Online Journal of Communication and Media Technologies, 2024, **14**(3), e202440
e-ISSN: 1986-3497

OPEN ACCESS

Research Article

Exploratory research on understanding university students' artificial intelligence literacy in a Korean university

Yong-Jik Lee [1]
0000-0001-8783-2237

JongHyun Oh [1*]
0009-0003-7201-6423

Changwoo Hong [1]
0009-0003-7235-2566

[1] Chonnam National University, Gwangju, SOUTH KOREA
[*] Corresponding author: jonghyun@jnu.ac.kr

Citation: Lee, Y.-J., Oh, J., & Hong, C. (2024). Exploratory research on understanding university students' artificial intelligence literacy in a Korean university. *Online Journal of Communication and Media Technologies, 14*(3), e202440. https://doi.org/10.30935/ojcmt/14711

ARTICLE INFO

Received: 28 Mar 2024
Accepted: 22 May 2024

ABSTRACT

This study explored university students' perceptions of artificial intelligence (AI) literacy and AI education. Specifically, the authors sought to understand the level of AI literacy among university students, the extent of their prior exposure to AI education, and the factors that affect their AI education. The study was conducted through an online survey distributed among 300 university students at a Korean university. The study findings indicate that most university students are interested in learning AI. Moreover, the results showed that students with prior experience with software (SW) education showed superior knowledge, a better grasp of AI concepts, and more confidence in using AI technologies, especially in computer coding skills. On the other hand, students with less exposure to prior AI education expressed a need for more learning opportunities and sufficient knowledge of computer coding skills. In addition, we found that students who had received SW education during their K-12 schooling showed better math skills than those who had only received short-term training in university. These findings underscore the importance of addressing the educational barriers that impede university students' ability to harness this interest effectively. In conclusion, our study provides valuable insights into university students' perceptions regarding AI literacy and the factors that affect their AI education.

Keywords: AI, AI literacy, AI education, university students, higher education

INTRODUCTION

The fourth industrial revolution has renewed interest in the practical applications of artificial intelligence (AI) across different fields. This growth has resulted in the development of numerous AI-based products and services, making AI literacy a crucial focus in higher education. The significance of AI literacy extends beyond computer science and engineering, emphasizing the need for a comprehensive understanding of AI across diverse disciplines (Kang, 2022). In this broader context, AI literacy can empower students and society with the knowledge and skills to navigate an AI-driven world, regardless of their field of study (Hwang et al., 2023).

AI literacy for university students is a multifaceted understanding transcending mere technical proficiency. It encompasses the ethical, societal, and practical dimensions of AI. Scholars argue that AI literacy should include foundational knowledge of AI concepts and technologies, the ability to assess AI applications in various fields critically, and an understanding of the ethical implications of AI systems (Yi, 2021). This broader definition aims to prepare students as future professionals who might work with AI technologies and as informed citizens capable of contributing to societal debates about AI's role and impact (Han, 2020).

Previous studies have been conducted on AI literacy among university students to understand their knowledge, attitudes, and competencies regarding AI. These studies show that students generally possess a moderate level of AI literacy, characterized by a basic understanding of AI concepts and an awareness of its societal impacts (Yang, 2022). However, significant gaps in comprehensive knowledge and practical skills related to AI highlight the urgent need for enhanced educational programs. Some studies suggest that while students are familiar with AI's presence in technology and media, their depth of understanding needs substantial improvement, especially regarding ethical implications, algorithmic biases, and data privacy concerns (Kim & Kwon, 2023).

To address these gaps, ongoing efforts to improve AI literacy in higher education have been recommended. These efforts include integrating AI-related courses across various disciplines beyond computer science and engineering. Such initiatives aim to equip students with critical thinking skills and ethical considerations for navigating the rapidly evolving AI landscape. However, it is crucial to emphasize that these efforts must be sustained rather than one-time solutions. Ongoing assessments of AI literacy levels among university students are essential to adapt teaching strategies and content that align with technological advancements and labor market demands, ensuring that our education system remains relevant and effective (Hong & Kim, 2020; Kim & Lee, 2022).

This study explores AI literacy within higher education, focusing on what university students think and learn about AI, their level of AI literacy, and the factors that influence their AI literacy. By aligning with and advancing the current discourse on AI literacy and AI education, this research aims to highlight university students' potential contributions to AI literacy. The study addresses the following research questions:

RQ1. What do university students think and learn about AI?

RQ2. What are the knowledge and attitudes related to AI among university students?

RQ3. What factors influence university students' AI literacy when learning AI?

The findings of this study will provide valuable insights into how AI literacy can be effectively integrated into higher education curricula, offering significant contributions to the field of communication. This study underscores the importance of preparing students to critically evaluate and ethically engage with AI in various contexts by aligning with and advancing the current discourse on AI literacy and education. This holistic approach fosters proficiency in AI technologies among university students and equips them to meet the challenges and opportunities an AI-driven future presents.

