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Brief Report

Smart or Sweat: The Bittersweet Journey of Teachers' AI Literacy

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Abstract
This study examines the intricate connection between teachers' agency and their levels of artificial intelligence (AI) literacy. Utilizing qualitative data from two teachers, the analysis showed that Christine's proactive stance led to positive changes, while Sam's reluctance reflected the limitations resulting from insufficient guidance and support. The results highlighted the influence of institutional assistance, peer collaboration, and individual beliefs on teachers' engagement with AI in their classrooms. The paper emphasizes the need to cultivate a supportive environment for AI literacy among teachers, allowing them to adapt to technological changes while managing the challenges of their professional roles.

Keywords
Teacher agency, artificial intelligence, teachers' AI literacy

Sam: I am sweating because I am uncertain if and how I should use AI for teaching!
Christine: I try to teach smartly with limited AI resources.

1 Introduction

While still in its early stage, the rise of generative artificial intelligence (GAI) presents new opportunities across various sectors: medical, financial, and business. However, education, in particular, stands at the forefront of this new societal revolution. Over the past two years, scientific studies, workshops, and conferences about AI in education have flourished.

Akin to the adoption of previously new but now mainstream technologies such as computers and mobile technologies, this new revolution calls for a re-examination of digital literacy (Pegrum et al.,

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2022). Conversations about AI literacy have become essential for helping teachers and educators understand the nuanced influences, make informed decisions, and address the digital divide brought by this emerging technology (Walter, 2024; Yang, Wu, & Xie, 2024).

AI literacy, according to Ng et al. (2021), encompasses the abilities 1) to know and understand, 2) to use and apply, 3) to evaluate and create AI, and also 4) to consider AI ethics. Similarly, Laupichler et al. (2022) provide a definition as the capacity to "understand, use, monitor, and critically reflect on AI applications" (p. 1). AI literacy does not require individuals to develop AI models themselves; rather, it emphasizes understanding how AI works, its potential applications, and its limitations. This includes being able to critically evaluate AI-driven tools, interpret their outputs, and make informed decisions about their use in various contexts (see a systematic review Teng, 2024). In recent years, educators all over the globe have made attempts to deepen the understanding of students' current levels of AI literacy (e.g., Su et al., 2023; Toker Gokce et al., 2024). Ng et al. (2024), for example, implemented AI-driven recycling bins to promote AI literacy among primary school learners in Hong Kong. Their findings indicated that through collaborative, hands-on, project-based learning, young learners were able to develop a solid understanding and practical skills for using AI in educational contexts. Likewise, Huang and Mizumoto (2024), focusing on a sample of 327 Japanese university students, argued that ChatGPT's integration can improve intrinsic motivation and writing self-efficacy, helping students manage issues such as plagiarism. Hwang et al. (2023) made use of AI-generated images to enhance Korean students' AI prompt literacy, suggesting that teachers need to tailor their support to accommodate learners with varying levels of English language proficiency.

Yet, compared to students' AI literacy, teachers' AI literacy remains an underexplored topic. Based on UNESCO, teachers' AI literacy encompasses five key aspects (UNESCO, 2024), including 1) human-centered mindset (human agency, accountability, and social responsibility in human-AI interactions), 2) ethics of AI (understand, adopt, and create ethical AI principles), 3) AI foundations and applications (select, apply, and customize AI tools), 4) AI pedagogy (validate, integrate, and innovate AI in teaching), and 5) AI for professional development (enable, enhance, and transform professional growth). According to the latest review on teacher education and AI, Sperling et al. (2024) concluded that while AI literacy is a rapidly evolving topic in education, it has yet to reach the field of teacher education. Luckily, some pioneering studies have begun to address this gap. For example, Ding et al. (2024) discovered that middle school teachers in the United States benefited from methods such as case-based learning, leveraging prior experience and knowledge about AI, and receiving direct instruction. Yang, Liu, and Wu (2024), drawing upon a teacher-and-students poetic autoethnography, highlighted that ChatGPT is a "ghostwriter" that requires teachers' careful navigation. Though the studies offer useful insights into teacher education, understanding teacher agency in the AI context has received minimal scholarly attention thus far.

