Research Report

JMST

Educational Use and Ethical Perceptions of Generative AI Tools: A Pilot Study among Students from the College of Health Sciences

Wootaek Lim, PT, Ph.D[1,2]

[1]Department of Physical Therapy, College of Health and Welfare, Woosong University, Daejeon, South Korea
[2]Department of Digital Bio-Health Convergence, College of Health and Welfare, Woosong University, Daejeon, South Korea

Background Generative artificial intelligence (AI) is rapidly proliferating in educational settings, influencing a range of learning activities such as information retrieval, conceptual understanding, and writing assistance. However, most studies have focused on engineering disciplines, and research on sex-based differences in adopting AI remains limited.

Purpose This pilot study aimed to examine the current use, perceptions, and ethical attitudes toward generative AI tools among undergraduate students in health science disciplines, and identify sex-based differences.

Study design Cross-sectional survey

Methods A cross-sectional survey was conducted among health science undergraduates. The questionnaire comprised 20 items across six domains: demographic characteristics, AI usage experience, purpose of use, perceptions of learning outcomes, ethical awareness, and intentions for future use. Descriptive statistics, cross-tabulation, and chi-square tests were used to analyze the data, with statistical significance set at $p<.05$.

Results All respondents reported prior experience with generative AI tools. The most frequently cited purposes were information retrieval (80.0%), and summarization and organization (57.1%). Reported benefits included time saving (65.7%), although concerns were noted regarding lack of accuracy (77.1%) and reliability (65.7%). Only 8.8% did not consider the direct use of AI-generated text in assignments as plagiarism, while 26.5% indicated they would provide citations. Sex-based comparisons showed that men were more likely than women to perceive a positive impact of AI on critical thinking, with higher expectations regarding future contributions of AI to learning, and stronger intention for active use.

Conclusions Although health science students actively integrated generative AI into their learning and generally perceived positive effects, appropriate actions regarding potential ethical concerns were limited. These findings underscore the need for AI ethics education and establishing clear institutional guidelines. In addition, the observed sex-based differences in technology acceptance suggest that instructional strategies should be aligned with the needs of diverse learner groups.

Key words Ethics; Generative artificial intelligence; Sex difference; Surveys and questionnaires.

J Musculoskelet Sci Technol
2026; 10(1): 43-51
Published Online Jun 30, 2026
pISSN 2635-8573
eISSN 2635-8581

Article History
Received 20 Dec 2025
Revised 8 Jan 2026 (1st)
Revised 25 Jan 2026 (2nd)
Accepted 10 Feb 2026

CONTACT
wootaeklimpt@wsu.ac.kr
Wootaek Lim
Department of Physical Therapy, Woosong University, Daejeon, South Korea

INTRODUCTION

In recent years, generative artificial intelligence (AI) has rapidly expanded across industry, research, and education. Within the educational domain, tools built on large language models (LLMs), such as ChatGPT, Gemini, and Microsoft

Copilot, have transformed the students' learning processes via their natural language understanding and generation capabilities.[1,2] Early versions were primarily used for limited functions, including writing assistance and translation, whereas current applications extend to more complex tasks such as problem-solving and report writing.[3] These developments have enabled learners to design and execute self-directed learning activities without relying solely on traditional lectures.[4,5] The scope and depth of this trend is expected to increase in the coming years.

Recent studies applying frameworks such as the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology, examined factors influencing attitudes toward generative AI and intentions to use it, and identified educational benefits, including enhanced information accessibility, improved learning efficiency, and reduced cognitive load.[6,7] However, technological advancements do not always yield positive outcomes, and concerns regarding potential adverse effects such as plagiarism, copyright infringement, and biased information are being increasingly debated.[8] Dahiya and Kumari reported that university students who had received AI ethics education had greater awareness and a stronger intention for responsible use.[9] Such findings underscore the need to address both ethical awareness and corresponding behaviors in AI use. Previous studies have developed instruments for measuring AI ethics awareness and critical evaluation skills in university populations, noting that women students often achieve higher ethics-related scores than their men counterparts.[10] Nevertheless, most existing research has either targeted general university cohorts without differentiating by field of study or has focused predominantly on engineering disciplines.[11,12] Investigations specifically involving students in health science disciplines, in which face-to-face interaction and communication are central, remain limited. Furthermore, even when sex differences are acknowledged, analyses frequently combine men and women participants without conducting separate examinations.