LITERATURE REVIEW

Definition of Artificial Intelligence Literacy

Over time, the definition of literacy has transformed, encompassing a broader scope of knowledge and communication abilities (Castillo-Martínez et al., 2023). Initially, it was defined simply as the ability to read and comprehend writing, focusing on character decoding. However, with the advent of various technologies and modes of communication, the definition of literacy has expanded to include effective communication and writing. In today's diverse and technologically advanced society, literacy encompasses a range of professional knowledge and communication skills that employ written language across various fields (Castillo-Martínez et al., 2023).

In the present digital age, literacy has further evolved to include information and communication technology (ICT) literacy, which refers to ICT-related knowledge and skills. Within this context, AI literacy is defined as the ability to evaluate AI critically, communicate effectively using it, and collaborate with it as a tool in both personal and professional settings. A foundational understanding of digital literacy is essential to achieve AI literacy, comprising computer, data, computational, and scientific skills (Aydin, 2021). Digital literacy is considered a prerequisite for AI-related education, with data literacy particularly recognized as a valuable asset across various fields. Data literacy involves understanding, interpreting, and utilizing data effectively. Data literacy is vital as data becomes increasingly central to numerous sectors, especially AI. Understanding data and its applications in AI is crucial for achieving AI literacy. Therefore, individuals must possess a strong grasp of digital literacy, particularly data literacy, to be considered AI literate, as it plays a pivotal role in AI (Lei et al., 2021). Achieving AI literacy entails understanding the technical aspects of AI and its ethical, social, and

cultural implications. Individuals must be mindful of AI's ethical and moral principles and use the technology responsibly, transparently, and socially justly. Emphasizing the importance and relevance of their skills to the audience is also crucial (Eguchi et al., 2021).

Research on University Students' Artificial Intelligence Literacy

Integrating AI into modern technologies has made it essential for individuals to comprehensively understand AI's mechanisms, ethical considerations, and broader societal implications. To comprehensively address AI literacy among university students, it is crucial to incorporate a broader range of relevant literature from interdisciplinary perspectives (Ng et al., 2021). AI literacy extends beyond technical proficiency, intersecting with communication, education, psychology, and sociology. AI literacy enables students to critically evaluate and effectively use AI tools for information dissemination, media production, and interpersonal communication. This proficiency enhances their technical skills and equips them to navigate and influence the evolving landscape of digital media. Students can better engage with and contribute to contemporary communication practices by understanding AI's role in shaping public discourse (Laupichler et al., 2022).

AI literacy is essential for preparing students to engage with advanced technological tools and methodologies in education. Incorporating insights from educational literature, educators can develop curricula that integrate AI literacy with pedagogical strategies, fostering a more holistic learning environment. Additionally, from a psychological perspective, AI literacy encompasses understanding AI's cognitive and behavioral impacts on individuals and communities (Laupichler et al., 2022). By exploring psychological literature, educators can address the ethical implications of AI, promoting responsible and mindful usage. Sociology further enriches this interdisciplinary approach by examining the societal implications of AI, including issues of equity, access, and the social dynamics influenced by AI technologies. Integrating these diverse perspectives ensures that AI literacy education is comprehensive, equipping students with the knowledge and skills to navigate and influence an AI-driven future responsibly and effectively (Ng et al., 2021).

Research on AI literacy among university students has become increasingly significant. While university students are generally aware of AI and its applications, their understanding often needs more depth regarding its mechanisms, ethical considerations, and broader societal implications (Yi, 2021). Previous studies have shown that students in STEM tend to have higher levels of AI literacy than those in the humanities and social sciences, highlighting the need for tailored educational interventions that cater to diverse student populations. Furthermore, engaging students with AI through practical projects, internships, and collaborations with industry experts is emphasized. Such hands-on experiences help bridge the gap between theoretical knowledge and real-world applications, providing students with practical insights into AI (Visvizi, 2021). Initiatives such as the AI4K12 guidelines, which outline the five big ideas of AI for K-12 education and can be adapted for higher education, emphasize the importance of understanding AI concepts, including perception, representation and reasoning, learning, natural interaction, and societal impact (Touretzky et al., 2019).

In recent years, there has been increasing recognition of the importance of AI literacy in higher education. For example, Kim et al. (2022) investigated the perceptions and level of AI literacy among university students, the amount of AI-related education they have received, and the factors influencing their learning of AI. A survey was conducted with 112 students, and some were also interviewed. The results revealed that while there was a strong interest in AI and AI education, self-evaluated AI literacy was low, with significant variation by age. Additionally, the proportion of respondents who had received AI-related education was lower than expected, with several factors influencing this result. The study suggests the need for systematic AI-related education at the liberal arts and major levels to foster AI literacy among college students majoring in language and language education.