In language teacher education, there have been some studies exploring language teachers' perceptions about AI and teaching. Al-khresheh (2024), for example, surveyed 46 language teachers from multiple countries about their perceived pedagogical benefits and challenges of AI. Moorhouse and Kohnke (2024) interviewed 13 language teacher educators from Hong Kong about their understanding of AI and language education. Though these studies have cast useful light on language teachers' perceptions of the pedagogical use of AI, they did not have a specific focus on teachers' AI literacy. In 2024, Ma et al. conducted a global and comprehensive approach to understanding teachers' AI literacy. Their large-scale survey proposed six constructs of AI literacy for language teachers, including benefits, limitations, prompts, evaluation (of ChatGPT responses), assessment (assisted by ChatGPT), and ethics. They argued that an advanced level of teachers' AI literacy can lead to "more progressive and technologically enriched language educational approaches for the future" (p. 8).

When new pedagogical innovations are suggested, teachers often have to enact their personal and professional agency to either accept or reject the innovations, including AI. Teachers demonstrated a love-hate relationship in integrating AI into language teaching (Toncelli & Kostka, 2024). Such complex feelings reflect their agency. Teacher agency, according to Biesta et al. (2015), is "not

something that people can have – as a property, capacity or competence – but is something that people do…the engagement of actors with temporal–relational contexts-for-action, not a quality of the actors themselves" (p. 626). This conceptualization underscores the mediating role of social and material environments in which teachers operate and the dynamic interplay between teachers and their contexts. Priestley et al. (2013) propose a framework for delineating teacher agency, explaining that it is shaped by past professional and learning experiences, afforded or constrained by present cultural, structural, and material resources, and oriented toward future short-term and long-term professional goals. Recognizing this interplay between context and time is crucial in understanding teacher agency as it must go beyond just the individual's life journey and include how the contexts for action evolve over time (Biesta et al., 2015). However, Teng (2019a) highlighted a thorny issue of how teachers can stimulate agency, i.e., finding a room for "maneuver within a system of constraints", particularly when teachers are entangled "in a state of emotional flux" (p.82).

Teacher agency has been explored over the past decade (e.g., Miller & Wu, 2022; Teng & Wu, 2021), however, to the best of our knowledge, there is a lack of research on uncovering teacher agency in relation to AI within language education. To address this gap, the present study aims to contribute to the understanding of language teachers' AI literacy by examining the experiences of two language teachers. Guided by UNESCO's framework, the paper compares and contrasts differing perceptions and practices of these teachers regarding AI, with a focus on their agency.

2 The study

The present study investigated the experiences of two university teachers at a university in Macau. Christine (pseudonym) is a language teacher with approximately four years of teaching experience. She holds a doctoral degree in Education and has conducted educational research herself. Sam (pseudonym), on the other hand, is a senior language teacher with over 15 years of teaching experience. Sam's BA and MA degrees are not related to linguistics or education. Both participants were willing participants in the study once they were invited to talk about their experiences of using AI in teaching/learning.

Similar to Teng and Wu (2021), the two teachers participated in open-ended interviews, provided their teaching plans to the researchers, and completed written reflections on their actual teaching practices. They were prompted to reflect on their existing teaching practices with AI and their perceived challenges and affordances of using AI in teaching. Informed by the five aspects of UNESCO's AI literacy (2024) for teachers: Human-centered mindset, Ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional development, thematic analysis (see detailed steps in Braun & Clarke, 2006) was applied to analyze the data from interviews and written reflections, extracting insights into the teachers' experiences and the challenges they faced while adapting to AI-assisted teaching. Based on the thematic analysis, teaching plans were examined to see how the teachers integrated AI into the design of different learning units.

3 Findings

3.1 Aspect 1: Human-centered Mindset

Christine suggested in her interview that AI should be used to support the best interests of teachers and students, rather than to replace teachers. She argued in her interview that "ultimately, it is teachers who make the decisions about when and how AI should be used in teaching." Christine in her reflection expressed her commitment to encouraging her students to explore various technological tools as she held the belief that today's teachers should update their knowledge and practices to prepare for future teaching practices and learners need to enhance their understanding of new technologies to better prepare for the workforce.