Sex-based differences in receptivity to emerging technologies extend beyond simple variations in preference or frequency of use. They may encompass broader influences, including attitudes, self-efficacy, and cultural or structural factors embedded in educational experiences.[13–15] Meta-analyses have indicated that men generally exhibit more favorable attitudes toward technology and higher self-efficacy, patterns thought to be shaped by intersecting factors such as traditional gender role expectations, access to educational opportunities, and persistent stereotypes.[16,17] Recent research suggests that these tendencies also manifest in AI adoption, with men often evaluating AI more positively and adopting it more readily than women.[18,19] From the perspective of Social Reproduction Theory, proficiency in using generative AI can be considered a type of cultural capital.[20] Accordingly, sex-based disparities in acceptance and use may contribute to learning gaps and potentially foster new forms of inequality within educational settings.

The present study investigated the use, purposes, perceptions, attitudes, and ethical awareness regarding generative AI tools among health science students, and sex-based differences. This pilot study aims to provide foundational data for future large-scale investigations.

METHODS

Study design and participants

This study employed a cross-sectional survey design targeting undergraduate students enrolled in a College of Health Sciences at a four-year university. Data collection was conducted on campus using a structured questionnaire. Participation was voluntary, and only currently enrolled students were eligible. Before the survey, all participants were informed regarding the study objectives and provided informed written consent. A total of 35 respondents were recruited for this pilot survey via convenience sampling, without an a priori power analysis. The primary aim was to assess feasibility and generate preliminary data to inform sample size estimation for future large-scale studies. To ensure anonymity, no personally identifying information was collected. This study was approved by the Institutional Review Board of Woosong University (IRB. 1041549-251014-SB-227).

Data collection

The questionnaire comprised the following six domains and a total of 20 items, including three questions on demographic characteristics:

(1) Demographic characteristics (sex, age, and year of study)

(2) Experience with generative AI tools (use history, number of tools used, frequency of use)

(3) Purposes and usage patterns (information search, exam preparation)

(4) Learning outcomes and perceived impact (effects on current learning achievement and critical thinking skills)

(5) Ethical awareness and attitudes (perceptions of plagiarism, ethical actions taken)

(6) Intentions and outlook for future use (anticipated

future impact on learning, willingness to use actively)

Most items were single-choice questions rated on a five-point Likert scale, while some were multiple-choice questions allowing more than one response. The survey was conducted as part of a pilot study and content validity was established through a review of relevant literature and expert consultation.

Data analysis

Prior to statistical analysis, all single-choice responses were coded numerically, and multiple-choice responses were converted into dichotomous variables (1=selected, 0=not selected) in Microsoft Office Excel version 2019. Statistical analyses were performed using SPSS Statistics version 28.0 (IBM Corp., Armonk, NY, USA).

Descriptive statistics were computed for all responses. Single-choice items were summarized as percentages, whereas multiple-choice items were organized as multiple response sets prior to analysis. Crosstabulation and chi-square tests were used to examine associations between categorical variables, including associations between AI usage frequency and selected learning-related variables, as well as sex-based comparisons between men and women participants. Participants who did not report sex were excluded from these analyses. For contingency tables containing cells with an expected frequency<5, Fisher's exact test was additionally performed to supplement the chi-square results. Adjustments for multiple comparisons were not implemented due to the exploratory nature of this pilot study. The significance level (α) was set at .05.

RESULTS

Descriptive figures present aggregated data to outline overall trends in AI use and perceptions. Sex-based differences were examined through statistical analyses and are presented in the corresponding section.

Participant characteristics and experience with generative AI tools

The sample included an equal number of men and women students (n=17 each), with one respondent not reporting sex (Table 1). Regarding age distribution, 45.7% were 18–20 years, 37.1% were 21–23 years (thus 82.8% were aged≤23 years), 8.6% were 24–26 years, and 8.6% were≥27 years. Year of study was distributed as follows: first year 34.3%, second year 11.4%, third year 37.1%, and fourth year 14.3%.

All participants reported prior use of generative AI tools (100%). In terms of usage frequency, the most common response was "almost every day" (28.6%), followed by "two to three times per week" (40.0%), "once per week" (22.9%), and "once or twice per month" (8.6%) (Figure 1). The most frequently used tool was ChatGPT (97.1%), followed by Gemini (25.7%), Microsoft Copilot (11.4%), Claude (2.9%), and other tools (8.6%) (Figure 2).