Li and Lee (2024a) conducted an online survey with 177 students from various departments at a Chinese university in Korea. The results show that Korean universities recognize the personal implications of AI for students' academic disciplines and future careers. They also acknowledge the significance of AI education, irrespective of students' current majors. Additionally, the findings indicate that prior exposure to AI education significantly influences the perceived importance of AI convergence education. However, students without prior AI experience may face challenges meeting the requirements of AI courses in liberal arts due to a lack

Table 1. Demographics of survey participants (n=300)

Category		Frequency	Percentage (%)
Gender	Male	130	43.3
	Female	170	56.7
Grade	Freshmen	176	58.7
	Sophomores	74	24.7
	Juniors	32	10.7
	Seniors	18	6.0
Major	Education	35	11.7
	Secondary liberal arts education	62	20.7
	Engineering	79	26.3
	Free major	54	18.0
	Others	70	23.3
AI learning experience	Yes	97	32.3
	No	203	67.7
Type of AI learning experience	K-12 SW education	56	57.7
	University courses (major or liberal arts classes)	31	32.0
	Short-term training (special lectures or extracurricular programs) at a university or department	10	10.3

of preparation. This study provides valuable insights for tailoring AI convergence education to meet the diverse needs of university students in higher education.

Li and Lee (2024a) explore the perceptions and effectiveness of AI instruction among pre-service teachers (PSTs) at a Chinese university. The results indicate that while PSTs had limited knowledge of AI education and its practical applications, they demonstrated a strong interest in the subject and recognized its importance. There was a noticeable demand for AI-based education, with variations based on the students' majors and grade levels. The study found that personal teaching efficacy and interaction with AI were low, while expectations for AI concept recognition and teaching outcomes were high. The study underscores the need to customize the AI curriculum to align with the majors and specific education levels of PSTs to enhance the effectiveness of AI instruction. These findings can provide essential data for developing AI-related teacher education programs across diverse majors in higher education.

Lastly, Kong et al. (2021) focused on creating and assessing an AI literacy course for university students to determine if students from different academic backgrounds could gain a solid understanding of AI concepts. Both pre-course and post-course surveys demonstrated significant advancements in participants' comprehension of AI principles, empowering them to engage with AI effectively. The results indicate that students from diverse disciplines and genders could grasp complex AI concepts such as machine learning, supervised learning, regression, classification, unsupervised learning, and clustering, irrespective of their prior programming knowledge.

By fostering AI literacy, higher education institutions can prepare students to navigate and contribute positively to a future, where AI plays a central role in their professional and personal lives. This study aims to provide valuable insights into AI literacy in higher education and its potential contributions to strategies and discussions.

RESEARCH METHOD

Study Participants

This study recruited participants in a convenient sampling method. For this study, liberal arts classes at G University in Korea were recruited. The course instructors notified the research and participation, and 300 students who encountered the notice participated. The consent form was provided on the first page of an online survey. The demographic of survey participants is listed in **Table 1**. Among them, 130 were male students, and 170 were female students. Most participants were first-year university students (n=176, 58.7%), with 74 second-year students, 32 third-year students, and 18 fourth-year students also included. Study participants represented various majors, with 35 from the college of education, 62 from the college of humanities and social sciences, 79 from the college of engineering, and 54 from the convergence major.

Table 2. Survey questions

Variable	Number of questions	Cronbach alpha
Interest of AI	3	.876
Necessity of AI	3	.802
Knowledge of AI	3	.824
Skill for AI	6	.730
Attitudes toward future expected to be created by AI	6	.555
Factors influencing AI education & ways to improve AI education	8	.769
Total	29	.749

Table 3. Descriptive statistics of interest & learning about AI

Questions	Mean	Standard deviation
I am interested in AI.	3.630	.880
I want to know the core knowledge and skills of AI.	3.500	1.062
I want to receive AI-related education.	3.560	.984

Over half of the participants had no prior AI-related learning experience (n=203, 67.7%). Most of those with prior AI-related learning experience reported learning through software (SW) education during elementary, middle, and high school (n=56, 57.7%). Additionally, 31 participants learned through major courses or liberal arts classes in university, while another 10 participants learned through special lectures or non-curricular programs.

Data Collection & Analysis

Kim et al.'s (2022) study utilized a survey to explore various facets of AI literacy and education among Korean university students. The survey was separated into two sections. The initial section sought to gather demographic data on the respondents, including their major and gender. This information was critical in understanding how diverse university students perceive AI and its implications. The second portion of the survey concentrated on the relevance and interest of AI, the significance of ethics in AI, and the identification of respondents' AI knowledge and competencies. Additionally, the survey sought to investigate their attitudes toward the future that AI is expected to create.

The survey questions were designed using Likert scale, with the response section ranging from one to five, where 'not at all' was assigned a value of one and 'highly agreed' a value of five. Likert scale measured the respondents' interest, necessity, importance, knowledge, competence, and attitude toward AI. The reliability analysis revealed that Cronbach's alpha of this questionnaire ranged from .555 to .876, with a Cronbach's alpha of .749 for all questions, indicating good reliability. **Table 2** shows survey questions.