Sam conveyed that he had heard a lot of negative news about AI so he tried to avoid using it. He believed that prior to the advent of AI in teaching, he was able to teach effectively without it, and thus he saw no need to adopt AI just to satisfy current trends or the wishes of his students. In his interview, he explained that he felt he was protecting himself, remarking "this technology is so new that no one knows whether it will be a blessing or a curse." In addition, he was worried that by the time he learned about AI, it had become outdated so he would waste his valuable time to prepare for "a technology which could be replaced any minute by a new technology" (written reflections).

3.2 Aspect 2: Ethics of AI

Although AI was new to Christine, she expressed enthusiasm for exploring its ethical use with her students. With her academic background in education, she emphasized that teachers must utilize their pedagogical knowledge to make informed judgments about the ethical use of AI. She actively encouraged her students to voice their needs and concerns, believing that open dialogues would enhance her ethical teaching practices. In addition, she took the initiative to read literature and reports about the ethical implications of AI in education. She said, "I was unaware of what ethical issues might come up in teaching so I did some research and read reports from UNESCO and other educators."

On the other hand, without any institutional guidance or peer support, Sam demonstrated reluctance and anxiety about integrating AI into the curriculum. He was particularly worried that students might have ethical concerns and thus file complaints about his changes in teaching. Sam shared his concern in his interview, "I am not sure what will happen with AI, too many uncertainties. Students could complain about the ethical practices and I could get into trouble." With such a mindset, Sam, as mentioned, did not make use of any AI software in his lesson plans.

3.3 Aspect 3: AI Foundations and Applications

It should be noted that ChatGPT is inaccessible in Macau, which has caused major barriers to both teachers reported on here, however, they responded to this challenge differently. Christine addressed this issue by strategically seeking alternative software that aligned with her specific teaching purposes. In her reflections, Christine commented that "there are tons of AI resources now, not just ChatGPT. The key is understanding what we teachers need and how well these tools are able to serve our teaching purposes." Christine demonstrated her willingness and effort in finding useful AI software. For example, in one of her lesson plans, she made use of Mapify, mind mapping software, to support her students in enhancing their reading skills. This choice was further explained in her interview as she elaborated, "No teacher knows which software is best for teaching. I chose Mapify as a colleague recommended it to me. I then tried it out and found it easy to use; it helped visualize reading passages, so I believed it would be useful to my students and they responded positively."

In contrast, Sam did not make any effort to search for appropriate AI resources. He commented that he had thought AI was synonymous with ChatGPT and since ChatGPT was unavailable in Macau, he assumed that there were no AI tools for someone like him. He reflected, "I thought generative AI was only for people with computer science knowledge, not for me." With this mindset, he did not invest any time or effort into exploring potential AI software.

3.4 Aspect 4: AI Pedagogy

Christine taught a course focused heavily on language drilling exercises and grammar practice. Surprisingly, she used technological tools, including AI software, in nearly every lesson outlined in her lesson plans. She explained in the interview that "in the long run, technology helps teachers alleviate teaching load. AI was used in my course to improve teaching efficiency, allowing my students and me

to achieve our objectives more quickly." She provided another example in her lesson plans, in addition to Mapify, Monica was used to summarize YouTube videos shown in class, which helped students understand the content. Similar examples were found in her lesson plans to assist the students in practicing speaking, listening, reading, and writing skills.

Additionally, by identifying herself as a teacher-researcher, Christine said that she derived many of her teaching ideas from research papers in educational journals *Language Learning & Technology* (open access), *Computers and Education: Artificial Intelligence* (open access), and *Computers & Education: X Reality* (open access). Despite the limited access to research journals in her university library, she persevered by utilizing open-access journals to learn from other educators' experiences.

In contrast to Christine, Sam faced the same challenges of a heavy teaching workload and a demanding schedule but chose to avoid AI integration altogether. He mentioned that "I am already overwhelmed with my teaching schedule. I cannot take on more." In his interview, Sam further commented, "I consider it a success if I can get through the syllabus. This AI thing is not necessary so it doesn't matter." When examining the lesson plans, unlike Christine who viewed AI as a valuable assistant, Sam perceived it as an additional burden to his daily teaching. In fact, his lesson plans included minimal technology, primarily limiting his resources to PowerPoint slides and videos.