Table 1. Participant characteristics (N=35)

Characteristics	Categories	n (%)
Sex	Men	17 (50.0)
	Women	17 (50.0)
Age	18–20 years	16 (45.7)
	21–23 years	13 (37.1)
	24–26 years	3 (8.6)
	> 27 years	3 (8.6)
Year of study	1st year	12 (34.3)
	2nd year	4 (11.4)
	3rd year	13 (37.1)
	4th year	5 (14.3)

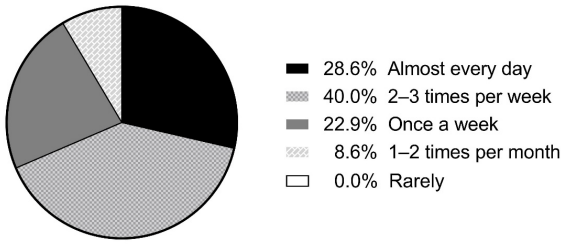

Figure 1. Frequency of generative AI usage among students from the college of health sciences. The pie chart shows the proportion of respondents reporting different usage frequencies.

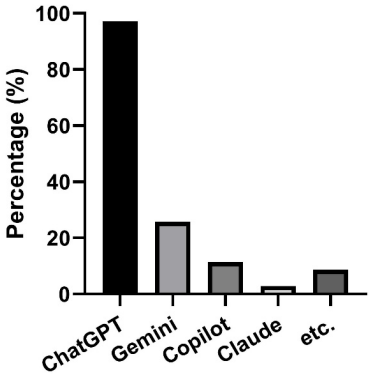

Figure 2. Percentage of participants reporting use of each generative AI tool. The bar graph illustrates the percentage of participants reporting use of each tool.

Purposes and usage patterns

The most frequently reported purposes for using generative AI tools were information search (80.0%), summarizing and organizing information (57.1%), understanding concepts (51.4%), writing assistance (45.7%), exam preparation (37.1%), translation (37.1%), and report or essay writing (34.3%). The most frequently perceived benefits were time saving (65.7%), increased understanding of study materials (62.9%), improved access to information (57.1%), reduced workload for assignments (54.3%), and enhanced self-directed learning skills (45.7%), while improved creative problem-solving skills was less frequently reported (14.3%). Reported difficulties included lack of accuracy (77.1%), lack of reliability (65.7%), increased dependency (42.9%), plagiarism concerns (31.4%), difficulty in understanding how to use the tools (25.7%), conflicts with assignment guidelines (10.2%), and reduced critical thinking skills (5.7%).

Learning outcomes and perceived impact

Regarding the impact of AI use on learning achievement, 82.9% of respondents reported a positive effect ("Significantly improved" 34.3% and "Somewhat improved" 48.6%), while 14.3% reported "No change," and 2.9% reported "Somewhat decreased"; no participant selected "Significantly decreased." The responses to impact on critical thinking skills were predominantly positive, with 17.1% indicating "Significantly improved," 42.9% "Somewhat improved," 25.7% "No change," and 14.3% "Somewhat decreased." Regarding trusting the information or responses provided by generative AI tools, the most frequent response was "Trust somewhat" (61.8%), followed by "Neutral" (32.4%), "Completely trust" (2.9%), and "Do not trust" (2.9%); none of the respondents selected "Do not trust at all" (Figure 3).

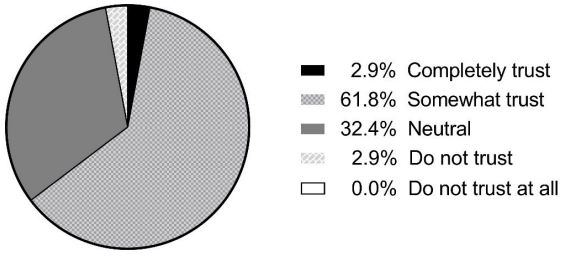

Figure 3. Trust levels in AI-generated information or responses. The pie chart shows the proportion of respondents reporting different levels of trust.

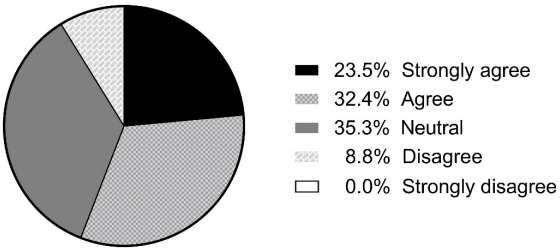

Figure 4. Perceptions on whether using AI-generated text in assignments without modification constitutes plagiarism. The pie chart shows the distribution of respondents across agreement levels.

