



Exploring the Integration of Artificial Intelligence in K-12 Education: An Indonesian Case

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Abstract. Previous research on the utilization of Artificial Intelligence (AI) in K-12 education suggests that when used properly, AI can cater to the diverse needs of K-12 students. AI-powered tools have the potential to enrich students' learning experiences and improve the quality of teaching. In Indonesia, studies on the utilization of AI have focused on its uses in higher education institutions. Not many studies focus on how AI is used for students in K-12 educational levels. This study aims to explore the views of K-12 policy makers and teachers regarding the utilization of AI in schools. This study is a qualitative study in nature. The participants of the study were the director of the school foundation in Central Java, and two high school principals. The data are collected through interviews. The findings of this study found that AI has yet fully integrated into the high school curriculum. Training on the utilization of AI for both teachers and students was still lacking, even though schools recognize the potential of AI to promote critical thinking skill and enhance learning process.

Keywords: Artificial Intelligence, K-12 education, high school, teacher

1 Introduction

Recent studies suggest that many organizations are falling short in creating tangible business value through AI (Shollo, Hopf, Thiess, & Müller, 2022) and that returns on AI investment are below expectations (Mikalef & Gupta, 2021). However, many do not realize that the use of AI technology can help in many ways. Often people avoid using AI because they cannot use high technology. Even those who understand technology

often use it for bad things. Here the failure to realize the potential of AI-based technology is largely due to the way society and organizations are too simple in recognizing information technology, but in fact its use is very widespread in treating the relationship between AI and humans in the value creation process (Metcalf, Perelman, Boothe, & McDowell, 2021).

The most important thing in the development of AI technology is in the areas of accuracy, accuracy, trustworthiness, and human-machine interaction, but it seems to be a significant obstacle to implementation and performance, as well as the development of integrated and synchronous human and technical systems. The results of organizational performance generally depend on how well the organization can strategically adopt information systems including using AI to adapt, integrate, and update itself in a constantly changing technological environment (Raftopoulos & Hamari, 2024).

In education circles, ChatGPT has sparked mixed reactions, with some being shocked and amazed. On the other hand, schools and universities as well as policymakers are panicking, because ChatGPT is considered to make it easier for students to cheat on their exams. On the other hand, many are enthusiastic about using ChatGPT because it allows for automatic creation of lesson plans, assessments, short essays, engaging in semi-Socratic dialogues, and more (Mintz, Holmes, Liu, & Perez-Ortiz, 2023). This is a challenge for the education world to be able to use ChatGPT wisely. Another study suggested that practitioners can use the findings to implement AI in K-12 education (Martin, 2024). Researchers can benefit from the findings of the review but also build on the gap in research on AI K-12 education.

Currently, AI has been cited to have the capability to transform the behavior and policies of governments, businesses, industries, education, and healthcare. AI continues to advance rapidly in education, but its true impact in K-12 learning environments has yet to be realized (Ghamrawi, Shal, & Ghamrawi, 2024). Artificial intelligence in education is a growing body of literature with a diverse perspective. Many studies examined the implementation of AI with the research topic investigating both the technical design of educational systems and examining the adoption, impacts, and challenges associated with the use of AI in education, as well as identifying future research opportunities in this dynamic field (Wang, 2019).

The Indonesian government provides opportunities for the development of artificial intelligence (AI) in Indonesia. This development must be accompanied by AI regulation in the form of regulations that are prepared by considering ethical values in Indonesia. The government is committed to seeking the use of technology, digital literacy and also the development of the digital economy (Agustini, 2023). In its development, individuals and institutions in the world of Indonesian education, especially high schools, must immediately design AI-based learning, to control the negative use of AI. This study was conducted to analyze the policies made by institutions that oversee high school education, as well as how the planning and implementation of the process of raising awareness of teachers to be friends with AI to be able to keep up with the times and can direct students to be able to use AI technology wisely. This study is aimed at examining the integration of AI in K-12 education, focusing on the current school practice, the school policies and school support systems that are currently implemented to guide teachers and students in incorporating AI in classrooms. More specifically, this study intends to investigate whether regulations or manuals were created to promote the use of AI-generative tools in classrooms. In addition, this study attempts to examine

school support for AI adoption such as workshops, training, and infrastructure designed for teachers as well as students.

The findings of this study hopefully will add a greater contribution to the understanding of how high schools in Central Java in particular, in adopting AI. The existing literature in AI adoption and integration has mostly focused on higher education institutions. Research on the adoption and integration of AI in K-12 education is still lacking.

