Journal of Information Technology Education: Research

An Official Publication of the Informing Science Institute
InformingScience.org

JITEResearch.org

Volume 24, 2025

EXPLORING AI IN EDUCATION: PRESERVICE TEACHER PERSPECTIVES, USAGE, AND CONSIDERATIONS

UnHyeok Ko*	University of Nevada, Las Vegas, Las Vegas, NV, United States	Kou1@unlv.nevada.edu
Kendall Hartley	University of Nevada, Las Vegas, Las Vegas, NV, United States	Kendall.hartley@unlv.edu
Merav Hayak	University of Nevada, Las Vegas, Las Vegas, NV, United States	Meravper22@gmail.com

*Corresponding author

ABSTRACT

Aim/Purpose	This study investigated how undergraduate and graduate students in a teacher education program perceived, used, and ethically reflected upon generative AI tools. The problem is the unclear state of preservice teachers' understanding and use of generative AI in educational settings, which this study aimed to explain.
Background	Given generative AI's growing presence in education, this study addressed a gap in understanding by examining preservice teachers' perceptions, experiences, and ethical concerns, particularly in relation to self-regulated learning.
Methodology	A convergent parallel mixed-methods design was used to gather quantitative and qualitative data from 73 students enrolled in a teacher education program at the University of Nevada, Las Vegas. Descriptive statistics, correlations, and thematic analysis were used for data analysis.
Contribution	This study contributes to the emerging literature by providing insights into preservice teachers' usage patterns of generative AI, the relationship between AI use and self-regulatory skills, and a detailed examination of ethical concerns, informing effective AI integration into teacher education programs.
Findings	Text-based generative AI was the most familiar tool among participants. The primary reasons for the use included editing papers, searching for new ideas,

Accepting Editor Martin D Beer | Received: April 25, 2025 | Revised: May 21, June 5, 2025 | Accepted: June 11, 2025.
Cite as: Ko, U., Hartley, K, & Hayak, M. (2025). Exploring AI in education: Preservice teacher perspectives, usage, and considerations. *Journal of Information Technology Education: Research, 24,* Article 21.
https://doi.org/10.28945/5592

	and understanding course material. A significant positive correlation was identified between information search with the help of generative AI and resource management skill. Key themes identified by thematic analysis included perceived benefits for student engagement and creativity, AI's potential as a writing assistant, and ethical concerns about plagiarism and misuse. Overall, preservice teachers demonstrated surface-level use and a general lack of in-depth knowledge about AI integration.
Recommendations for Practitioners	Teacher educators should provide explicit training in generative AI, including practical guidelines and clear ethical frameworks to foster effective and responsible integration into classroom practice.
Recommendations for Researchers	Future researchers should develop validated measurement instruments specifically designed for studying generative AI perceptions and usage and explore longitudinal impacts as preservice teachers transition into professional teaching roles.
Impact on Society	By guiding preservice teachers toward informed and ethical use of generative AI, this study supports broader societal goals of promoting digital literacy, ethical technology integration, and enhanced learning experiences for future generations.
Future Research	Subsequent research should further explore reasons behind the limited adoption of generative AI among preservice teachers, examine the long-term impacts of AI use on pedagogical practices, and investigate structured frameworks for promoting deeper AI integration within the teaching and learning domain.

Keywords	generative AI, preservice teachers, self-regulated learning, ethical considerations, pedagogical integration

INTRODUCTION

In recent years, natural language processing (NLP) has seen significant advancements, particularly with the development of large language models like the Generative Pre-trained Transformer (GPT-3) (Floridi & Chiriatti, 2020). ChatGPT, a type of generative AI, is a text-based artificial intelligence tool capable of various language-related tasks, including translation and computer programming (OpenAI, 2022). Reaching 1 million users within 5 days of its release in late 2022, ChatGPT signaled the popular beginning of the generative AI era. Unlike its predecessors, rule-based AI models that operate under predefined code and instructions, generative AI trains on extensive datasets and produces new content based on its training (Caruccio et al., 2024). As AI becomes more embedded in educational practices, understanding how future educators perceive and use it is essential. At present, it is unclear how to take practical advantage of generative AI and how it can be integrated into teaching and learning.

Regarding technology integration in education, lack of knowledge and discrepancy in how educators perceive technology can negatively impact instructional quality and result in ineffective teaching strategies (Mishra & Koehler, 2006). The purpose of this paper is to supplement the emerging literature on the use of AI and to provide insight into AI use in education through the lens of undergraduate and graduate preservice teachers. Teachers use technology more effectively when their perspectives are considered, as their perspectives on teaching and learning in the classroom are closely associated with their use of technology (Watson & Rockinson-Szapkiw, 2021). By investigating how preservice teachers interact with and perceive the role of AI, this study particularly focuses on how AI can support personalized learning, enhance self-regulatory skills, and address emerging ethical issues.