Ethical awareness and attitudes

When asked whether using AI-generated text in assignments without modification constitutes plagiarism, 23.5% responded "Strongly agree," 32.4% "Agree," 35.3% "Neutral," 8.8% "Disagree," and none selected "Strongly disagree" (Figure 4). The most common ethical action taken when using generative AI tools was reviewing and editing AI-generated results (73.5%), followed by limiting the use of generative AI tools (38.2%), citing AI-generated content as a source (26.5%), and following ethical guidelines (20.6%); 5.9 % reported taking no specific action. Only 23.5% reported receiving education on AI ethics. Awareness of their institution's guidelines for AI use was most often "Neutral" (38.2%), followed by "Somewhat aware" (32.4%), "Barely aware" (17.6%), "Very well aware" (5.9%), and "Not aware at all" (5.9%).

Intentions and outlook for future use

Perceptions regarding the potential positive impact of generative AI tools on future learning were generally favorable, with 48.5% responding "Strongly agree" and 36.4% "Agree." "Neutral" responses accounted for 9.1%, while 6.1% selected "Disagree," and none selected "Strongly disagree." A similar pattern was observed for the intention to actively use generative AI tools in the future: "Strongly agree" 48.5%, "Agree" 39.4%, "Neutral" 6.1%, "Disagree" 3.0%, and "Strongly disagree" 0%. The most anticipated future developments were improved accuracy (84.8%) and enhanced personalization features (75.8%), followed by ethical safeguards (39.4%), legal or regulatory frameworks (15.2%), and improved interface or accessibility (9.1%).

Relationship between AI usage frequency and learning-related variables

To explore whether the extent of AI use was associated

with learning-related perceptions, associations between AI usage frequency and selected learning-related variables were examined. No statistically significant association was observed between AI usage frequency and perceived current learning achievement (χ^2=7.395, p=0.596). However, the relationship between usage frequency and expectations for future learning impact trended towards significance. While Pearson's chi-square test did not reach significance (p=0.092), the Linear-by-Linear Association test indicated a statistically significant association (χ^2=6.338, p=0.012). Additionally, the relationship between perceived current learning achievement and future expectations was statistically significant in both Pearson's chi-square (χ^2=25.688, p=0.002) and the Linear-by-Linear Association (χ^2=12.096, p=0.001). Figure 5 presents a heatmap of the frequency distribution, where darker shading indicates a higher concentration of responses for each combination of current and future learning impact ratings.

Sex differences

Sex-based comparisons revealed statistically significant differences in three variables. First, perceptions concerning the impact of generative AI tools on critical thinking skills differed significantly between men and women students (Pearson χ^2=8.197, p=0.042). All men respondents in the "strongly positive" category represented 100% of that response group, whereas responses from women were distributed primarily across "somewhat positive" and "no change." Significant differences were observed in expectations of generative AI's future contribution to learning (χ^2=10.705, p=0.013) and in the intention to use generative AI tools actively in the future (χ^2=10.583, p=0.014). In both cases, men more frequently selected "strongly agree," while women more often selected "agree" or "neutral." Cramer's V values indicated moderate to large effect sizes (Table 2). No other variables showed statistically significant differences between men and women.

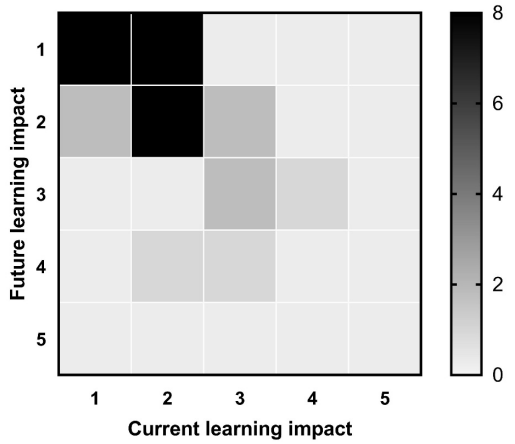

Figure 5. Heatmap showing the frequency distribution between current and future learning impact of generative AI tool usage.

DISCUSSION

Recent advances in generative AI technologies have fundamentally changed how students approach learning and utilize information. While several studies have examined AI use in higher education, research on ethical awareness and sex-related differences remains lacking.