1.1 Defining AI

The term AI was coined by John McCarthy in 1955 (Manning, 2020). He defined AI as “the science and engineering of making intelligent machines” (McCarthy, 2007). Throughout the years, scholars have proposed various definitions of AI along with the increased interest on AI used in education, industry, and other institutions. However, so far, there is no uniformly accepted definition of AI, and no definition can describe what AI actually involves (Samoili, Montserrat Gómez, Prato, Giuditta Martínez-Plumed, & Delipetrev, 2020; Wang, 2019). However, as Samoili, Montserrat Gómez, Prato, Giuditta Martínez-Plumed, & Delipetrev (2020) pointed out, many scholars defined AI as “machines that behave like humans or are capable of actions that require intelligence” (McCarthy, 2007).

1.2 The Potentials and the Downsides of AI

Current literature on the potential of AI in education mostly has pointed out that AI is beneficial for personalized learning. AI has the capability to perform many functions and adapt them according to the learning needs and styles (Ivanov, Cristea, Vlase, & Munteanu, 2023). In addition, students can use AI anytime and anywhere without limited support from another person. Another benefit of AI is that it provides immediate feedback. Students who use AI independently can receive feedback and input for their performance (Roy & Paul, 2023). In the classrooms, to increase student engagement, teachers can create interactive and customized content. Studies also have indicated that teachers utilized AI to help them with the administrative tasks, so that they will have more time to focus on student performance (Holmes, 2023).

Even though AI provides many advantages, significant challenges are evident. Two of the most-cited challenges of AI are digital ethics and academic dishonesty. There are concerns if students use AI-generative tools to write a whole essay. However, this concern needs to be tested since cheating has existed even before the emergence of ChatGPT (Lee, Pope, Miles, & Rosalía, 2024). Teachers raised their concerns over improper use of AI for school assignments, especially with the emergence of ChatGPT. Students can easily copy and paste from ChatGPT. They used the tool for shortcuts to complete whatever assignments they have. Lack of guidance and support from school administrators exacerbate this issue. Students may not be aware of the consequences of plagiarism due to overreliance on the tool (Mintz, Holmes, Liu, & Perez-Ortiz, 2023). Another concern is the privacy breach. Since AI collects information from the vast database including personal information, anyone with sufficient knowledge to manipulate or retrieve data can lead to privacy violation (Akgun & Greenhow, 2022).

1.3 Integration of AI in K-12 education

The discussion of AI integration in education has primarily focused on the university level (Jianzheng & Xuwei, 2023; Sutjarittham, Gharakheili, Kanhere, & Sivaraman, 2019). Although AI existed as early as the 1950s, many education institutions are not well-prepared and well-equipped to implement AI-generative tools into their curriculum, especially K-12 institutions (Casal-Otero, et al., 2023). In Asia, some progressive countries such as China, Hong Kong, and Singapore have integrated AI into their curriculum (Yim & Su, 2024). In their review, they pointed out that previous studies have investigated the impact of AI-generative learning tools on students' performance in older students in universities, but such research among younger students is still underrepresented. This results in a big gap in understanding how AI-generative tools can benefit younger students. Studies on AI integration in K-12 education still lacks theoretical frameworks or conceptual models. Yim & Su (2024) further reiterated the importance of those models to provide guidance for AI instructions.

This lack of integration often stems from rejection of technology to lack of understanding of AI technology (Adiwardana & Herawati, 2024). Teachers and school administrators are inundated with the complexity of AI; thus, many of them refuse to incorporate those tools in their classrooms. Studies on the impact of AI for younger students; therefore, is imperative.

2 Method

This study employed a qualitative method, a research method whose purpose is to understand how people or groups of people put meaning on essential issues in their lives (Creswell, 2017). In particular, this study aims to investigate the integration of AI-generative tools in K-12 schools, school policies, and school support regarding AI-generative tools. The two high schools in this study were under Citra Kasih foundation. The foundation itself oversees many elementary to high schools in several provinces in Indonesia. The authors have several collaborations with several schools under this foundation. In other words, they have access to contact the participants.

2.1 Method of Data Collection

2.1.1 Participants

The participants in this study were two high school principals and the director of Citra Kasih Foundation. Among them, two were males, and one was female. The participants in this study were selected using convenience sampling. The authors contacted several people and contacted those whose schedules were open for data collection. Purposeful sampling was adopted to recruit the participants. The participants' ages range from 30 – 50 years old. One has had more than five years' experience as a high school principal, while the other had just less than three years of experience, but she had several years of experience in the high school curriculum development team which evaluates, monitors,

assesses, and designs the curriculum in high schools under the Citra Kasih Foundation. In this study, the authors used pseudonyms for participants and the foundation's names to protect the confidentiality of the participants.

2.1.2 Instruments

The main instrument in this study was the interviews. The authors designed semi structured interviews whose questions aimed to obtain in-depth information regarding integration, school policies, and school support of AI-generative tools in high schools. The authors had met the participants at different events; thus, the interviews were conducted in a very comfortable atmosphere.