LITERATURE REVIEW

Online learning platforms, such as Google Classroom, video conferencing tools, and digital resources like e-books and interactive materials, have become increasingly prevalent in education. Additionally, a shift toward self-directed and asynchronous learning has emerged, providing students with greater autonomy in their learning. This increased independence includes flexibility to progress through coursework at their own pace (Baidoo-anu & Owusu Ansah, 2023). The implications of this change can be understood in part through self-regulated learning theory. Based upon Bandura's (1991) social cognitive theory, self-regulated learning theory recognizes that metacognitively active learners are generally more successful. Throughout the metacognitive process, self-regulated learners plan, set goals, organize, self-monitor, and self-evaluate at forethought, performance, and reflection phases in their learning journey (Zimmerman, 1989). At different phases, learners develop and manage a set of skills and traits that are essential to their successful learning journey. Resource management skills are one of them, and they refer to the learner's ability to manage their time, effort, and learning environment to optimize their academic success. Another essential trait for becoming a successful self-regulated learner is self-efficacy, which refers to a learner's belief in their ability to succeed in specific tasks. Learners with high self-efficacy exhibit greater persistence with their goals. They are more likely to engage in goal-setting and self-monitoring, which are key components of the forethought and reflection phases of the self-regulated learning process (Zimmerman, 2002).

Corresponding to the increased use of technology in educational contexts and the transition toward a more self-regulated learning environment, large language models provide a unique opportunity where personalized learning is available (Pratama et al., 2023). For instance, ChatGPT can be used to promote group discussion by creating an appropriate discussion structure in an online setting (Kasneci et al., 2023). Another evaluative study reported that ChatGPT enhanced personalized learning by providing individual guidance and instant feedback, allowing students to engage more effectively in independent study and coding skill development (Hartley et al., 2024). Research conducted by Chen et al. (2020) further demonstrated the efficacy of a conversational agent utilizing a generative model in delivering personalized math tutoring, resulting in enhanced learning achievements. Past studies report the use of generative AI in personalized learning, indicating its potential impact on self-regulated learning skills. While Hwang and Chien (2022) demonstrated that rule-based chatbots can develop students' self-regulated learning skills, researchers have not yet studied how newer AI models like ChatGPT affect these skills.

From the teachers' perspective, integrating ChatGPT into the grading process allows teachers to focus on other teaching responsibilities. According to Kim et al. (2019), the generative model (ChatGPT), after training on a human-graded essays dataset, could effectively assess high school student essays with a correlation as high as 0.86 with human evaluators. Despite its promising opportunities, the application of AI in teaching and learning creates new ethical risks (Akgun & Greenhow, 2022). Lack of interpretability is one significant limitation, as the reasoning behind the model's predictions is not clearly understood. Generative models rely on statistical patterns within their training data and may lack a true understanding of the concepts that they are intended to help students learn (Ansari, 2022). Other ethical considerations include biased content and privacy concerns (Baidoo-anu & Owusu Ansah, 2023).

The teacher's perspective greatly influences any technology integration, and further technological and pedagogical knowledge is necessary for successful educational integration (Mishra & Koehler, 2006; Watson & Rockinson-Szapkiw, 2021). For example, teachers with a greater understanding of the capabilities of AI tools are more likely to use them to enhance learner motivation and engagement (Chiu et al., 2024). AI technology, in the same sense, can be effectively integrated into teaching when educators possess sufficient pedagogical knowledge to leverage AI-based tools, making a teacher's knowledge of AI crucial for providing personalized learning experiences and timely feedback (Cavalcanti et al., 2021; Popenici & Kerr, 2017).

While researchers have studied AI's potential benefits and risks, preservice teachers' perspectives on its use in educational contexts are limited, highlighting the need to measure the preservice teachers' awareness of AI and its pedagogical potential. Additionally, understanding how preservice teachers use generative AI can provide insights into the development of self-regulatory skills, which are essential for success in today's learning environments that emphasize self-driven and autonomous learning. Moreover, teachers' perspectives towards educational technology that utilizes AI have a potential impact on the learning outcomes of their future students. It is essential to know more about preservice teachers' acceptance of AI (Sanusi et al., 2024; Zhang et al., 2023). Thus, this paper seeks to fill the gap in understanding preservice teachers' perceptions and use of generative AI and its potential association with self-regulatory skills by investigating the following research questions:

(1) How do preservice teachers use Gen AI?

(2) How is the use of Gen AI associated with the user's self-regulatory skills?

(3) How do preservice teachers perceive the use of Gen AI in teaching and learning?