This study utilized SPSS 27.0 to analyze the collected data. Initially, we conducted a reliability analysis using Cronbach's alpha to verify the internal consistency of the survey instruments. Subsequently, employing descriptive statistics, we examined university students' overall perspectives on the interest and necessity of AI, their knowledge and skill of AI, and their attitudes toward the future envisioned with AI. To explore variances in university students' perceptions of AI based on the presence or absence of AI learning experience and the type of AI learning experience, we employed independent sample t-tests and one-way analysis of variance (ANOVA). The independent sample t-tests were used to compare the mean scores between two groups, while one-way ANOVA was used to compare means across multiple groups.

STUDY RESULTS

Interest & Learning About Artificial Intelligence

Table 3 shows that all study participants were interested in AI. The results showed that the level of interest in AI revealed an average value of 3.5 or higher, indicating that the participants were highly interested in AI. The university students' interest in AI education was particularly high, as they expressed the need to gain knowledge about this field.

Table 4 indicates that university students with prior AI learning experience exhibit greater interest in AI compared to those without such experience (t=2.054, p=.041, d=.876). Additionally, they demonstrate a higher

Table 4. Interest & learning about AI depending on AI learning experience

Questions	AI learning experience	M±SD	t	p	d
I am interested in AI.	O	3.780±.881	2.054	.041*	.876
	X	3.560±.873			
I want to know core knowledge & skills of AI.	O	3.680±1.016	2.084	.038*	1.056
	X	3.410±1.074			
I want to receive AI-related education.	O	3.720±1.028	1.934	.054	.980
	X	3.490±.956			

Note. M: Mean & SD: Standard deviation

Table 5. Interest & learning about AI depending on type of AI learning experience

Questions	Type of AI learning experience	M±SD	F	p	Scheffe	η^2
I am interested in AI.	K-12 SW education	3.640±.841	1.104	.336	-	.023
	University courses	3.940±.892				
	Short-term training	3.780±1.093				
I want to know core knowledge & skills of AI.	K-12 SW education	3.540±.990	.790	.457	-	.017
	University courses	3.810±1.046				
	Short-term training	3.780±1.093				
I want to receive AI-related education.	K-12 SW education	3.610±1.093	.531	.590	-	.011
	University courses	3.810±1.078				
	Short-term training	3.890±.928				

Note. M: Mean & SD: Standard deviation

Table 6. Descriptive statistics of necessity of AI

Questions	M	SD
AI should also be taught in language & language education-related departments at universities.	3.650	.914
AI-related education should be a regular subject in universities.	3.520	.916
Universities should teach AI-related coding skills to all students.	3.290	1.057

Note. M: Mean & SD: Standard deviation

Table 7. Necessity of AI depends on AI learning experience

Questions	AI learning experience	M±SD	t	p	d
AI should also be taught in language & language education-related departments at universities.	O	3.870±.812	2.971	.003**	.904
	X	3.550±.945			
AI-related education should be a regular subject in universities.	O	3.750±.778	3.364	.000***	.903
	X	3.400±.957			
Universities should teach AI-related coding skills to all students.	O	3.550±.924	2.942	.004**	1.043
	X	3.170±1.095			

Note. M: Mean & SD: Standard deviation

inclination towards acquiring core knowledge and technology of AI, with statistically significant differences observed (t=2.084, p=.038, d=1.065). While there was not a discernible variance in the willingness to receive AI-related education based on the level of AI learning experience, it was notably higher among university students with AI learning experience (t=1.934, p=.054, d=.980).

However, no significant differences were observed in interest and learning about AI based on the type of AI learning experience shown in **Table 5**.

Regarding AI's necessity, most respondents agreed on the importance of AI education shown in **Table 6**. The results on the necessity of AI education showed that many students believed that AI should be taught in universities (3.650±.914). Moreover, many respondents agreed that AI-related education should be a regular university subject (3.520±.916). Although the need for learning coding skills was relatively low among all students, the average score showed that it was still essential (3.290±1.057).

Table 7 showed that university students with prior AI learning experience demonstrated a stronger perception that AI should be incorporated into university curricula than those without such experience, with a statistically significant difference observed (t=2.971, p=.003, d=.904).

Furthermore, students with AI learning experience expressed a greater need for AI-related education to be a regular subject at the university level, also showing a statistically significant difference (t=3.364, p=.000, d=.903).