Descriptive analysis indicated that all respondents had prior experience using generative AI tools, with 68.6% reporting regular use at least two to three times per week. Among them, 28.6% reported using generative AI tools almost daily, suggesting that a substantial proportion of university students already integrate these tools into their academic routines. Similar patterns of rapid, year-on-year growth in adopting AI have been observed internationally.[21,22] Information search emerged as the most frequently cited purpose (80%), which implies that generative AI tools are not limited to a supportive learning role but have begun to substitute some functions of traditional search engines such as Google[23] A comparative study between ChatGPT and Google Search found that ChatGPT required less time for task completion and produced more accurate responses to intuitive queries[24]; participants highly rated the quality of information and expressed greater satisfaction when using ChatGPT. Moreover, while the performance of Google Search tended to vary with the participants' educational level, ChatGPT's performance remained relatively consistent, suggesting its

Table 2. Sex-based comparisons of key variables

Variable	χ^2	p value	Cramer's V
Impact of generative AI tools on critical thinking skills	8.197	0.042	0.491
Expectations of AI's future contribution to learning	10.705	0.013	0.578
Intention to use generative AI tools actively in future	10.583	0.014	0.575

potential to help reduce digital disparities. Following information search, students most often used generative AI tools for summarization, conceptual understanding, writing assistance, and exam preparation.[25,26] Translation also ranked highly, likely because health science curricula frequently involve English-language textbooks and international academic resources. Although concerns remain regarding the accuracy and reliability of AI-generated content, students in this study reported positive experiences regarding time savings, improved comprehension, and reduced workload. These findings indicate that generative AI has already evolved beyond a supplementary role to function as a substantive learning tool.[27,28] Current issues such as hallucinations are expected to diminish with continued advances in LLM through techniques such as "retrieval-augmented generation," "self-reflection," and "iterative model-level contrastive learning," which may further expand the scope of use.[29–31] ChatGPT was by far the most widely used tool (97.1%). A 2023 survey of U.S. adults reported that 79% had at least heard of ChatGPT, and among those under 30, 58% had used it.[32] Its early release relative to other generative AI platforms, extensive media exposure, and the availability of multiple model types designed for different tasks (such as GPT-4o for general applications, o3-Pro for reasoning, GPT-4.1 for coding, GPT-4.5 for writing) possibly contributed to its strong brand recognition.

The relationship between AI usage frequency and perceived learning achievement was not statistically significant, indicating that usage frequency does not necessarily translate into perceived qualitative benefits. However, a notable trend emerged between usage frequency and expectations of AI's future contributions to learning. This suggests that while current experiences may not fully meet students' expectations, they nonetheless anticipate greater benefits as the technology matures.[33] Furthermore, students who perceived generative AI tools as positively influencing their current learning were more likely to hold higher expectations for future impact. This pattern implies that positive experiences and perceptions of learning benefits contribute to sustained intentions to use these technologies.

Only 8.8% of respondents indicated that directly using AI-generated text in assignments without modification would not constitute plagiarism. The term "AI-giarism" was recently introduced, highlighting that students increasingly perceive this as a new form of academic misconduct.[34] Despite the generally high level of ethical awareness, practical actions remain lacking. While the most frequently reported action when using generative AI tools was reviewing and editing AI-generated outputs (73.5%), the proportion citing AI-generated content as a source (26.5%) or referring to ethical guidelines (20.6%) was notably low. Interestingly, the percentage opting to "limit AI use" (38.2%) was higher than that for citation, suggesting a tendency to avoid use altogether rather than comply with attribution practices. Overall, the findings indicate that although respondents were aware of potential ethical concerns, their understanding and implementation of specific operational guidelines or behavioral principles did not match this awareness. This gap may not reflect individual negligence but rather structural issues, including the insufficient provision of AI ethics education.[35] Most participants in this study lacked prior training and reported low awareness of guidelines, which appears to result in defensive strategies such as limiting usage instead of proper citation. Therefore, higher education should incorporate ethics-related content with a focus on actionable guidance, alongside a need for proactive governmental involvement. This holds particular significance in health science education, where the ethical use of information, critical evaluation, and professional responsibility are integral to clinical reasoning and patient safety. While institutional regulations are important, there is also a need for overarching guidelines similar to those established by institutional review boards. For example, the recent passage of the Artificial Intelligence Act by the European Parliament mandates clear labeling of AI-generated content under its transparency provisions[36]. However, given the rapid pace of AI development, legislative measures lag behind, underscoring the continued importance of institutional-level initiatives.