3.5 Aspect 5: AI for Professional Development

Both Christine and Sam expressed concerns about the absence of institutional policies to guide their adoption of AI tools in teaching. Christine described this situation in her interview as "always many steps behind global trends", which meant she had to "depend on herself to update knowledge and expertise about AI in education." She mentioned that in other institutions she worked at, there tended to be a lack of regulations about technologies. In a similar vein, Sam in his interview stated that he hoped the university would facilitate discussions on AI at an institutional level, produce detailed guidelines, and organize hands-on workshops to support teachers like him, who were not particularly tech-savvy. Also, Sam noted in his reflections that the lack of clear administrative guidance left him uncertain about the university's stance on AI usage in the classroom, leading to "hesitations about its integration into [his] teaching."

Both teachers also highlighted the lack of peer-teacher support in making the best of AI resources. In her reflection, Christine cited examples of how universities in Hong Kong have developed guidelines and hosted workshops for their faculty. She felt that "teachers in Hong Kong were better equipped with theoretical and practical knowledge about this emerging technology." "In that Hong Kong workshop I attended," she also mentioned in her interview, "teachers exchanged what they did in different courses and useful ideas were generated in that workshop, some of which are used in my course now."

In contrast, Sam complained that, as a senior teacher unaccustomed to AI, he found it embarrassing to admit that he did not know how to integrate AI into his teaching. "In our local culture," he stated in his interview, "senior teachers are expected to know more and teach better than novice peers. Asking junior staff for advice can be uncomfortable." In his reflection, he further wrote "I am unsure if my colleagues will be open to discussing this thorny topic." Apparently, Sam's apprehensions about collegial relationships hindered his willingness to engage with the topic of AI, as he feared it might expose his lack of knowledge and be perceived as a troublesome or embarrassing issue.

4 Discussion

Our findings suggested that Christine and Sam demonstrated diverse levels of teacher agency, with Christine more proactive while Sam more passive. Drawing upon the concept of teacher agency, different factors affect the two teachers' agency with AI literacy (see Figures 1 & 2). Overall, Christine adopts a

human-over-technology mindset while Sam has a technology-over-human mindset. Next, we discuss the main findings that have emerged from the study.

First, past learning and teaching experiences have salient impacts on teachers' agency in treating AI in teaching (Figs 1 & 2: Past). Despite a lack of AI knowledge per se, Christine agentively resorted to the literature to inform herself of how AI can be used in her teaching. This is partly due to the fact she gained her degrees in education and was able to research concepts she was unfamiliar with. Even when her school library did not subscribe to the journal databases she wanted, she still attempted to refer to open-access journals for teaching ideas about AI. On the other hand, Sam's lack of computer knowledge presented challenges for him as he developed a misconception that AI was not useful for everyday life or his teaching practice. In addition to this, as a senior teacher, his past successful teaching experience seemed to further hinder his adoption of AI in teaching as he believed it was sufficient to teach the way he used to teach (Fig 2: Past). Therefore, he did not see the benefits that he might gain by integrating AI into his lessons. These findings echo the argument made by Biesta et al. (2015) that teachers draw upon their past experience (both professional and personal) to make future goals and thus make pedagogical judgments relevant and related to their current situations. Apparently, Christine's previous educational background supported her to be an independent educator while Sam's existing beliefs did not align with the principles of the educational reform caused by AI. Sam's extensive teaching experience was translated into resistance, also a form of teacher agency (Terhart, 2013) and became one of the experienced teachers who are usually "difficult, slow, and often transient" (Bonner et al., 2020, p. 365) when faced with radical changes in education.

Second, various contextual factors influence teachers' agency in developing AI literacy (Figs 1 & 2: Present). The lack of institutional guidance did not seem to hinder Christine from taking proactive measures to develop her AI literacy. Instead, she said that she became used to this "policy lagging behind the technology" problem so she would explore the use of AI with her students by herself. She believed that even without administrative support, student-teacher joint explorations can benefit both teaching and learning. Despite still being a novice teacher, Christine showcased her proactive agency by not just reading the literature for possible reform ideas, but also attending workshops to discuss issues related to the use of AI with peer teachers. Facing external constraints, Chrstine's determined characteristics differed from the pre-service teachers in Teng (2019b) who experienced more difficulties in managing their agency. This perhaps was due to the educational levels of Christine and her prior teaching experiences compared to student teachers.