Table 8. Necessity of AI depends on type of AI learning experience

Questions	Type of AI learning experience	M±SD	F	p	Scheffe	η^2
AI should also be taught in language & language education-related departments at universities.	K-12 SW education	3.880±.740	.161	.852	-	.003
	University courses	3.770±.956				
	Short-term training	3.890±.928				
AI-related education should be a regular subject in universities.	K-12 SW education	3.790±.825	.229	.796	-	.005
	University courses	3.680±.702				
	Short-term training	3.670±.866				
Universities should teach AI-related coding skills to all students.	K-12 SW education	3.570±.988	.086	.918	-	.002
	University courses	3.480±.890				
	Short-term training	3.560±.882				

Note. M: Mean & SD: Standard deviation

Table 9. Descriptive statistics of knowledge, skills, & attitudes of AI

Variable	Questions	Mean	Standard deviation
Knowledge of AI	I can understand the content of articles or articles about AI.	3.150	.960
	I know a lot about AI.	2.580	.905
	I can give my opinion about AI.	2.910	1.063
Attitudes of AI	AI will create more jobs than there are now.	3.580	1.071
	AI will make people happy.	3.370	.885
	There will be human jobs that AI cannot replace.	4.160	.923
	AI will destroy human jobs.	3.330	.908
	I am worried that AI will become smarter than humans.	3.260	1.142
	AI will threaten human survival.	2.890	1.061

Additionally, respondents with AI learning experience emphasized the importance of teaching AI-related coding skills to all university students, with a statistically significant difference detected (t=2.942, p=.004, d=1.043). However, no significant differences were observed in the necessity of AI based on the type of AI learning experience shown in **Table 8**.

Knowledge & Attitudes About Artificial Intelligence

The study also examined study participants' knowledge, usage, and attitudes toward AI. The researchers employed a method that allowed respondents to subjectively judge their overall knowledge and understanding of the functional elements of AI literacy. This approach is exploratory, as it needs to confirm specific knowledge and functions related to AI objectively. The analysis results are shown in **Table 9**.

First, the study's results indicated that the university students' knowledge of AI was average. However, when respondents were asked if they knew AI well, it was evident that their foundation of knowledge could have been stronger. Then, participants showed confidence in using general AI technology when responding to questions about its functional or competency-based applications. However, they exhibited low confidence when it came to coding-related surveys. Despite this, most of the students expressed a desire to learn coding skills. Lastly, the study found a generally positive attitude toward AI technology among the respondents. Many were optimistic about the future and had a low agreement rate with negative outcomes that could arise from AI. This finding highlights the positive impact of AI education.

The analysis results of knowledge and attitudes towards AI, based on the presence or absence of AI learning experience, are presented in **Table 10**. Firstly, it was demonstrated that university students with prior AI learning experience possessed greater knowledge about AI (t=4.266, p=.000, d=.880), exhibited better comprehension of AI-related articles (t=4.058, p=.000, d=.936), and were more capable of articulating their opinions on AI compared to those without AI learning experience (t=4.609, p=.000, d=1.029), with statistically significant differences. Secondly, students with prior AI learning experience expressed more concerns about the future implications of AI than those without such experience. Particularly, they were apprehensive about the possibility of AI surpassing human intelligence (t=2.041, p=.042, d=1.136) and posing threats to human survival (t=2.029, p=.043, d=1.056).

However, no significant differences were observed in the knowledge and attitudes of AI depending on the type of AI learning experience shown in **Table 11**.

Table 10. Knowledge & attitudes of AI depending on AI learning experience

Variable	Questions	AI learning experience	M±SD	t	p	d
Knowledge of AI	I can understand content of articles or articles about AI.	O	3.460±.936	4.058	.000***	.936
		X	3.000±.936			
	I know a lot about AI.	O	2.900±.952	4.266	.000***	.880
		X	2.430±.844			
	I can give my opinion about AI.	O	3.310±.993	4.609	.000***	1.029
		X	2.720±1.045			
Attitudes of AI	AI will create more jobs than there are now.	O	3.620±1.075	.430	.667	1.073
		X	3.560±1.072			
	AI will make people happy.	O	3.350±.925	-.308	.758	.886
		X	3.380±.868			
	There will be human jobs that AI cannot replace.	O	4.200±.837	.421	.674	.925
		X	4.150±.964			
	AI will destroy human jobs.	O	3.430±.865	1.315	.189	.907
		X	3.290±.927			
	I am worried that AI will become smarter than humans.	O	3.450±1.061	2.041	.042*	1.136
		X	3.170±1.170			
	AI will threaten human survival.	O	3.070±.982	2.029	.043*	1.056
		X	1.930±1.145			

Note. M: Mean; SD: Standard deviation; *p<.050; & ***p<.001

Table 11. Knowledge & attitudes of AI depending on type of AI learning experience

