





Teachers' Readiness to Adopt AI for Teaching Materials Development: The Impact of AI Literacy Training at a Senior High School in Depok



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ABSTRACT

Background: This article analyses teachers' readiness to adopt artificial intelligence when developing teaching materials. It explicitly measures teachers' competency after participating in AI literacy training.

Objective: This study aimed to determine whether the training can improve high school teachers' understanding and competence in utilising generative artificial intelligence as a tool for developing teaching materials.

Method: This quantitative study employed a one-group pretest–posttest design and a pre-experimental method. Fifty teachers at SMAN 1 Depok were chosen as responders using a total sampling technique. A questionnaire was used to gather information in order to assess the effectiveness of the AI literacy training program. In order to supplement the quantitative data, observations and interviews were also carried out.

Results: The study's findings show that instructors at SMAN 1 Depok are highly prepared to incorporate AI into the creation of instructional materials. The AI literacy training has effectively improved the teachers' perceptions, knowledge, and skills while applying AI in educational contexts.

Conclusion: Seven variables measured in this study, which include aspects of understanding, skills, views, ethics, threat perception, innovation, and job satisfaction, experienced a statistically significant increase ($p < 0.05$), with a large effect size (Cohen's $d > 0.8$) in almost all aspects, indicating a substantial practical impact of the training.

Keywords: Artificial Intelligence, Artificial Intelligence Literacy, Artificial Intelligence Adoption, High School Teachers, Depok City.

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INTRODUCTION

Over the past decade, artificial intelligence (AI) has provided adaptive learning solutions tailored to students' needs (Zhai et al., 2021). Zhai et al. (2021) identified three main dimensions of AI utilisation in education: the development dimension, which includes classification, matching, recommendation, and deep learning; the extraction dimension, which includes feedback, reasoning, and adaptive learning; and the application dimension, which includes affective computing, immersive learning, gamification, and role-playing. The optimal implementation of these dimensions depends on educators' readiness to adopt AI technology. Readiness is defined by the Merriam-Webster Dictionary as "the quality or state of being ready", which, in education, is an integral component of teaching and learning processes (Karaca et al., 2021). AI adoption readiness refers to users' transition from limited knowledge of AI to understanding its usefulness and making informed decisions in selecting and using AI technology according to their needs (Luckin, 2022). Teacher readiness to adopt AI includes cognition, ability, vision, and ethics (Karaca et al., 2021), which influence AI-enhanced innovation and job satisfaction, while perceived threats toward AI may hinder innovation and reduce job satisfaction (Wang et al., 2023).

AI readiness is closely related to AI literacy, particularly among teachers. AI literacy refers to an individual's ability to manage information through technical and metacognitive skills needed to face future challenges (Yi, 2021). Long and Magerko (2020) define AI literacy as a set of competencies that enables users to critically evaluate AI technology, communicate and collaborate effectively with AI, and use AI as a tool in various contexts. Almatrafi et al. (2024) further identify six key components of AI literacy: recognising, understanding, applying, evaluating, creating, and ethically navigating AI. These components highlight the importance of technical, cognitive, and ethical capacities in supporting responsible AI use. In Indonesia, since the end of 2024, AI has expanded across various sectors, including trade, education, and business. Generative artificial intelligence (GAI) has significantly influenced education by transforming how people work, interact, and learn. According to a Statista Consumer Insights survey, Indonesia ranks fourth among countries with the highest enthusiasm for adopting GAI in daily activities (Fleck, 2023).

In the educational context, the use of GAI as a teaching and learning medium has grown rapidly in recent years (Joksimovic et al., 2023; Crompton & Bruke, 2024; Law, 2024; Mah & Groß, 2024). Research in this area has focused on preventing misuse or fraud in educational assessment and evaluating the impact of GAI on teaching methods (Hodges & Kirschner, 2024; Mao et al., 2023). Crompton and Bruke (2024) found that GAI in education can be used in three functional categories: instructional support, task automation, and professional development. Its main functions include content creation, lesson planning, personalised learning experiences, and student assessment. GAI can assist teachers in developing content, lesson plans, learning activities, and syllabi (Kasneci et al., 2023), as well as creating language learning dialogues and subject ideas (Topsakal & Topsakal, 2022; Cooper, 2023).