(4) What are the ethical concerns with the use of Gen AI in education from a preservice teacher perspective?

Specifically, Research Questions 1 and 2 explore how generative AI use is associated with learners' resource management and self-efficacy, core constructs from Zimmerman's model (Zimmerman, 2002). Then, Research Questions 3 and 4 further explore the topic through a qualitative lens. To address both perspectives, this study employs a convergent parallel mixed methods to explore AI use and self-regulation.

METHODOLOGY

In the convergent design, quantitative and qualitative data are collected simultaneously, analyzed, separated, and integrated during interpretation (Creswell & Clark, 2017) (see Figure 1). Fetters and Molina-Azorin (2017) further identified the design as an appropriate mixed-method approach for examining the validity of quantitative measures. In this study, we collected quantitative and qualitative data through an online survey that captured both the frequency and perception of AI use among preservice teachers. This concurrent data collection procedure was time efficient and enabled the interpretive analysis of each dataset to inform the other (Fetters & Molina-Azorin, 2017). We used descriptive statistics, correlation, and thematic analysis to interpret the data in the analysis phase. Integrating these two approaches was intended to provide a more thorough understanding of the topic and uncover teachers' perceptions and attitudes toward Gen AI.

We addressed Research Question 1 with quantitative data, including the frequency of different uses and purposes of ChatGPT and user experience with different types of generative AI, including text-based AI, image generative AI, and embedded AI. An artificial intelligence tool that is integrated directly into a commonly used application without requiring users to separately engage specialized software is interpreted as embedded AI in this study. Specific examples of each tool category, such as OpenAI's ChatGPT (text), Midjourney (image), and Google Docs Help Me Write (embedded), were given in the question.

Next, Research Question 2 was addressed by looking at the correlation coefficient between the self-regulatory skills, specifically resource management and self-efficacy, of participants and different uses of generative AI. We address Research Questions 3 and 4 primarily through qualitative analysis of open-ended questions.

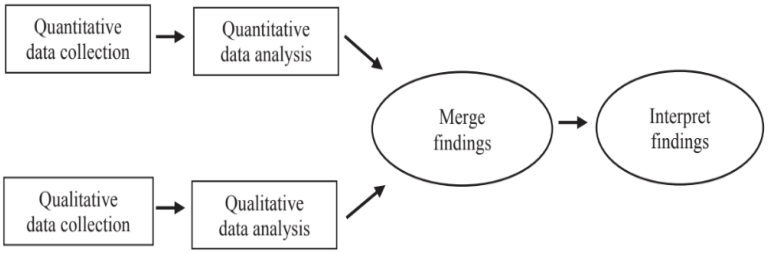

Figure 1. Convergent design

DATA COLLECTION

The data for this study were part of a larger study that included an online survey measuring a variety of self-regulation variables. The survey was sent via Qualtrics to undergraduate and graduate students in a teacher education program between October 2023 and February 2024. This study particularly adopted AI-related data related to the self-regulated learning measure from MSLQ.

INSTRUMENTS

The survey was divided into four main sections to align with research purposes. The first part employed the Motivated Strategies for Learning Questionnaire (MSLQ) to measure participants' self-regulated learning skills. Specifically, it included the Motivation Scale, which focused on self-efficacy for learning and performance, and the Learning Strategy Scale, which assessed resource management (Pintrich et al., 1991). Then, the second part of the survey captured the amount of GenAI use (1 = not at all, 5 = constantly) and frequency (1 = once a month or less, 7 = more than ten times a day) of GenAI use. The third section explored AI-related ethical concerns and perceptions using open-ended questions designed to capture preservice teachers' perceptions of AI and any potential ethical considerations. The last part of the survey included demographic information, such as the participant's year in school.

DATA ANALYSIS

We performed descriptive analysis focusing on frequencies for quantitative analyses. We identified different AI uses from descriptive measures alongside demographic data like enrollment status. We conducted a correlation analysis between participants' MSLQ scores and generative AI uses. We ran Cronbach alpha tests for reliability and used a convergent design for validity (Fetters & Molina-Azorin, 2017).

We uploaded data to ATLAS.ti for qualitative analysis and conducted content analysis (Lincoln & Guba, 1985) in two stages. First, each researcher identified the main ideas from open-ended responses and created title statements through open coding. We then grouped similar titles into categories. Themes emerged directly from data without preconceptions. We discussed the themes to develop similarities and divergences and then refined them to align with research objectives (Shkedi, 2004).