Questions were carefully designed to enable participants to reflect on their own experiences and insights thoroughly and elaborately. The interviews were conducted in person and virtually. All interviews were recorded using a recording application in smartphones. To ensure the privacy of the conversation and to prevent unnecessary distractions, the interviews were conducted through Zoom or the participants' office in the evening or after the classes were over. The researchers conducted a pilot study to make sure the questions did not cause miscommunication and could be understood well.

The interviews consisted of four parts. The first was the Introduction. In this part, the researchers mentioned the purposes of the study and the ethical considerations, such as confidentiality. The second part was personal background information. The third part consisted of probing questions related to the research question. The last part was closing. In this part, the researchers mentioned the possibility of further contacts for confirmation, clarification, and member-checking.

To collect data, the researchers first designed interview questions and a pilot study to test the interview questions. Then, they asked permission from the director of the Citra Kasih foundation to do interviews. After that, participants were contacted. The next step was to conduct interviews according to the participants' schedules.

3 Findings and Discussion

3.1 AI Integration in High Schools

The first research question in this study deals with the current practice of AI integration in high schools. The researchers found three themes related to the issue. Each theme was discussed in detail along with some excerpts from the interviews.

3.1.1 AI-generative tools have not been fully incorporated into classrooms.

The participants in this study reported that AI-generative tools have not been integrated fully in the classroom. Information regarding the potential of AI-generative tools for the classrooms has not been made available for any teachers. There are many reasons why the integration of AI-generative tools is lacking. First, many teachers have limited knowledge of what AI in general, and AI-generative tools in particular. Many teachers are senior teachers who claimed to have been unable to keep up with the latest technological advancement or who were not technologically savvy. One of the participants

noted that teachers of Information Technology were among those who have incorporated or adopted AI-generative tools in their classrooms and have designed interactive classes using AI. Teachers of English language have also been the pioneers of AI adoption in their schools. However, many teachers of various subjects still use traditional teaching methods to deliver their courses. Senior teachers rely on their younger colleagues when it comes to technology. Lukas, one of the headmasters, recalled how his senior teachers simply “let the younger teachers deal with the new technology”. In his opinion, this is unfortunate because senior teachers were supposed to be able to inspire younger teachers.

3.1.2 AI is used to help administrative tasks.

Among the teachers who used AI, the integration was mostly limited to AI-generative tools to help them with administrative tasks such as helping them to make project proposals and brainstorming ideas. Tools such as ChatGPT and Quillbot can be used to make proposal outlines. They emphasized that they were aware that they should not just copy and paste. Thus, those AI-generative tools merely function as brainstorming tools. Their ability to collect information from a large database was useful even if the information is not thoroughly accurate and sometimes not suitable with Indonesian conditions. One of my participants said that actually without ChatGPT she could complete her proposal well. However, the application makes her writing process a lot faster since she could use the ideas that ChatGPT offers.

3.1.3 Pedagogical approaches for AI-based tools have not been further explored and discussed.

Because AI has not been fully integrated into the curriculum, pedagogical approaches for AI-based tools have yet to be explored. One of the headmasters suggested that their teachers attended some trainings on digital tools, but there had been lack of efforts to disseminate the information obtained from such workshops. Discussions among teachers to incorporate AI technology were mostly done in informal settings. Imaya said:

Such sharing is not done in formal setting where we get together. Mostly, we share informally. We have no event set up for information dissemination. For instance, I once informed students about ChatGPT in the teachers’ room. Then those who have used ChatGPT shared their knowledge as well (Imaya, interview).

Nurdin, one of the participants of this study, added that among school principals had regular meetings once every two months and they used this event as a place to exchange and disseminate information, including best practices with emerging technologies.

3.2 School Policies

The second research question is intended to examine the school policies regarding the integration and the utilization of AI in schools. There are two emerging themes for this research question. They are:

3.2.1 Efforts to guide teachers in the use of AI have been sporadic.

The foundation is one of the biggest school foundations in Indonesia covering schools throughout Indonesia. However, the policy makers in this foundation did not have centralized strategies for the utilization of AI. Although the foundation has ad hoc team for curriculum development, their responsibilities focused on the character building of the students and the core values of the foundation. Some teachers who are relatively progressive in the area of digital technology received guidance from other institutions. Professional development for teachers was also based on the type of schools. The foundation oversees many schools in various regions in Indonesia, from prestigious schools in big cities to schools for economically disadvantaged communities in more remote areas. Schools with more resources are more likely to be able to conduct programs for teachers' professional growth or send their teachers to workshops. Imaya, one of the participants said "I informed teachers about AI technology, but specialized trainings on integration of AI technology has yet to be conducted. However, a few teachers attended webinars on AI integration held by other institutions.". She further added that dissemination of information from the webinars remains lacking. The director of the foundation said that dissemination of information was determined by each school. The foundation manages the budget, but the allocation of the budget for the dissemination of information is the responsibility of each school.