Since its launch in late 2022, ChatGPT has become a prominent technological phenomenon in education and learning as a form of generative AI developed by OpenAI (Ali et al., 2023). ChatGPT can personalise learning by adapting texts to students' levels, assigning tasks with varying complexity, and analysing student writing to provide specific feedback (Kasneci et al., 2023). Teachers can also use

ChatGPT to design questions that stimulate critical thinking and problem-solving. However, integrating AI into learning requires teachers to have a multidimensional and holistic understanding of AI, including technical skills, scientific knowledge, and ethics (Stolpe & Hallström, 2024; Knoth et al., 2024; Ayanwale et al., 2024). Although ChatGPT is one of the most popular and widely utilised AIs, it is not the first developed AI (Eke, 2023). In education, GAI offers meaningful potential to transform teaching through personalised learning, increased student engagement, and improved efficiency in developing learning materials and evaluations (Bhutoria, 2022; Yeh, 2024; Ding et al., 2024). Nevertheless, AI use as a teaching and learning tool remains limited because educational institutions are not fully prepared to utilise GAI and still lack professional staff with expertise in this field.

Despite its potential, GAI also raises several challenges and concerns, including possible disruption to teachers' roles, ethical issues, plagiarism, algorithmic bias, and information misuse (Eke, 2023; Chan & Tsi, 2024; Holmes et al., 2022). Teachers therefore play an important role not only in transmitting educational materials but also in facilitating learning, mentoring students, and cultivating moral principles. Improving teachers' understanding and ability to use GAI sensibly and responsibly is essential. Although GAI is widely used by the public, including students, comprehensive understanding of this technology remains limited. Many educators are still unfamiliar with the potential and limitations of AI in educational settings (Du et al., 2024). This condition shows the urgency of developing AI literacy among teachers, as it supports adaptive teaching competencies and enables teachers to guide students in navigating an increasingly digitalised world shaped by AI.

Based on these issues, this study aims to identify teachers' readiness to adopt AI in developing teaching materials, specifically among teachers at SMAN 1 Depok. This study serves as a tactical step in equipping teachers with knowledge and practical skills to use AI as a learning tool. Through AI-based, relevant, and interactive teaching materials, teachers can increase student engagement and foster more contextual and meaningful learning, which may improve the quality of secondary education in the long term. Depok City was selected because it has demonstrated a strong commitment to educational innovation, including the development of a smart culture in schools (Depok City Government, 2024). This policy reflects the readiness of Depok's educational ecosystem to adopt and integrate new technologies into learning and offers the potential to become an initial model for technology-based teacher competency development that can be replicated in other Indonesian cities. Although numerous studies have examined AI literacy among teachers, they remain limited to practical aspects, general perceptions, or teachers' readiness to adopt GAI (GS et al., 2024). Previous studies have also not sufficiently addressed changes in specific variables after structured interventions. Therefore, this study fills this gap by using a quantitative approach through a one-group pre-test–post-test pre-experimental design to measure changes in teachers' perceptions across seven key variables reflecting readiness to adopt GAI in teaching before and after an AI literacy training intervention.

METHODS

This study employed a quantitative approach with a pre-experimental method with a one-group pre-test–post-test design. This pre-experimental method emphasizes initial testing of the effect of a treatment with limited control (Campbell & Stanley, 1966). The one-group pre-test–post-test design was chosen to measure changes in participants' perceptions of seven GAI adoption readiness variables in teaching materials development before and after a program or intervention. There

was no control group, as the primary focus of the study was to examine differences within the same group (within-subject). The experimental scheme used in this study can be seen in Table 1.

Table 1 Research Experiment Scheme

| Pre-test | Intervention | Post-test |
|----------|--------------|-----------|
| T1 | X | T2 |

Note. T1: The pre-test was conducted once before the intervention was given. X: AI interventions were provided to teachers through AI literacy workshop sessions. T2: The post-test was conducted once after the intervention was given.