FINDINGS

QUANTITATIVE

According to our descriptive statistics (Table 1), text-based AI was the most commonly used type, with 48% of participants having experience with it. Fewer participants had used embedded AI (33%) and graphic AI (8%). Participants used embedded AI approximately once per week (mean = 2.08). Our sample included 54 undergraduate students (74%), 13 graduate students (17.8%), and 6 participants with unreported enrollment status. For ethical concerns, 40 (55.6%) out of 73 responses rec-

orded yes, 32 no, and one missing response. Of those who said yes (40 responses) to the ethical question, 25 were undergraduate students. More than half of the undergraduate participants responded 'no' or 'maybe' when asked about ethical concerns. Table 1 shows the participants' demographic breakdown for the ethical concern question.

Table 1. Descriptive statistics of graduate and undergraduate responses to ethical concerns

	N	% (out of n=73)
Undergraduate	54	74
Yes	25	34
No and maybe	28	40
Graduate and missing	19	26
Yes	15	21
No and maybe	4	5

Regarding the frequency of different types of AI, some key findings included that nearly half of the participants had experience with text-based AI, such as ChatGPT, but relatively little experience with graphic and embedded AI. However, as opposed to its low experience rate, embedded AI had the most frequent usage among the three. Based on Table 2, the mean usage of embedded AI on a Likert scale is 2.08, which is equivalent to "once a week."

Table 2. Descriptive statistics of experience with different types of AI

	TextAI	GraphicAI	EmbeddedAI
N	73 (100%)	73 (100%)	73 (100%)
Yes	35 (48%)	6 (8%)	24 (33%)
No	34 (47%)	61 (84%)	46 (63%)
Unsure	4 (5%)	6 (8%)	3 (4%)
Mean frequency	1.71	1.17	2.08
Std. dev.	1.1	0.408	1.02

Additionally, the frequency of different uses of generative AI data included editing papers, searching for new ideas, and deepening understanding of course material, which are the top three most frequently used purposes. Table 3 depicts the different usage from the highest mean to the lowest, and the study found that none of the different uses had a mean above 2, indicating low frequency in the use of generative AI in general.

Table 3. The frequency of different types of Gen AI use

	Mean	Std dev	N
Editing papers	1.93	0.97	73
Searching for new ideas	1.82	1.18	73
Deepening understanding of course concept	1.75	1.14	73
Searching for Information	1.74	0.99	72
Translation	1.73	1.28	73
Writing papers	1.71	1.12	73
Drafting papers	1.58	1.18	73
Preparing presentations	1.56	0.94	73
Solving assignment problems	1.52	0.87	73
Examining the tool	1.47	0.85	73
Writing lessons	1.3	0.68	73

For the correlation analysis, we compared the 11 different uses of generative AI with the MSLQ mean scores for resource management and self-efficacy. Cronbach's alpha indicated good reliability for both resource management ($\alpha = 0.76$) and self-efficacy ($\alpha = 0.93$) (Pintrich et al., 1991). Based on the correlation data, searching for information using generative AI was found to be moderately correlated with resource management skills and also found to be statistically significant ($p < .01$). However, except for searching for information, the other categories did not yield statistical significance. Our analysis showed weak positive correlations between translation use and both self-efficacy (0.20) and resource management (0.23). Solving assignment problems was the only use case that showed a negative correlation with self-efficacy (-0.17), though the correlation was weak. Table 4 depicts the correlation coefficients of all categories.

Table 4. Correlation coefficient between different uses of Gen AI & MSLQ

	Resource management	Self-efficacy
Editing papers	0.32**	0.16
Searching for new ideas	-0.03	0.08
Deepen understanding of the course concept	-0.08	0.006
Searching for information	0.06	-0.17
Translation	0.13	0.05
Writing papers	0.12	0.07
Drafting papers	0.03	0.10
Preparing presentations	-0.02	0.10
Solving assignment problems	0.20	0.23
Examining the tool	0.004	0.04
Writing lessons	0.19	-0.06

QUALITATIVE

A qualitative thematic analysis of student statements on AI tools revealed three primary themes: (1) perceived benefits of AI tools in teaching and learning, (2) AI-powered writing assistance, and (3) ethical considerations and uncertainties. A detailed analysis of these themes, presented in descending order of frequency, follows.

Perceived benefits of AI tools in teaching and learning (32 statements)

The students recognized the potential of AI tools to enhance teaching and learning experiences. They emphasized the potential of GenAI to foster engagement, creativity, and problem-solving skills, as well as to enhance technology integration in pedagogical practices. The following quotes illustrate how students perceive GenAI tools as valuable assets in the classroom, envisioning their potential to enhance learning:

- AI should be used to strengthen our ideas and help us get creative with new ones.
- AI applications can have an impact on the teaching and learning process since they can be an always-available resource that can try to translate concepts and ideas into words that someone might understand better than a teacher could.
- Students will be required to understand problem-solving. Having to reboot applications and figure out how to get things to work.
- I have used Chat GPT to help understand how concepts may be practiced/taught through different methods and theories in Educational Psychology.