In contrast, Sam, with over a decade of teaching experience, expressed concerns over institutional attitudes before taking on reforms and his negative news reading experience about AI discouraged him from learning and adopting this new technology (Fig 2: Present). Furthermore, influenced by his local culture, he refused to talk to colleagues as he felt embarrassed to ask teachers with less teaching experience for advice or support. Sam demonstrated his teacher agency as he considered the local cultural practices and interactions with colleagues and decided not to take action to change his practices. The finding is consistent with previous studies that the power dynamics in schools, which include both formal authorities and informal social influences, can either restrict or enhance professional agency (Vähäsantanen, 2015). The finding aligns with Teng and Wu (2021), which suggests collegial support is essential in encouraging teachers to exercise proactive teacher agency in response to changes.

Third, future orientations toward the teaching profession affect the two teachers' agency in adopting AI (Figs 1 & 2: Future). For Christine, she saw in AI a future need for teachers and learners and it promoted her identity as a teacher-researcher. She also believed that AI would eventually reduce her teaching load. On the other hand, Sam showed anxiety and fear of integrating AI into teaching as he was concerned about student complaints and an increase in his workload. Furthermore, he refused to invest any effort into finding out more about AI in teaching as he believed it would soon be replaced by some other emerging technologies so his effort would be wasted. This result shows that teachers' agency with AI was influenced by their self- and social positioning (Sang, 2020), i.e., Christine's concerns for

her future identity as a teacher-researcher versus Sam's concerns about being judged as an incompetent teacher by his students and colleagues. Similarly, Teng (2019b) also emphasized that teacher agency is not only determined by the external environment, but more importantly, "personal disposition and internal beliefs" (p. 203).

Figure 1

Christine's Teacher Agency in Relation to AI Literacy

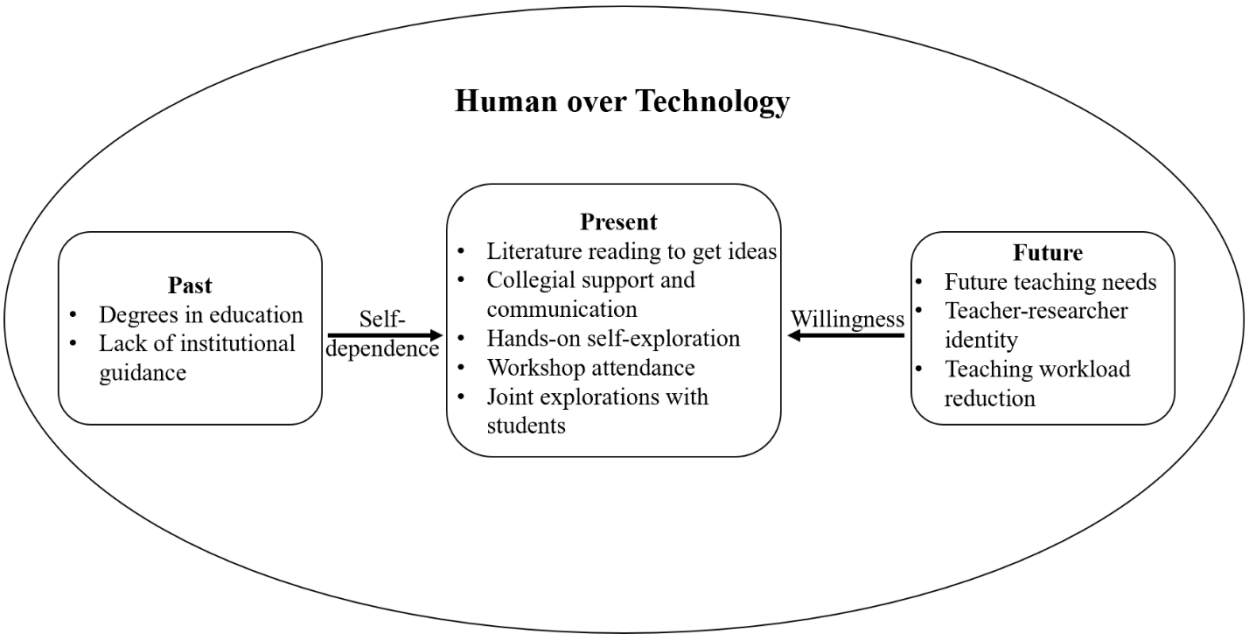
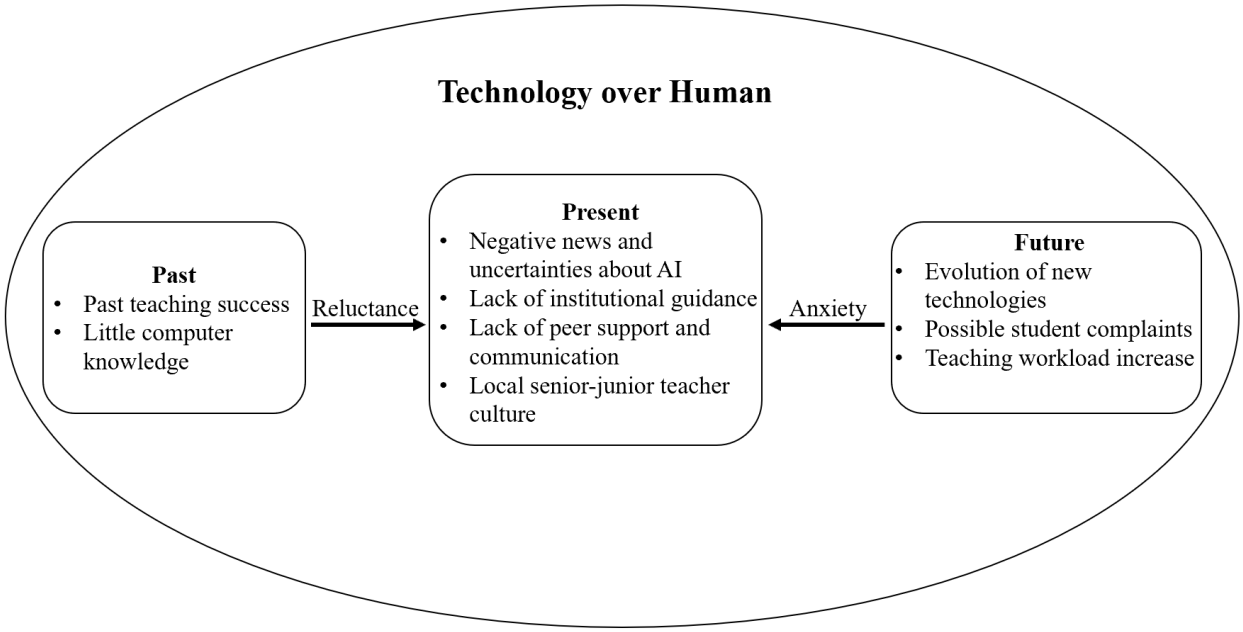