This study has gone through the respondents' approval before filling out the questionnaire and before taking part in the training that we will provide. This study involved 50 teachers at SMAN 1 Depok, selected using a total sampling technique. Data were collected through a questionnaire to measure seven variables: understanding of artificial intelligence (PtKB), ability to use artificial intelligence (KPKB), views on artificial intelligence (PKB), ethics in using artificial intelligence (EPKB), threats in using artificial intelligence (APKB), innovation enhanced by artificial intelligence (IKB), and job satisfaction when using artificial intelligence (KPKmKB) (see Appendix A). A 1 to 5 Likert-type scale was used to measure each variable from this study. For the purpose of data analysis, a paired sample t-test was administered to check for statistical significance of the differences in score for each domain before and after the intervention ($p < 0.05$) (Field, 2024). Effect sizes were calculated and assessed for strength using Cohen's and Hedges' correlation (effect size Cohen's $d > 0.8$) (Cohen, 2013).

The training was conducted for six days, covering the concepts of information literacy for teachers, the importance of artificial intelligence literacy for teachers, the use of AI in learning, and the use of AI tools such as chatGPT, Gemini, Deepseek, and others for developing teaching materials. Each training session was divided into two parts: a lecture session, which included the presentation of concepts by the resource person, followed by a practical session conducted by the teachers under the guidance of facilitators.

RESULTS

Validity and Reliability Test

To determine whether the items in the research instrument genuinely measured intention, a validity test was conducted. In this research study, the validity was assessed using inter-item correlation using the SPSS program, where the item was considered valid when its correlation value with the total score or other items was ≥ 0.30 . The analysis showed significant strong correlations for most items between 0.40 and 0.89. Therefore, all items in the instrument were declared valid. Reliability testing was conducted using Cronbach's Alpha score. If the Cronbach's Alpha value is more than 0.60, then it is considered reliable.

Table 2 Reliability Test Results

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .926 | 31 |

The result of reliability test in Table 2 demonstrates a Cronbach's Alpha value of 0.926 (>0.7). It indicates a high level of reliability. In other words, the instrument used consistently measures the variables studied.

Respondent Demographic Data

Fifty teachers from various backgrounds were the respondents in this study. They participated in all activities: a pre-test, an intervention including a series of AI literacy training sessions, and a post-test. Based on the data, Table 3 shows the proportion of the respondents.

Table 3 Respondent Demographic Data

| Variable | Category | N | Percentage |
|-------------------|--|----|------------|
| Gender | Male | 18 | 0,36 |
| | Female | 32 | 0,64 |
| Age | <36 years | 10 | 0,2 |
| | 36-45 years | 12 | 0,24 |
| | 46-55 years | 22 | 0,44 |
| | 56-65 years | 6 | 0,12 |
| Highest Education | D4 (Diploma)/S1 (Bachelor's Degree) | 26 | 0,52 |
| | S2 (Master's Degree) | 24 | 0,48 |
| Subjects | Science, Mathematics and Natural Sciences | 16 | 0,32 |
| | Language and Literature | 9 | 0,18 |
| | Social Sciences, Economics, and Humanities | 10 | 0,2 |
| | Counselling Guidance | 3 | 0,06 |
| | Religious Education | 3 | 0,06 |
| | Physical Education | 2 | 0,04 |
| | Civic Education | 3 | 0,06 |
| | Arts and Culture | 1 | 0,02 |
| | Information Technology | 2 | 0,04 |
| | Entrepreneurship | 1 | 0,02 |

By gender, most respondents were female (32/ 64%). Meanwhile, 18 respondents (36%) were male. In other words, the survey was dominated by female respondents. By age, the respondents were between 28 and 65 years old: below 36 years consisted of 10 (20%), aged 36-45 comprised 12 (24%), aged 46-55 were 22 (44%), aged 56-65 were 6 (12%). It shows most respondents were around 36-45 and 46-55 years old. It shows that most were already mature especially in their careers and professional experience as teachers. By recent education, the proportion was be balanced. Twenty-six (52%) respondents had a Diploma 4/Bachelor's degree. Twenty-four (48%) had a Master's degree. It indicates that all respondents pursued a higher education, relevant to the need of understanding AI in education.

The respondent distribution reflects a varied representation across the different disciplines of education. Most respondents were from Science and Mathematics and Natural Sciences with 16 respondents (32%), the next group was Social Sciences, Economics, and Humanities with 10 respondents (20%), and Language and Literature with 9 respondents (18%). In contrast to this higher number of respondents, there was only 1 from Arts and Culture and 1 from Entrepreneurship, each with 2%. Nevertheless, this distribution still suggests diverse academic disciplines. It provides cross-disciplinary lenses, theorizing understanding and application of, AI in education.