AI-powered writing assistance (20 statements)

Students valued using AI tools for academic writing. They reported using AI tools for assignment assistance, spelling and grammar improvement, sentence structure enhancement, and overall writing skills development. Here are some examples:

- AI, such as ChatGPT, can be used in the early stages of planning. You can use it to come up with a list of starting ideas. You can use it to experiment with ideas and formats. You can also use it to help generate examples to help with writing blocks.
- I've used ChatGPT to create model examples for my students to read in class, like when I needed a narrative and had it generate one for me.
- Personally, I would use it to help my students with their punctuation and grammar.

Students suggest utilizing AI tools to brainstorm initial ideas, experiment with different formats, generate examples to overcome writer's block, and even create model texts for students to analyze. Additionally, three statements relate to envisioning using AI to assist with grammar and punctuation. On the other hand, one statement relates to the student's belief that AI has positive and negative educational potential. While hopeful about its positive impact, this student acknowledges the possibility of improper use, such as students relying on AI to write their papers instead of doing the work themselves.

- That is why I believe there are both positive and negative effects of AI, but I'm hopeful that it will be utilized more beneficially than detrimentally in the realm of education. However, knowing students, it may be used inappropriately, like writing their papers for them, and to save time.

Ethical considerations and uncertainties (15 statements)

Students raised concerns about the ethical implications of GenAI tools in academia. These concerns were centered in four subcategories: academic dishonesty, responsible AI proficiency, information integrity, and assistive potential.

Academic dishonesty concerns (7 statements)

A primary ethical issue identified by students was the potential for AI to facilitate academic dishonesty and plagiarism. Students expressed that using AI to generate entire papers without significant personal input constitutes an ethical violation and devalues the educational process.

- I think there is an ethics issue with AI when it is being used to simply write a paper straight up with minimal authorial input beyond minor edits.
- I think it is unethical to use ChatGPT to write entire essays, as it is academically dishonest as well as plagiarism of the work in the AI's database.
- It could be plagiarism if AI is used improperly. If students use AI to solve all the questions, it should be considered academic dishonesty and thus invalidate the purpose of education.

Responsible AI proficiency (5 statements)

Participants emphasized the importance of developing skills for appropriate and ethical AI usage. There was concern that over-relying on AI, for example, for academic assignments, could prevent genuine self-learning and understanding. They also saw an opportunity for students to contribute to improving AI's ethical framework.

- I think certain uses of ChatGPT are unethical because if it is used to do all the work, then people are not learning or understanding the reason for the work.
- The main skill will be understanding appropriate AI usage. Without this, AI won't benefit students.
- A new requirement will be understanding how to utilize artificial intelligence ethically and avoid plagiarism.
- I believe it is important for students to be more ethical with the use of AI. Mastering this skill will enable students to use AI responsibly and ethically. Furthermore, these students could contribute to enhancing AI's accuracy and ethical considerations.

Information integrity (2 statements)

Concerns were also voiced regarding the accuracy and trustworthiness of information generated or sourced by AI, highlighting the need for vigilance in scientific and academic contexts.

- AI can be unethical if it is used in scientific research, and the paper is published with inaccurate information.
- An app that would improve my success as a student would be something that weeds out articles that are irrelevant or that don't provide trustworthy information.

Assistive potential (1 statement)

Despite prevalent concerns, one student also recognized that AI could be used ethically, particularly as an accessible and assistive tool.

- I think AI can be ethical, because it can help learners and people who have a disability that doesn't allow them to write or type like someone else, and AI can assist in that.

Overall, while students see potential in GenAI, their responses emphasize the need for establishing clear ethical guidelines and fostering responsible usage in academic environments.

DISCUSSION

HOW DO PRESERVICE TEACHERS USE GEN AI

Student engagement is one of the primary benefits perceived by the preservice teacher. Past studies have shown that using AI-based chatbots in educational activities increases student motivation, engagement, and learning outcomes (Deng & Yu, 2023). Additionally, preservice teachers recognized Gen AI tools for their writing capabilities and the writing assistance provided. In support of this finding, the frequency of different uses of Gen AI indicated editing papers as the most frequently used feature. In contrast to the findings of perceived benefits, our study also found that while preservice teachers increasingly use AI tools like ChatGPT, their experience with embedded and graphic AI remains very limited. Even with widely used text-based AI like ChatGPT, nearly half of the preservice teachers reported no experience with it, far fewer than expected. One possible explanation could be the perception of the chatbot as nonhuman and reluctant to interact with it accordingly (Araujo, 2018). A future study may include investigating the underlying reasons for underutilization revealed in this study. Past studies consistently reported that preservice teachers significantly underutilize technology in delivering their lessons (Dawson, 2008; Liu, 2012), which this study confirms with relatively low usage of generative AI. While embedded AI is not as widely adopted as text AI, its highest mean in usage frequency indicated that it holds potential relevance and utility for those who integrate it into their academic routine. Considering the increase in the variety and utility of embedded AI, there could be a future study delving deeper into its use and integration into teaching and learning.