Variable	Questions	Type of AI learning experience	M±SD	F	p	Scheffe	η^2
Knowledge of AI	I can understand content of articles or articles about AI.	K-12 SW education	3.290±1.004	1.666	.195	-	.035
		University courses	3.650±.915				
		Short-term training	3.670±.866				
	I know a lot about AI.	K-12 SW education	2.770±.953	1.216	.301	-	.025
		University courses	3.100±1.012				
		Short-term training	3.000±.866				
	I can give my opinion about AI.	K-12 SW education	3.200±1.034	.458	.634	-	.010
		University courses	3.390±.955				
		Short-term training	3.440±1.333				
Attitudes of AI	AI will create more jobs than there are now.	K-12 SW education	3.790±1.004	1.666	.195	-	.035
		University courses	3.350±1.170				
		Short-term training	3.560±1.014				
	AI will make people happy.	K-12 SW education	3.300±1.025	1.601	.207	-	.033
		University courses	3.320±.748				
		Short-term training	3.890±.782				
	There will be human jobs that AI cannot replace.	K-12 SW education	4.300±.784	1.872	.160	-	.039
		University courses	4.000±.931				
		Short-term training	3.890±.782				
	AI will destroy human jobs.	K-12 SW education	3.590±.826	2.486	.089	-	.051
		University courses	3.230±.884				
		Short-term training	3.110±.928				
	I am worried that AI will become smarter than humans.	K-12 SW education	3.450±1.025	2.461	.091	-	.050
		University courses	3.520±1.092				
		Short-term training	2.670±1.000				
	AI will threaten human survival.	K-12 SW education	3.200±.999	1.258	.289	-	.026
		University courses	3.200±.999				
		Short-term training	3.890±1.167				

Note. M: Mean; SD: Standard deviation; & *p<.050

Factors Influencing Artificial Intelligence Education & Ways to Improve Artificial Intelligence Education

The research on students' Interest in AI uncovered that, although they were intrigued by the field, the majority expressed a need for more hands-on experience in AI learning (**Table 12**).

When questioned about their challenges in learning about AI, most of the respondents identified the scarcity of learning opportunities and their limited knowledge of coding (3.960±1.106), computers (3.430±1.168), and mathematics (3.460±1.149) as primary difficulties.

Table 12. Descriptive statistics of difficulty learning AI

Questions	M	SD
Lack of opportunities to learn	3.300	1.029
Lack of enough time to study	3.220	.992
The burden of learning costs is high	3.250	1.025
Lack of learning devices such as computers or laptops	1.950	1.095
Lack of colleagues to study with	2.630	1.168
Lack of computer knowledge	3.430	1.168
Lack of coding knowledge	3.960	1.106
Lack of mathematics knowledge	3.460	1.149

Note. M: Mean & SD: Standard deviation

Table 13. Difficulty learning AI depending on type of AI learning experience

Questions	AI learning experience	M±SD	t	p	d
Lack of opportunities to learn	O	3.290±1.051	-.093	.926	1.031
	X	3.300±1.021			
Lack of enough time to study	O	3.260±.939	.415	.670	.993
	X	3.210±1.018			
The burden of learning costs is high	O	3.220±1.023	-.391	.696	1.027
	X	3.270±1.028			
Lack of learning devices such as computers or laptops	O	1.920±1.133	-.355	.723	1.096
	X	1.970±1.078			
Lack of colleagues to study with	O	2.730±1.195	.054	.957	1.169
	X	2.720±1.157			
Lack of computer knowledge	O	3.350±1.259	-.849	.397	1.168
	X	3.470±1.123			
Lack of coding knowledge	O	3.790±1.198	-1.806	.072	1.101
	X	4.040±1.052			
Lack of mathematics knowledge	O	3.420±1.215	-.388	.698	1.150
	X	3.480±1.118			

Note. M: Mean & SD: Standard deviation

While some participants mentioned constraints related to opportunity (3.300±1.029), time (3.220±.992), and cost (3.250±1.025), these factors were relatively less significant.

The difficulty in learning AI analysis results, categorized by the presence or absence of AI learning experience, are displayed in **Table 13**. The study revealed that both experienced and inexperienced learners found the requirement for computer, coding, and mathematics knowledge to be the most challenging aspect of learning AI. Interestingly, there was no significant difference in the reasons cited by both groups.

However, upon examining the comparison results in **Table 14**, it was statistically significant that university students with SW education experience in elementary, middle, and high school exhibited greater proficiency in mathematics compared to those with short-term training experience, such as special lectures at university ($F[2, 93]=3.378$, $p=.038$, $\eta^2=.068$).

DISCUSSION

RQ1. What Do University Students Think & Learn About AI?

This research demonstrates that university students generally understand AI and its applications in modern technology. However, the study emphasizes the need for a comprehensive understanding of AI's mechanisms, ethical considerations, and broader societal implications. The findings also underscore the influence of previous AI learning experiences on students' interest levels. This suggests that hands-on experience is crucial for nurturing a deeper interest and engagement with AI. Furthermore, the study supports the argument that it is essential to equip university students with the knowledge and skills to navigate and positively contribute to a future, where AI plays a central role in their personal and professional lives.