Evaluation of Intervention Effectiveness

The effectiveness was evaluated in three phases: a pre-test, the AI literacy training, and a post-test. The pre-test and post-test were designed to capture the effect of AI literacy training on seven important variables that reflect the cognitive,

affective, and ethical dimensions of respondents' willingness to adopt AI as shown in Table 4.

Table 4 Effectiveness of AI Literacy Training based on paired samples t-test results.

| Variable | Description | Mean (Pre-test) | Mean (Post-test) | Significance (p) | Size Effect (Cohen's d) |
|----------|--------------------------------|-----------------|------------------|------------------|-------------------------|
| PtKB | Understanding of AI | 0,170833 | 0,219444 | p = .000 | 0,065972 |
| KPKB | Ability to use AI | 0,175694 | 0,195833 | p = .000 | 0,061111 |
| PKB | Views on AI | 0,184028 | 0,215278 | p = .000 | 0,067361 |
| EPKB | Ethics in using AI | 0,188194 | 0,213194 | p = .000 | 0,041667 |
| APKB | Threats in using AI | 0,144444 | 0,097917 | p = .017 | 0,077083 |
| IKB | Innovation enhanced by AI | 0,161111 | 0,211111 | p = .000 | 0,064583 |
| KPKmKB | Job satisfaction when using AI | 0,145833 | 0,191667 | p = .000 | 0,064583 |

The results of this study indicate significant changes in the respondents' perceptions and assessments of AI after the training. The paired samples t-test result of the seven main variables indicates that there was a large increase in the mean average of six of the variables identified: knowledge of AI (PtKB), understanding of how to use an AI (KPKB), perceptions of AI (PKB), ethics of using ai (EPKB), integrating AI into innovation (IKB), and satisfaction with using an AI (KPKmKB). All of these variables increased in average score with a significance value of $p < 0.001$ which indicates that the increases in the sample data were not due to chance, and were a genuine effect of the training program. Further, the perceived threat of AI (APKB) decreased, also statistically significant ($p=0.017$), as well as a large Cohen's d effect size for each variable in sample. This shows that the training had a significant effect in not only increasing understanding and capacity but also in reducing the participants' anxiety or concerns around potential threats of using an AI.

Understanding of AI

The teachers' knowledge of fundamental concepts and applications of AI improved considerably after the training (mean pre = 4.06; post = 4.76; $p = 0.000$; Cohen's d = 0.95; increase of 0.70). This again provided evidence that the AI literacy training intervention can close a gap in knowledge of AI, preventing it from being adopted. The teachers had gain better insights into AI, including the applications to education, and how it can potentially inform more effective teaching and learning processes.

Furthermore, this deeper knowledge of AI was evidenced in the way teachers articulated the links between their professional identities and the evolution of AI, and potentially also how they may place themselves purposefully in a growing digitalised education environment. They had also begun to understand more about some general working mechanisms of AI (e.g., how to distinguish between different applications and their possible utility in the learning context). The training gave new insights into how they could use AI to support the end-to-end processes of data-driven decision-making more ethically and effectively.

Therefore, all the conceptual, functional, and reflective facets of AI understandings were increased post-analysis in the training. The interviews supported this data as respondents stated they felt they were able to articulate the differences in the functions of different AI applications (e.g. they were more predisposed to using ChatGPT than Gemini). They view ChatGPT as a user-friendly artificial intelligence according to the researchers, although they had to invent particular prompts to successfully achieve relevant or on-topic responses. This

evidence showed that there was an increase in conceptual literacy and critical consciousness to select and use the tool appropriately in the educational context.

Ability to Use AI

The results show that teachers not only understand the theory but also develop practical skills to use AI in developing teaching materials (Mean pre = 3.73; post = 4.42; $p = 0.000$; Cohen's $d = 0.88$; improvement = 0.69). After the training, they were more confident using AI-based applications to design interactive and adaptive learning materials.

Based on observations and interviews with teachers, they have started to give permission for their students to use ChatGPT for assignments. Therefore, the students can get new knowledge from ChatGPT. However, students should critically analyse the questions from the teachers. Therefore, it will also require teachers to explore ChatGPT as a partner to enhance knowledge and ideas in developing teaching materials.