The results collectively suggested low awareness of GenAI use and preservice teachers' general lack of knowledge regarding technology use. There have been consistent studies highlighting the limited technology knowledge of educators, apprehensive attitudes toward its use, and low self-efficacy in using ICT (Angeli & Valanides, 2009; Esfijani & Zamani, 2020). Technological disparities, particularly across different age groups, may affect familiarity with newer technologies like generative AI. A number of factors have been identified in past studies to affect the use of technology, varying based on task type, social context, and individual or group work (Sweeney, 2024). In addition to the current literature, findings from this paper supplement the need for more technology training in teacher education programs that can increase teacher knowledge related to the use of technology

ETHICAL CONCERN AND FUTURE FORECAST

Qualitative findings identified ethical concerns as a prominent theme that consistently emerged from the data. Students expressed concerns about the ethical implications of using AI tools to generate complete papers without significant student input. They emphasized the importance of understanding how to use AI appropriately to avoid plagiarism and ensure ethical use. Additionally, students suggested that being proficient in AI could allow them to contribute to improving its accuracy and ethical considerations. Sølvberg (2003) found that as students gained more knowledge, their beliefs

about their ability to use technology effectively grew stronger and were more likely to persist in using technology. In terms of generative AI use, this could suggest that as preservice teachers become more knowledgeable about generative AI, they are more confident about their ability to use it and more likely to integrate it into their teaching. These findings highlight the need for educators and institutions to address ethical concerns and guide students on the appropriate and responsible use of AI tools in academic settings. Descriptive data support this finding, as more than half of the participants acknowledged ethical concerns. Findings in this study suggested that successfully integrating AI in a pedagogical context requires addressing academic integrity and accountability issues appropriately, and this concern may explain why preservice teachers are hesitant to use AI actively, as there is currently no established framework for its appropriate use and guidelines to follow. Looking ahead, proactively navigating these ethical considerations is paramount, not only to mitigate potential misuse but also to harness AI as a transformative tool that empowers future teachers. This requires ongoing, adaptive development of ethical frameworks that uphold academic honesty, ensure data privacy, and critically address overreliance, thereby aligning pedagogical innovation with responsible self-regulated use of AI.

Possible Contribution to Self-Regulatory Learning Skills

One of the research questions of this study was to identify potential relationships between the use of generative AI and the development of self-regulatory skills in users. Given that key aspects of self-regulated learning can be complemented with capabilities of generative AI, such as personalized learning and assistance with self-driven learning (Kasneci et al., 2023), particularly in the areas of resource management and self-efficacy, this study examined those connections through correlation analysis.

The results revealed a significant positive correlation between the use of generative AI for searching for information and resource management ($r = 0.32$, $p < 0.01$), suggesting that using AI tools to find information can help users better manage their time, effort, and learning environments. This finding aligns with the idea that AI can support self-regulated learning by providing timely access to relevant information, allowing learners to plan and organize their studies more efficiently. As a quick reference and guide, a generative AI can allow users to structure their learning more strategically. On the other hand, we did not identify any significant correlations between AI usage and self-efficacy. Even though there was a modest positive correlation between using AI for translation ($r = 0.23$) and self-efficacy, it was not statistically significant. This suggests that while generative AI tools might support learners in managing their resources, their impact on users' belief in their capabilities and self-efficacy remains unclear. The current AI use among preservice teachers may still be task-oriented rather than skill-building, meaning that users may rely on AI to complete specific tasks without developing a deeper sense of mastery or control over the learning process. Another possible interpretation is that the limited connection between AI use and self-efficacy may reflect the incomplete integration of AI in an educational context or the lack of clear guidelines for using AI as a skill-building tool. Preservice teachers may benefit from structured guidance on using AI as a functional and simple task-performing tool and as a resourceful tool to build confidence in their problem-solving abilities and academic competencies.