Sex-based differences were evident in three variables. First, men were significantly more likely than women to consider the impact of generative AI tools on critical thinking skills as highly positive.[37] Furthermore, men expressed stronger expectations regarding generative AI's future contribution to learning and a greater willingness to use generative AI tools actively. Prior research similarly has shown that men use generative AI more frequently and gained 6.4% more productivity compared to women.[38] Additional studies have reported that women tend to be more apprehensive toward AI and had lower usage rates, indicating meaningful sex-based disparities in adoption.[19,39] These differences have also been observed from a technology acceptance perspective. For example, studies on adopting new software showed that men were more likely to emphasize perceived usefulness, whereas women prioritized perceived ease of use.[19] Taken together, these findings suggest that sex-based differences in AI adoption and attitudes might stem from variations in technology-related

self-efficacy and differing approaches to technology acceptance. Theoretical perspectives from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) elucidate these patterns.[40,41] Within these frameworks, behavioral intention hinges on core constructs such as perceived usefulness (performance expectancy) and ease of use (effort expectancy), alongside facilitating conditions. Additionally, individual factors including technology-related self-efficacy and anxiety act as significant influences. Accordingly, the observed sex-based differences in this study may reflect differences in technology acceptance and affective responses to AI (e.g., AI-related anxiety), which together influence attitudes toward AI and intentions for continued use.

This study has several limitations. First, although conducted as a pilot at a single institution, the relatively small sample size limits the generalizability of the findings to other health science programs or institutional contexts. Future large-scale, multi-institutional studies involving students from a broader range of academic disciplines are warranted. Second, usage patterns and learning outcomes measures were based on subjective self-assessment, which limits the ability to draw conclusions regarding the relationship with objective indicators such as actual academic performance or task completion quality. Subsequent research should incorporate quantitatively measurable outcomes to evaluate the tangible effects of AI use in relation to user perceptions and behaviors.

CONCLUSIONS

This study examined the use of generative AI tools and related ethical attitudes among undergraduate students in health science disciplines. Most participants were already incorporating tools such as ChatGPT into their learning processes and perceived benefits including time savings and improved comprehension. With regard to ethical awareness, students were highly aware of the potential issues associated with AI use; however, their corresponding corrective actions were often limited. The findings also indicated a notable lack of formal education on AI ethics, underscoring the need for integrating ethical competency training into AI-related curricula. Sex-based analyses revealed higher future expectations and stronger intentions for active use among men, suggesting potential differences in technology acceptance between sexes. Overall, the results indicate that generative AI is evolving from a supplementary learning aid into a significant educational medium that shapes both learning experiences and attitudes. In parallel with this transition, the development and implementation of appropriate ethical guidelines and training are becoming increasingly important. Furthermore, given the possibility of sex-related differences in technology acceptance, instructional strategies may need to be adapted to align with the characteristics and needs of different learner groups. As this was a pilot study with a limited sample size, the findings should be interpreted as hypothesis-generating and are intended to inform the design of future large-scale investigations, rather than to provide definitive conclusions.

Key Points

Question What are the patterns of use, perceptions, and ethical attitudes toward generative AI among health science undergraduates, and are there sex-based differences?

Findings All students had used generative AI tools and perceived learning benefits, but concerns about accuracy and limited ethical practices persisted; men reported more positive views on critical thinking and stronger intentions for future use.

Meaning As generative AI is already embedded in learning, targeted AI ethics education and clear institutional guidelines are needed, with attention to sex-based differences in technology acceptance.

Article information

Conflict of Interest Disclosures: None.

Funding/Support: This research was supported by 2025 Woosong University Academic Research Funding and the Regional Innovation System & Education (RISE) program through the Daejeon RISE Center, funded by the Ministry of Education (MOE) and the Daejeon Metropolitan City, Republic of Korea (2025-RISE-06-009).

Acknowledgment: None.

Ethic Approval: This study was approved by the Institutional Review Board of Woosong University (Approval number: 1041549-251014-SB-227).

Data Availability: The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Author contributions

Conceptualization: WT Lim.
Data acquisition: WT Lim.
Design of the work: WT Lim.
Data analysis: WT Lim.
Project administration: WT Lim.
Interpretation of data: WT Lim.