Additionally, the results emphasize the importance of integrating AI education early in students' academic journeys to cultivate sustained interest and competence in AI. This highlights the necessity for early and consistent exposure to AI education. This research uncovered several critical points when comparing its

Table 14. Difficulty learning AI depending on AI learning experience

Questions	Type of AI learning experience	M±SD	F	p	Scheffe	η^2
Lack of opportunities to learn	K-12 SW education	3.320±1.114	.098	.907	-	.002
	University courses	3.230±.920				
	Short-term training	3.220±1.093				
Lack of enough time to study	K-12 SW education	3.270±1.018	.128	.880	-	.003
	University courses	3.290±.864				
	Short-term training	3.110±.782				
The burden of learning costs is high	K-12 SW education	3.380±1.019	2.138	.124	-	.044
	University courses	3.130±.957				
	Short-term training	2.670±1.118				
Lack of learning devices such as computers or laptops	K-12 SW education	1.790±1.124	1.118	.331	-	.023
	University courses	2.000±.931				
	Short-term training	2.330±1.500				
Lack of colleagues to study with	K-12 SW education	2.730±1.286	.092	.912	-	.002
	University courses	2.680±1.013				
	Short-term training	2.560±1.130				
Lack of computer knowledge	K-12 SW education	3.500±1.321	1.117	.332	-	.023
	University courses	3.160±1.068				
	Short-term training	3.000±1.323				
Lack of coding knowledge	K-12 SW education	4.040±1.095	2.801	.066	-	.057
	University courses	3.520±1.208				
	Short-term training	3.330±1.414				
Lack of mathematics knowledge	K-12 SW education	3.630±1.184	3.378	.038*	a>c	.068
	University courses	3.100±1.106				
	Short-term training	2.780±1.202				

Note. M: Mean; SD: Standard deviation; & *p<.050

findings with previous studies. While the general awareness and enthusiasm for AI align with previous research, this study emphasizes the significant impact of prior AI learning experiences on students' interest and confidence levels. This suggests that hands-on, experiential learning strategies may be more effective in fostering deep AI literacy (Li & Lee, 2024b).

RQ2. What are the Knowledge & Attitudes Related to AI Among University Students?

The results revealed that the participants had average knowledge about AI. However, they exhibited high confidence in using general AI technology for functional or competency-based applications but showed lower confidence in computer coding-related tasks. Most respondents expressed a positive attitude towards AI technology and were optimistic about its future. Moreover, they showed a low agreement rate with potential negative outcomes associated with AI. These findings suggest that students perceive AI positively and its potential to transform various fields.

Interestingly, students with prior AI learning experience exhibited greater knowledge about AI, better comprehension of AI-related articles, and a stronger ability to articulate their opinions on AI. However, they also expressed concerns about AI surpassing human intelligence and posing threats to human survival. These concerns highlight the need for a balanced approach to AI education that addresses the potential ethical and existential risks associated with AI while promoting responsible AI usage.

The study's findings align with previous research that suggests a disparity in AI literacy levels among university students from different academic backgrounds (Li & Lee, 2024b). Therefore, tailored educational interventions such as advanced AI courses for students with a strong interest or background in technology are recommended. These initiatives can provide students with hands-on experience and help them develop the skills needed for the future job market.

The study highlights the need for balanced educational content that addresses the potential risks associated with AI while promoting responsible AI usage. It also emphasizes the importance of tailored educational interventions and practical projects to enhance students' knowledge and skills related to AI (Li & Lee, 2024b).

RQ3. What Factors Influence University Students' AI Literacy When Learning AI?

The research revealed that most participants identified the scarcity of learning opportunities and their limited knowledge of computer coding skills and mathematics as primary difficulties that hindered their ability to learn AI. Although some respondents mentioned constraints related to opportunity, time, and cost, these factors were less significant. Interestingly, both experienced and inexperienced university students regarded the requirement for computer, coding, and mathematics knowledge as the most challenging aspect of learning AI. It was also observed that there was no significant difference in the reasons cited by both groups.

In addition, the research revealed that university students with prior SW education experience in elementary, middle, and high school exhibited greater mathematics proficiency than those with short-term training experience, such as special lectures at university. This finding emphasizes the potential of early and continuous exposure to relevant subjects in significantly enhancing students' readiness to engage with AI education at the university level. The study also found that customized AI education is necessary for the majors of various college students. One possible approach is to identify AI-related components within individual major areas and address these aspects convergently. However, the method of AI education in individual major fields has yet to be determined. Therefore, future research is needed in this area, given the evolving nature of AI and its increasing relevance in various fields.

Our findings support the need for tailored educational approaches, as Fang and Jiang (2024) and Hong and Kim (2020) suggested. The persistent challenge of insufficient foundational skills in coding and mathematics necessitates targeted interventions from early education through higher education. This highlights the need for more integrated and continuous learning pathways to build AI literacy effectively. The persistent challenge of insufficient foundational skills in coding and mathematics underscores a gap that existing curricula still need to address fully. Therefore, interventions should be designed to provide students with longer-term exposure to relevant subjects to improve their proficiency in these areas.