Limitation

This study has several limitations as well. First, the sample size was relatively small and localized, which may restrict the generalizability of the findings and reduce the power to detect subtle differences or correlations. A larger sample size would allow more findings from quantitative analysis, including correlation and descriptive data, which this study includes. Second, the composition of the sample, with a predominance of undergraduates compared to graduates, might introduce bias. The reliance on self-reported data could also increase biases from social desirability and recall inaccuracy. Third, the study lacked validated instruments to measure perceptions and behavioral use of generative AI. As generative AI is a relatively new issue, no validated measurement exists. A future study

may supplement this gap by developing a validated measure that can ensure the reliability and validity of the data instrument. Given the rapid evolution of generative AI tools, future studies should consider longitudinal designs to account for changes in technological capabilities, user perceptions, and integration strategies that evolve in generative AI tools. Finally, the selected sample of undergraduate and graduate preservice teachers at a single institution may limit the generalizability of the results to a broader population. Although this study specifically looked into the use of generative AI through the lens of preservice teachers, there is a limitation in that the findings from this study only apply to preservice teachers in the educational setting rather than broader and more general audiences.

CONCLUSION

Consistent with past studies, our study can identify that preservice teachers recognize the potential of generative AI to enhance engagement, showing a generally positive attitude toward its integration. This positive outlook is promising as it suggests that preservice teachers are more likely to be receptive to adopting new technology in the classroom, a crucial factor for successful technology integration. However, the mixed methods approach of this study also reveals a significant need for expanded knowledge about the effective use of generative AI. Currently, preservice teachers appear to use these tools only at a surface level, indicating that deeper understanding and training are essential to unlocking AI's full educational potential. This suggests the importance of developing clear guidelines for AI's appropriate and ethical use in educational contexts. Establishing such guidelines can help preservice teachers apply generative AI responsibly by addressing concerns related to plagiarism and privacy. Teacher education programs can use these findings to prepare future teachers to integrate AI responsibly by developing their knowledge and ethical decision-making frameworks.

REFERENCES

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

Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT–TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, *52*(1), 154-168. https://doi.org/10.1016/j.compedu.2008.07.006

Ansari, T. (2022, December 7). Freaky ChatGPT fails that caught our eyes. *Annals of India Magazine, 7*. https://analyticsindiamag.com/ai-features/freaky-chatgpt-fails-that-caught-our-eyes/

Araujo, T. (2018). Living up to the chatbot hype: The influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions. *Computers in Human Behavior*, *85*, 183-189. https://doi.org/10.1016/j.chb.2018.03.051

Baidoo-anu, D., & Owusu Ansah, L. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI, 7*(1), 52-62. https://doi.org/10.61969/jai.1337500

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, *50*(2), 248-287. https://doi.org/10.1016/0749-5978(91)90022-L

Caruccio, L., Cirillo, S., Polese, G., Solimando, G., Sundaramurthy, S., & Tortora, G. (2024). Can ChatGPT provide intelligent diagnoses? A comparative study between predictive models and ChatGPT to define a new medical diagnostic bot. *Expert Systems with Applications, 235*, 121186. https://doi.org/10.1016/j.eswa.2023.121186

Cavalcanti, A. P., Barbosa, A., Carvalho, R., Freitas, F., Tsai, Y.-S., Gašević, D., & Mello, R. F. (2021). Automatic feedback in online learning environments: A systematic literature review. *Computers and Education: Artificial Intelligence*, *2*, 100027. https://doi.org/10.1016/j.caeai.2021.100027

Chen, Y., Chen, Y., & Heffernan, N. (2020). *Personalized math tutoring with a conversational agent.* PsyArXiv.

Chiu, T. K., Moorhouse, B. L., Chai, C. S., & Ismailov, M. (2024). Teacher support and student motivation to learn with artificial intelligence (AI) based chatbot. *Interactive Learning Environments*, *32*(7), 3240-3256. https://doi.org/10.1080/10494820.2023.2172044

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage.

Dawson, V. (2008). Use of information and communication technology by early career science teachers in Western Australia. *International Journal of Science Education*, *30*(2), 203-219. https://doi.org/10.1080/09500690601175551

Deng, X., & Yu, Z. (2023). A meta-analysis and systematic review of the effect of chatbot technology use in sustainable education. *Sustainability*, *15*(4), 2940. https://doi.org/10.3390/su15042940

Esfijani, A., & Zamani, B. E. (2020). Factors influencing teachers' utilisation of ICT: The role of in-service training courses and access. *Research in Learning Technology*, *28*, 2313. https://doi.org/10.25304/rlt.v28.2313

Fetters, M. D., & Molina-Azorin, J. F. (2017). The *Journal of Mixed Methods Research* starts a new decade: The mixed methods research integration trilogy and its dimensions. *Journal of Mixed Methods Research*, *11*(3), 291-307. https://doi.org/10.1177/1558689817714066

Floridi, L., & Chiriatti, M. (2020). GPT-3: Its nature, scope, limits, and consequences. *Minds and Machines*, *30*(4), 681-694. https://doi.org/10.1007/s11023-020-09548-1

