive, collaborative, and relevant learning environments for learners living in the digital age. However, learning in the digital age also poses various challenges, such as uneven internet access, unequal technological skills among students, and a lack of understanding of how to use technology effectively. in the learning process. Therefore, learning innovation is very important to overcome these challenges and improve student learning in the digital era.

The use of AI in education promises great potential to increase learner motivation,

effectiveness, personalization, and engagement. However, more in-depth research and development efforts are needed to more comprehensively understand the implementation and impact of AI use in learning contexts. With a careful approach, AI can be a powerful tool to support the educational process and improve the quality of education in the digital era (Batusalu, 2023). Educators can provide feedback in empowering learners to navigate the dynamic AI landscape effectively by adjusting educational approaches to facilitate the needs of each learner (Alhur et al. 2023). AI greatly facilitates collaboration, helping to facilitate communication and collaboration between learners, by providing a platform that allows them to exchange ideas, complete tasks together, and learn from each other. For example, AI-based collaborative tools can facilitate group art projects and support collaborative learning (Sahnir et al., 2023) . AI helps prepare educators to face the demands of 21st-century education and maximize the benefits of AI technology in the learning process (Hakeu et al. 2023). Another impact of AI integration is increased automation and efficiency, as evident in a study conclusion where the use of artificial intelligence, big data, and automation have a significant impact on HR performance in the digital era (Pratama et al. 2023).

In context formal education, teachers play a role important as a facilitator and innovator in create an appropriate learning process with the needs of students in the digital era. By therefore, mastery of information technology become one of the competencies that must be owned by teachers to support success of the learning process. Media learning is a tool that can describe messages or information from teachers to students that aim to facilitate the learning process (Sitepu, 2021). AI not only brings significance to various industrial sectors but also opens up new opportunities in education (Marlin et al., 2023). Digital literacy, which includes the ability to understand, use, and criticize digital technology, is becoming increasingly important as AI is integrated into everyday life (Simonigar et al., 2023). This AI technology has great potential to be applied in education (Al Ka'bi, 2023; Alqahtani et al., 2023; Chaudhry & Kazim, 2022; Owan et al., 2023; Su & Zhong, 2022), including for analyzing student data (Jaboob et al., 2024), personalizing learning (Pratama et al., 2023), and automating administrative tasks (Parycek et al., 2023). However, many teachers are not yet familiar with this technology, so special training is needed to equip them with the right knowledge and skills (Celik, 2023), in other words, this shows an urgent need to improve teachers' skills and knowledge regarding artificial intelligence (AI) and its application in learning (Anas, 2024; Chiu et al., 2023; Kim & Kwon, 2023; Susetyo & Fatqurhohman, 2024; Velander et al., 2024).

CONCLUSION

The development of information and communication technology has had a major impact, including in the field of education. Teachers, as the main agents in the learning process, need to follow these developments and improve their professional competence to face the challenges in this digital era. Teachers play a role important as a facilitator and innovator in create an appropriate learning process with the needs of students in the digital era. Understanding the knowledge and skills of teachers about Digitalization -Based Learning Innovation that can be applied in the learning process in the classroom that has a positive impact because there is a real change by innovating in real terms, both innovating the latest models today (based on science and technology/digitalization). AI technology can be used to assist the learning process, such as adaptive teaching, automatic assessment, virtual tutors, and learning data analysis. In addition, AI technology has great potential to improve the quality of learning in schools. However, in the field, there are still obstacles faced by teachers in implementing digital-based learning . (Tumiran, Efendi, et al., 2022). Thus, teachers are expected not only to understand the concept of AI but also to be able to implement it to increase the effectiveness and interactivity of learning. For example, through the use of AI- based learning applications , teachers can adjust learning materials according

to the needs of each student, so that the learning process becomes more personal and effective. To overcome these problems, systematic and sustainable efforts are needed to improve teacher competence. One strategy that can be implemented is through holding learning innovation workshops.

REFERENCES

Bayu Wibawa, M., & Hussein, S. (2019). *E-commerce training for Acehnese MSMEs*. Inotec UUI Community Service Journal, *1*(2).

Dhika, H., & Isnain, N. (2020). *Implementation of e-commerce in PKK groups in sub-districts Pabuaran-Cibinong*. PKM Journal: Community Service, *3*(3).

Hariono, T., Ashoumi, H., Qoirul Tabiin, H., Khoirul Faizin, M., Information, S., & Wahab Hasbullah, A. (2020). *PKM e-commerce creation of Banjarsari village*. *2*(2). Retrieved from https://ecommerce.banjarsari-jbg.desa.id

Prambudia, Y., Caesaron, D., & Arini, I. (2020). *Improving usage skills e-inventory and e-commerce application for the Sukajaya Cisewu Garut village community*. Retrieved from http://jurnal.sttgarut.ac.id

Kurnia, et al. (2021). *AI training for elementary and middle school education personnel in Cirebon City*. *Praxis: Journal of Community Service*, *1*(1), November.