Views on AI

Teachers' positive perceptions of AI increased significantly (mean pre = 3.85; post = 4.70; $p = 0.000$; Cohen's $d = 0.97$; increase = 0.85). It reflects a shift in attitude from scepticism to acceptance, which is crucial for successfully integrating technology in schools. This positive view enables teachers to consider AI as a supporting tool that can enrich the learning process and improve student learning outcomes, instead of as teacher's replacement.

The teachers' enthusiasm to participate in the AI literacy training shows their positive view on the significance of AI in education. They consider AI as a partner, giving ideas or recommendations on current issues in their subjects. AI can address several issues: (1) increasing research and discoveries; (2) increasing interactions between data, machines, and systems; (3) anticipating and preventing ruptures; (4) giving proper recommendations; (5) increasing expertise and learning; and (6) detecting obligations, responsibilities, and risk mitigation.

Ethics in Using AI

The increase in scores on the ethics aspect (Mean pre = 3.91; post = 4.67; $p = 0.000$; Cohen's $d = 1.00$; increase = 0.76) shows that the success of the training to enhance teachers' awareness of the ethical implications. Teachers better comprehend the significance of data privacy, algorithmic bias, and the social impact of AI use in the classroom. It is crucial to ensure that AI integration in education is conducted responsibly.

Observations and interviews show that teachers have a good awareness of the responsible use of AI. For instance, they do not simply use the raw AI results (when using tools like ChatGPT) to find ideas or references for teaching materials. Instead, they combine information from AI with trusted sources like textbooks, scientific articles, and mass media. Thus, the material presented to students is a combination of various sources, indicating an ethical and academic understanding of AI in teaching materials.

Threats in Using AI

Perceptions of the threat posed by AI illustrated a considerable decrease (mean pre = 2.88; post = 2.21; $p = 0.017$; Cohen's $d = 1.51$; decrease = 0.67). It reflects the successful training in decreasing teachers' anxiety or concerns about the possible negative impacts of AI, such as the possibility of AI replacing teachers or the

dominance of AI in the learning process. Before the training, some teachers were concerned that AI would replace their primary role.

However, after understanding the basic principles of AI, teachers realised that AI was just system that mirrored human thought processes. AI was not an entity with consciousness or pedagogical values. They also understood that the quality of AI output, like ChatGPT, depended highly on humans' input (the prompts). Based on interviews and observations, they believed that AI only supported (did not replace) as it still required human competence and intervention to function optimally in an educational context. This understanding reinforced their belief that AI would not replace their role.

Innovations Enhanced by AI

The researcher found a significant increase in teachers' perceptions of AI as a source of innovation (mean pre = 3.52; post = 4.64; $p = 0.000$; Cohen's $d = 0.93$; increase = 1.12). The data showed that AI is perceived as a connector and an enabler of innovation in the development and context of teaching materials. The materials are seen as more contextual, differentiated and providing an engagement for students. AI supports teachers in trialing new approaches to pedagogy.

Post the workshop, teachers were seen to demonstrate different innovations in developing teaching materials. One evident way was the use of design platforms such as Canva to produce more engaging and visual presentations to support learning. Furthermore, they made use of AI to identify teaching methods and strategies that aligned with the interests and characteristics of students today. Each group of teachers saw it important to highlight that as current development occurs, it is necessary to adjust or adapt teaching approaches accordingly. It was identified as a vital motivation for the teachers to continue to innovate with their method of delivering the learning materials.

Job Satisfaction when Using AI

Job satisfaction was also significantly improved (mean pre = 3.30; post = 4.36; $p = 0.000$; Cohen's $d = 0.93$; increase = 1.06). After the training, teachers expressed that the AI supported them in managing their workload more effectively, allowed increased focus on the creative aspects of developing learning media, and provided a sense of balance between work and personal life demands. Such findings align with the framework disseminated by [Ragu-Nathan et al. \(2008\)](#), that has identified how implementing the right technologies in a workplace can lead to increased job satisfaction, particularly when technologies act to lessen administrative burden, increase workflow autonomy, and provide opportunities for meaningful professional development.

DISCUSSION

Based on the findings in the field, teachers at SMAN 1 Depok demonstrate a high level of readiness to adopt AI for the development of teaching materials. This is evidenced by significant improvements across the seven measured variables, namely understanding, skills, views, ethics, threat perception, innovation, and job satisfaction after participating in AI literacy training. The statistically significant differences ($p < 0.05$) and large effect sizes (Cohen's $d > 0.8$) indicate that the training provided was not only statistically effective but also practically meaningful.