Hartley, K., Hayak, M., & Ko, U. H. (2024). Artificial intelligence supporting independent student learning: An evaluative case study of ChatGPT and learning to code. *Education Sciences, 14*(2), 120. https://doi.org/10.3390/educsci14020120

Hwang, G. J., & Chien, S. Y. (2022). Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective. *Computers and Education: Artificial Intelligence, 3*, 100082. https://doi.org/10.1016/j.caeai.2022.100082

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, *103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kim, S., Park, J., & Lee, H. (2019). Automated essay scoring using a deep learning model. *Journal of Educational Technology Development and Exchange*, *2*(1), 1-17.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage.

Liu, S. (2012). A multivariate model of factors influencing technology use by preservice teachers during practice teaching. *Educational Technology & Society*, *15*(4), 137-149.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017-1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

OpenAI. (2022, November 30). *Introducing ChatGPT*. https://openai.com/index/chatgpt/

Pintrich, P. R., Smith, D., Garcia, T., & Mckeachie, W. J. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ) (ED338122). ERIC. https://eric.ed.gov/?id=ED338122

Popenici, S. A. D., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, *12*, Article 22. https://doi.org/10.1186/s41039-017-0062-8

Pratama, M. P., Sampelolo, R., & Lura, H. (2023). Revolutionizing education: Harnessing the power of artificial intelligence for personalized learning. *Klasikal: Journal of Education, Language Teaching and Science*, *5*(2), 350-357. https://doi.org/10.52208/klasikal.v5i2.877

Sanusi, I. T., Ayanwale, M. A., & Tolorunleke, A. E. (2024). Investigating preservice teachers' artificial intelligence perception from the perspective of planned behavior theory. *Computers and Education: Artificial Intelligence*, *6*, 100202. https://doi.org/10.1016/j.caeai.2024.100202

Shkedi, A. (2004). Second-order theoretical analysis: A method for constructing theoretical explanation. *International Journal of Qualitative Studies in Education*, *17*(5), 627-646. https://doi.org/10.1080/0951839042000253630

Sølvberg, A. M. (2003). Computer-related control beliefs and motivation: A panel study. *Journal of Research on Technology in Education, 35*(4), 473-487. https://doi.org/10.1080/15391523.2003.10782397

Sweeney, D. M. (2024). Students' experiences of educational technology use to facilitate university learning: Factors influencing their mediation of learning. *Research in Learning Technology*, *32*. https://doi.org/10.25304/rlt.v32.3193

Watson, J. H., & Rockinson-Szapkiw, A. (2021). Predicting preservice teachers' intention to use technology-enabled learning. *Computers & Education*, *168*, 104207. https://doi.org/10.1016/j.compedu.2021.104207

Zhang, C., Schießl, J., Plößl, L., Hofmann, F., & Gläser-Zikuda, M. (2023). Acceptance of artificial intelligence among preservice teachers: a multigroup analysis. *International Journal of Educational Technology in Higher Education, 20*, Article 49. https://doi.org/10.1186/s41239-023-00420-7

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*(3), 329-339. https://doi.org/10.1037/0022-0663.81.3.329

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, *41*(2), 64-70. https://doi.org/10.1207/s15430421tip4102_2

AUTHOR

UnHyeok Ko is a doctoral student in curriculum and instruction with interaction and media sciences as a subplan at the University of Nevada, Las Vegas. His research interests include technological integration into teaching and learning from the perspective of self-regulated learning, self-determination theory, and TAM as a theoretical basis, promotion of active technological intervention into learning practice, and development of curriculum that aims to meet traditional and progressive educational goals. He also works as a curriculum development assistant in the online education department of the University of Nevada, Las Vegas.

Kendall Hartley is an Associate Professor of Educational Technology in the Department of Teaching and Learning at the University of Nevada, Las Vegas. He has served in multiple leadership roles, including Associate Dean of the Graduate College and Co-Director of the Learning & Technology PhD Program. His research focuses on the intersections of instructional technology, self-regulated learning, smartphone use in education, and the evolving role of artificial intelligence in teaching and learning environments. Dr Hartley has published extensively in high-impact journals and actively contributes to professional associations such as AERA.

Merav Hayak, PhD, a Postdoctoral Fellow at the Teachers College, Columbia University (Center for Sustainable Futures), blends extensive high-tech leadership with academic rigor. Her research focuses on educational change, innovation, and the organizational implementation of cutting-edge technologies (digital games, VR/AR, AI), and encompasses diverse fields, including climate change education. She also lectures at Achva Academic College, teaching entrepreneurship, innovation, and technology integration in education.