3.2.2 Not all teachers have opportunities to attend AI-related workshops.

One of the principals, Lukas, reported that his school conducted Saturday discussions every first and third Saturday. They invited experts to talk to teachers. The topic, however, did not always relate to technology. He further added that his teachers in his school have yet to attend training on AI literacy. The director of the foundation, Nurdin, mentioned a program that a university offered related to digital literacy. The program was intended to assess teachers' digital literacy. He said:

From the program, we can see that most teachers possess very basic digital literacy. There are a few who are more expert and knowledgeable, but most teachers do not have good understanding of basic digital technology even though such skills are necessary to guide students properly (Lukas, interview).

The training program for teachers was conducted online, but the impact of the training on teachers' digital literacy was still unclear. He stated the training was attended by all schools once. The foundation planned to conduct training for teachers who possessed intermediate digital literacy skills, but when the training would be held it was still unclear. The director believed that such training courses were of utmost importance for

teachers, but to implement the idea was challenging because of several factors such as geographical locations, access to the Internet, and each school's academic and non-academic activities.

3.3 School Support System

The third research question aims to examine the school support system. There are two emerging themes for this. They are as follows:

3.3.1 Support is available for teachers but not for students.

So far, support for the utilization of AI is only available for teachers. To date, no workshops or training are planned to guide students in using AI-based tools or to teach them digital ethics or academic dishonesty. One of the participants acknowledged the importance of such training because she saw the impact of ChatGPT on students' assessment. She said that students relied on ChatGPT when completing their assignments, but so far, her school has not planned to conduct training for students. She further said that it would be best if the researchers assisted her in providing such training. Imaya pointed out that training students about the potential of AI-generative tools can become two-sided coins. On one hand, students are more knowledgeable about AI-generative tools, but they can also use the loopholes to cheat. Imaya, instead, asked the authors to conduct workshops for students on digital ethics and ways to prevent academic dishonesty.

3.3.2 There is a lack of support for AI integration.

Imaya, one of the headmasters, reported that the school had technical support to assist any teacher or students who faced difficulties with their gadgets. Teachers who could not download images, edit their work, or use various applications in their schools can ask for technical support. The school's technical support is also responsible for any technical difficulties that might arise from wireless networks, software installations, hardware problems, and other digital tool-related glitches. Lack of expertise is one of the reasons why schools do not have support for AI integration. These schools rely on other institutions for further training on AI integration. Those who use AI do not necessarily comprehend that AI-based tools entail and how teachers can use AI to create more engaging content for any subject matter. Lukas reported that IT support usually prepares students to use their learning management system or national exam online portal. The IT team did not handle pedagogical approach for AI integration.

4 Discussion

The results of this study suggest that AI integration in K-12 education is still in its infancy, reflecting teachers' limited knowledge and available resources. In Asia, developing countries such as Hong Kong and Singapore show more rapid progress in AI integration in K-12 education. In those countries, AI has been incorporated seamlessly and systematically into their curriculum. In Indonesia, lack of government funding

might be one of the reasons why there is a shortage of training and workshops for teachers. Therefore, government needs to allocate more funding for various trainings related to technology in general or AI in particular. Concerted events or platforms for teachers are necessary for the exchange of ideas and best practices. Without them, teachers will likely to be unprepared to use AI technology. Schools and educational institutions would benefit from creating more formalized opportunities for teachers to collaborate, share their experiences with AI tools, and receive targeted training that goes beyond basic digital literacy.

This study also highlights how AI is still used for administrative purposes. This fact corroborates Yim & Su's findings which indicated that in K-12 education, AI has not received much attention as tools that can empower students to become independent learners (Yim & Su, 2024). AI has a lot of potential to revolutionize classrooms; however, it seems that many teachers in K-12 levels do not have confidence to incorporate AI. They might be too comfortable with their traditional teaching method or unwilling to embrace new technologies.

5 Conclusions and Suggestions

In conclusion, this study reveals that in high schools, the integration of AI-generative tools in high schools has yet fully developed and integrated. One of the causes of this is teachers' limited knowledge of AI, lack of support systems. Sporadic efforts to guide teachers were visible, but their impacts on their understanding and willingness to incorporate AI-generative tools remain unseen. Some teachers with higher digital and AI literacy have begun to experiment with AI, exploring the potential of AI to improve students' understanding of the subject matter and to increase students' interests. This study is an exploratory study limited to high schools in Central Java. Therefore, the findings might not reflect the current conditions of AI literacy among all high school teachers in Central Java. To fully benefit from AI technology, future research on the effectiveness of AI to promote independent learning, critical and analytical thinking skills while increasing awareness of overreliance on AI, digital ethics, and academic dishonesty is of utmost importance.

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