One of the main interpretations of these findings is that AI literacy training plays an important role in enhancing teachers' competence and confidence in integrating

AI into teaching practices. Improvements in understanding and skills indicate that teachers not only acquired conceptual knowledge but also practical abilities in using AI tools. Furthermore, positive changes in views and innovation suggest that teachers are increasingly open to utilizing AI as part of an innovative approach to teaching in the digital era. Teachers no longer feel concerned about being replaced by AI; rather, they have developed a stronger belief that AI will never replace the role of a teacher.

Another important aspect observed in this study is the improvement in teachers' ability to identify and select appropriate AI tools based on learning objectives and student needs. This indicates that the training provided was not merely introductory but also encouraged teachers to develop more strategic and pedagogically grounded approaches in the use of technology. Teachers' understanding of the functions, features, and characteristics of AI tools further strengthens their ability to make appropriate decisions in developing teaching materials. Through this training, teachers also began to understand the importance of constructing appropriate prompts in order to obtain accurate results.

In addition, changes in ethics and threat perception indicate that the training also included critical understanding related to the use of AI. Teachers not only became more capable but also more aware of the ethical dimensions and potential challenges in AI integration. Through this training, teachers also became more cautious in using AI for developing teaching materials, particularly in citing reference sources. Therefore, it is expected that the use of AI in education can be carried out responsibly.

The increase in job satisfaction further reinforces the positive impact of AI literacy training. When teachers feel more confident and competent in using AI, their engagement in integrating AI into teaching practices also increases. For example, in presenting materials in the form of PowerPoint, teachers have begun to create more engaging presentations for students. In addition, teachers feel greatly assisted by AI tools in finding case examples that can be used to stimulate classroom discussions. This demonstrates the positive contribution of AI utilization in the development of teaching materials.

Overall, the findings of this study indicate that AI literacy is highly beneficial for teachers in utilizing AI for the development of teaching materials. In addition, AI literacy provides teachers with an understanding of important considerations in using AI for teaching activities in schools. AI literacy also enhances teachers' abilities and provides strategies for utilizing AI tools that contribute positively to the development of teaching materials prepared by teachers. AI literacy is expected to improve teachers' cognitive, affective, and practical skill aspects comprehensively. Thus, AI literacy equips teachers to be more innovative in developing teaching materials in schools.

This study is limited to the context of teachers at SMAN 1 Depok; therefore, the findings only represent the readiness of teachers within this single institution. In addition, this study focuses on the impact of AI literacy training on seven main variables, namely understanding, skills, views, ethics, threat perception, innovation, and job satisfaction. Therefore, the findings are limited to the measurement of these variables in relation to the training intervention provided. It is expected that future research can examine teachers' ability to select, utilize, and use AI tools in developing teaching materials in schools. Furthermore, future studies can also explore in greater depth the challenges and risks associated with the use of AI in the development of teaching materials.

CONCLUSION

The findings of this study show it is evident that teachers at SMAN 1 Depok are very ready to utilize AI to develop learning or teaching materials. AI literacy training effectively enhanced educators' perceptions, confidence, knowledge, and skills in relation to the use of AI in educational contexts. The seven primary variables measured in this study – understanding, skills, views, ethics, threat perception, innovation, and job satisfaction – exhibited significant variation in relation to the training ($p < 0.05$), and we saw large effect sizes (Cohen's $d > 0.8$) in almost all of the categories suggest that the AI training was proportionally and practically very helpful initiative.

A significant and relevant item to note is the teachers' enhanced ability to recognize and choose appropriate detailed AI tools for whatever particular learning purpose. Teachers can identify the function of the tool, as well as, its features and overall characteristics, but most importantly, they can perceive how to apply the tools based on their specific learning outcomes and specific students. With this foundational understanding presented in the training, teachers have actually perceived some increased ability and competence to adopt the AI tools in the learning process. In conclusion, it seems reasonable to conclude that SMAN 1 Depok teachers are highly ready to adopt AI tools and AI strategies for pedagogical purposes as part of an innovative direction within teaching and learning taken as part of an innovative worldview taking place in digital education today.

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CONFLICT OF INTEREST

The author hereby declares that this research is free from conflicts of interest with any party.

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