Figure 2

Sam's Teacher Agency in Relation to AI Literacy



5 Conclusion

The study found that the two teachers in this study manifested different teacher agency in dealing with AI literacy. Both teachers' agency was encouraged or limited by a wide array of internal and external factors,

ranging from personal aspirations, prior learning and teaching experience, student-teacher relationships, collegial culture, classroom infrastructure, and university guidance.

Implications are put forward here. First, to enhance teachers' agency in improving their AI literacy, systemic support from institutions and peers is crucial. Policies, regulations, and training need to come from the institution, whereas open dialogues with colleagues and students will promote more knowledge transfer and result in more confidence in integrating AI into teaching. Detailed discussions, case studies, and hands-on activities of teachers' AI literacy can contribute to the enactment of teacher agency. Second, to ensure the improvement of AI literacy, schools should help teachers build positive emotions towards AI. Psychological states need to be ensured for teachers to exercise their agency in adopting AI into their teaching practices. Third, as the technological terrain evolves, it is more important to promote in teachers their agency to critically understand, and creatively use technological tools (Wu et al., 2024). By doing so, teachers will feel more willing and ready to make adaptations when new reforms are brought in by technological advancements.

While this exploratory study offers useful insights into a relatively under-researched topic, it is only based on two cases. Future work could benefit from a larger-scale investigation, incorporating a mixed-methods approach to quantitatively measure and qualitatively interpret language teachers' understanding of AI literacy and their pedagogical practices. Additionally, as the study suggests, teacher agency should be emphasized to support teachers to prepare for and effectively implement future technological innovations, not just AI. This is crucial in empowering teachers to teach smartly instead of sweating heavily when faced with new technologies.

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