Writing – original draft: WT Lim.
Funding acquisition: WT Lim.
Writing–review&editing: WT Lim.

REFERENCES

1. da Silva GS, Ulbricht VR. Learning with conversational AI: ChatGPT and Bard/Gemini in education. In: Isaias P, Sampson DG, Ifenthaler D, editors. *Artificial intelligence for supporting human cognition and exploratory learning in the digital age*. Cham: Springer Nature Switzerland; 2024. p. 101-117.
2. Rossettini G, Rodeghiero L, Corradi F, Cook C, Pillastrini P, Turolla A, et al. Comparative accuracy of ChatGPT-4, Microsoft Copilot and Google Gemini in the Italian entrance test for healthcare sciences degrees: a cross-sectional study. *BMC Med Educ*. 2024;24(1):694.
3. Hadi Mogavi R, Deng C, Juho Kim J, Zhou P, D. Kwon Y, Hosny Saleh Metwally A, et al. ChatGPT in education: A blessing or a curse? A qualitative study exploring early adopters' utilization and perceptions. *Computers in Human Behavior: Artificial Humans*. 2024;2(1):100027.
4. Marquardson J. Embracing artificial intelligence to improve self-directed learning: a cybersecurity classroom study. *Information Systems Education Journal*. 2024;22(1):4-13.
5. Roe J, Perkins M. Generative AI in self-directed learning: a scoping review [Internet]. arXiv; 2024.
6. Dahri NA, Yahaya N, Al-Rahmi WM, Aldraiweesh A, Alturki U, Almutairy S, et al. Extended TAM based acceptance of AI-Powered ChatGPT for supporting metacognitive self-regulated learning in education: A mixed-methods study. *Heliyon*. 2024;10(8):e29317.
7. Du L, Lv B. Factors influencing students' acceptance and use generative artificial intelligence in elementary education: an expansion of the UTAUT model. *Educ Inf Technol*. 2024;29(18):24715-24734.
8. Fowler DS. AI in higher education: academic integrity, harmony of insights, and recommendations. *Journal of Ethics in Higher Education*. 2023;(3):127-143.
9. Dahiya A, Kumari D. Cultivating ethical AI practices: the impact of AI ethics education on responsible AI. *Journal of Informatics Education and Research*. 2025;5(2).
10. Wang Z, Chai CS, Li J, Lee VWY. Assessment of AI ethical reflection: the development and validation of the AI ethical reflection scale (AIERS) for university students. *Int J Educ Technol High Educ*. 2025;22(1):19.
11. El Fathi T, Saad A, Larhzil H, Lamri D, Al Ibrahmi EM. Integrating generative AI into STEM education: enhancing conceptual understanding, addressing misconceptions, and assessing student acceptance. *Discip Interdscip Sci Educ Res*. 2025;7(1):6.
12. Fan L, Deng K, Liu F. Educational impacts of generative artificial intelligence on learning and performance of engineering students in China. *Sci Rep*. 2025;15(1):26521.
13. Tarhini A. The Effects of cultural dimensions and demographic characteristics on E-learning acceptance [Internet]. arXiv; 2016.
14. Chan RCH. A social cognitive perspective on gender disparities in self-efficacy, interest, and aspirations in science, technology, engineering, and mathematics (STEM): the influence of cultural and gender norms. *IJ STEM Ed*. 2022;9(1):37.
15. Campos DG, Scherer R. Digital gender gaps in students' knowledge, attitudes and skills: an integrative data analysis across 32 Countries. *Educ Inf Technol*. 2024;29(1):655-693.
16. Cai Z, Fan X, Du J. Gender and attitudes toward technology use: a meta-analysis. *Computers & Education*. 2017;105:1-13.
17. Christensen MA. Tracing the gender confidence gap in computing: a cross-national meta-analysis of gender differences in self-assessed technological ability. *Soc Sci Res*. 2023;111:102853.
18. Otis N, Cranney K, Delecourt S, Koning R. Global evidence on gender gaps and generative AI [Internet]. OSF; 2024.
19. Møgelvang A, Bjelland C, Grassini S, Ludvigsen K. Gender differences in the use of generative artificial intelligence chatbots in higher education: characteristics and consequences. *Education Sciences*. 2024;14(12):1363.
20. Tzanakis M. Bourdieu's social reproduction thesis and the role of cultural capital in educational attainment: a critical review of key empirical studies. *Educate~*. 2011;11(1):76-90.
21. Balabdaoui F, Dittmann-Domenichini N, Grosse H, Schlienger C, Kortemeyer G. A survey on students' use of AI at a technical university. *Discov Educ*. 2024;3(1):51.
22. Freeman J. Student generative AI survey 2025. HEPI policy note 61. Higher Education Policy Institute; 2025 Feb.
23. Amer E, Elboghdadly T. the end of the search engine era and the rise of generative AI: a paradigm shift in information retrieval. In: 2024 International Mobile, Intelligent, and Ubiquitous Computing Conference (MIUCC). 2024. p. 374-379.
24. Xu R, Feng Y, Chen H. ChatGPT vs. Google: a