Kurnia, I. R., Cahyani, C., Fahrezzi, R., & Nugraha, R. (2024). *The importance of group counseling in counselor services at SDIT Permata Hati Bekasi, Bekasi Regency for students to improve children's social skills in the digital era*. *HEMAT: Journal of Humanities Education Management Accounting and Transportation*, *1*(2), 819–828. https://doi.org/10.57235/hemat.v1i2.2833

Rismayani, Lestari, E. A., & Tarigan, N. N. U. B. (2021). *Problems of facilities and educational infrastructure*. *Al-Ulum: Journal of Islamic Education*, *2*(2), 136–149. https://doi.org/10.56114/al-ulum.v2i2.119

Djamaluddin, A. (2019). *Learning and teaching*.

Rachmadtullah, R., Subandowo, R. M., Humaira, M. A., Aliyyah, R. R., Samsudin, A., & Nurtanto, M. (2020). *Use of blended learning with Moodle: Study effectiveness in elementary school teacher education students during the COVID-19 pandemic*. *International Journal of Advanced Science and Technology*, *29*(7), 3272–3277.

Sutrisno. (2011). *Introduction to innovative learning*. Jakarta: Gaung Perkasa Press.

Hadisaputra, S., Gunawan, G., & Yustiqvar, M. (2019). *Effects of green chemistry-based interactive multimedia on students' learning outcomes and scientific literacy*. *Journal of Advanced Research in Dynamical and Control Systems*, *11*(7), 664–674.

Rahmadi, F., Munisa, M., Rozana, S., Rangkuti, C., Ependi, R., & Harianto, E. (2021). *Development of integrated school management based on information systems in North Sumatra*. *Fitrah: Journal of Islamic Education*, *2*(2), 96–109. https://doi.org/10.53802/fitrah.v2i2.64

Tumiran, et al. (2024). *Optimizing teacher competence through digitalization-based learning innovation workshop at Mas Tarbiyah Islamiyah, Hamparan Perak District, Deli Serdang Regency*. *Journal of Human and Education*, *4*(6), 253–260. E-ISSN 2776-5857, P-ISSN 2776-7876. Retrieved from https://jahe.or.id/index.php/jahe/index

Tumiran, Ependi, R., & Lubis, S. (2022). *The implementation of Islamic classroom management and teacher performance in improving students' learning achievement*. *Al-Ulum*, *22*(2), 465–488. https://doi.org/10.30603/au.v22i2.2981

Tumiran, T., Efendi, R., & Siregar, B. (2022). *Strengthening the problem of transformational leadership of school principals and Islamic environmentally aware management at SD Negeri 106153 Klambir Lima Kebun Hamparan Perak*. *Warta Dharmawangsa*, *16*(3), 422–436. https://doi.org/10.46576/wdw.v16i3.2236

Rahman, S. A. (2022). *Islamic boarding school strategy in facing the Society 5.0 era*. *6*(2), 1829–1836.

Sabri, I. (2019). *The role of arts education in the era of Society 5.0 for the Industrial Revolution 4.0*. *2019 National Postgraduate Seminar*, *2*(1), 344. Retrieved from https://proceeding.unnes.ac.id/index.php/snpasca/article/view/302

Zainullah, & Sayyi, A. (2019). *Dynamics of multicultural Islamic education from a tradition perspective and the development of Islamic boarding schools in Indonesia*. *Fikrotuna: Journal of Education and Management Islam*, *9*(1), 1137–1159. Retrieved from http://ejournal.kopertais4.or.id/madura/index.php/fikrotuna/article/view/3489

Hitachi Laboratories. (2018). *Society 5.0: A people-centric super-smart society*. The University of Tokyo.

Nastiti, F. E., Ni'mal 'Abdu, A. R., & Studi, J. (2022). *Indonesia's educational readiness facing the era of Society 5.0*. *Edcomtech*, *5*(1), 61–66.

Mudemar, A. Rasyidi. (n.d.). *Terrorism is not identical to Islam*.

Alhamuddin. (2019). *Hidden curriculum: Polarization of Islamic boarding schools in an effort to form piety individual and social (Case study of Darussalam Gontor Modern Islamic Boarding School, Ponorogo)*, *5*(1), 50–65.

Fukuda, K. (2020). *Science, technology, and innovation ecosystem transformation toward Society 5.0*. *International Journal of Production Economics*, *220*(July), 107460. https://doi.org/10.1016/j.ijpe.2019.07.033

Rojko, A. (2017). *Industry 4.0 concept: Background and overview*. *International Journal of...*