comparative study of search performance and user experience [Internet]. arXiv; 2023.
25. Duy NBP, Phuong TNM, Chau VNM, Nhi NVH, Khuyen VTM, Giang NTP. AI-assisted learning: An empirical study on student application behavior. *Multidisciplinary Science Journal*. 2025;7(6):2025275-2025275.
26. Hendrawan JH, Anggraeni NF, Silah SB, Anwar A. Artificial intelligence improving student learning achievement. *International Journal of Social Learning (IJSL)*. 2024;5(1):140-154.
27. Pitts G, Marcus V, Motamedi S. Student perspectives on the benefits and risks of AI in education [Internet]. arXiv; 2025.
28. Ward B, Bhati D, Neha F, Guercio A. Analyzing the impact of AI tools on student study habits and academic performance. In: 2025 IEEE 15th Annual Computing and Communication Workshop and Conference (CCWC). 2025. p. 00434–00440.
29. Tonmoy SMTI, Zaman SMM, Jain V, Rani A, Rawte V, Chadha A, et al. A comprehensive survey of hallucination mitigation techniques in large language models [Internet]. arXiv; 2024.
30. Béchard P, Ayala OM. Reducing hallucination in structured outputs via retrieval-augmented generation. in: proceedings of the 2024 conference of the North American chapter of the association for computational linguistics: human language technologies (Volume 6: Industry Track). 2024. p. 228-238.
31. Wu H, Li X, Xu X, Wu J, Zhang D, Liu Z. Iter-AHMCL: alleviate hallucination for large language model via iterative model-level contrastive learning [Internet]. arXiv; 2024.
32. McClain OS and C. 34% of U.S. adults have used ChatGPT, about double the share in 2023 [Internet]. Pew Research Center. 2025.
33. Delcker J, Heil J, Ifenthaler D, Seufert S, Spirgi L. First-year students AI-competence as a predictor for intended and de facto use of AI-tools for supporting learning processes in higher education. *Int J Educ Technol High Educ*. 2024;21(1):18.
34. Chan CKY. Is AI changing the rules of academic misconduct? an in-depth look at students' perceptions of "AI-giarism" [Internet]. arXiv; 2023.
35. Wiese LJ, Patil I, Schiff DS, Magana AJ. AI ethics education: A systematic literature review. *Computers and Education: Artificial Intelligence*. 2025;8:100405.
36. EU Artificial Intelligence Act [Internet]. The EU Artificial Intelligence Act: Up-to-date developments and analyses of the EU AI Act. 2024.
37. Sardi J, Darmansyah, Candra O, Yuliana DF, Habibullah, Yanto DTP, et al. How generative AI influences students' self-regulated learning and critical thinking skills? a systematic review. *International Journal of Engineering Pedagogy (iJEP)*. 2025;15(1):94-108.
38. Tang C, Li SK, Hu S, Zeng F, Du Q. Gender disparities in the impact of generative artificial intelligence: Evidence from academia. *PNAS Nexus*. 2025;4(2):591.
39. Russo C, Romano L, Clemente D, Iacovone L, Gladwin TE, Panno A. Gender differences in artificial intelligence: the role of artificial intelligence anxiety. *Front Psychol*. 2025;16:1559457.
40. Dwivedi YK, Rana NP, Tamilmani K, Raman R. A meta-analysis based modified unified theory of acceptance and use of technology (meta-UTAUT): a review of emerging literature. *Curr Opin Psychol*. 2020;36:13-18.
41. Marangunić N, Granić A. Technology acceptance model: a literature review from 1986 to 2013. *Univ Access Inf Soc*. 2015;14(1):81-95.