Our research analyzes how university students perceive, comprehend, and approach AI, underscoring the necessity for customized, hands-on teaching methods to improve AI literacy. We have identified similarities and variations, contributing to a more profound understanding of how to equip students for a future that AI increasingly influences. As AI advances, it is critical to continue researching and implementing adaptable educational strategies to address the shifting challenges and opportunities that AI presents.

CONCLUSIONS

This study evaluates university students' AI literacy levels, their exposure to AI education, and the factors that influence their learning about AI. The primary objective of the research is to provide deep insights into the knowledge, attitudes, and challenges students face concerning AI. The study results reveal a strong interest in AI among university students, particularly those with prior AI education. These students exhibited superior knowledge, greater understanding of AI concepts, and more confidence in utilizing AI technologies, especially computer coding skills. Additionally, these students showed greater concern for the potential risks associated with AI.

On the other hand, students with less prior AI education identified a lack of learning opportunities and inadequate knowledge in coding and mathematics as significant obstacles to acquiring AI skills. Despite these challenges, both groups recognized the importance of gaining AI knowledge. Interestingly, students with prior SW education from high school demonstrated better math skills than those who only had short-term university training.

The findings of this study highlight the importance of effectively addressing educational barriers to effectively channel students' interest in AI. This study emphasizes the need to integrate AI-related education into liberal arts and major-specific courses in higher education. Such integration can cultivate AI literacy among university students and bridge the gap between their interest in AI and their actual level of AI literacy. By providing comprehensive AI education, higher education institutions can ensure that students are well-equipped to handle the challenges and opportunities presented by AI in the workforce. Moreover, the study recommends integrating AI education across various disciplines to foster well-rounded AI literacy. The study also suggests tailored educational interventions, such as hands-on projects and collaborations with industry

experts, to bridge the gap between theoretical knowledge and practical application. The findings can inform educational policymakers and curriculum developers about the critical need for comprehensive AI literacy programs in higher education.

In conclusion, this research underscores the importance of prioritizing AI education in higher education institutions. It prepares students to navigate and contribute positively to an AI-driven future, ensuring they have the necessary skills and knowledge to leverage AI's benefits while mitigating its risks. Thus, AI literacy is a multifaceted and essential skill set that extends beyond technical proficiency to include ethical understanding, societal impact, and practical application. Previous research highlights the need for tailored educational interventions to address the disparity in AI literacy levels among students from different academic backgrounds. Continuous research and evaluation of AI literacy education outcomes are necessary to ensure educational content and methodologies keep pace with technological advancements. To further advance AI literacy in higher education, future research should focus on longitudinal studies to track the progress of AI literacy initiatives and their impact on students' professional and personal lives. Additionally, exploring innovative teaching methods, such as gamification and immersive learning environments, can enhance student engagement and understanding of AI concepts.

Author contributions: Y-JL: first draft; **JO:** editing; & **CH:** data collection. All authors approved the final version of the article.

Funding: This study was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2021S1A5B8096558).

Ethics declaration: The authors declared that this study does not require ethics committee approval or other documentation & that they have adhered to the highest ethical standards in academic publishing. Written informed consent was obtained from the participants.

Declaration of interest: The authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

REFERENCES

Aydin, M. (2021). Does the digital divide matter? Factors and conditions that promote ICT literacy. *Telematics and Informatics, 58*, 101536. https://doi.org/10.1016/j.tele.2020.101536

Castillo-Martínez, I. M., Cerros Regalado, C. P., Glasserman-Morales, L. D., & Ramírez-Montoya, M. S. (2023). Academic literacy among the university students in Mexico and Spain: A holistic perspective. *Frontiers in Psychology, 13*, 1055954. https://doi.org/10.3389/fpsyg.2022.1055954

Eguchi, A., Okada, H., & Muto, Y. (2021). Contextualizing AI education for K-12 students to enhance their learning of AI literacy through culturally responsive approaches. *KI-Künstliche Intelligenz* [*AI-Artificial Intelligence*]*, 35*(2), 153-161. https://doi.org/10.1007/s13218-021-00737-3

Fang, F., & Jiang, X. (2024). The analysis of artificial intelligence digital technology in art education under the internet of things. *IEEE Access, 12*, 22928-22937. https://doi.org/10.1109/ACCESS.2024.3363655

Han, S. G. (2020). Digital content to improve artificial intelligence literacy ability. *Journal of the Korea Society of Computer and Information, 25*(12), 93-100. https://doi.org/10.9708/jksci.2020.25.12.093

Hong, J. Y., & Kim, Y. (2020). Development of AI data science education program to foster data literacy of elementary school students. *Journal of The Korean Association of Information Education, 24*(6), 633-641. https://doi.org/10.14352/jkaie.2020.24.6.633

Hwang, H. S., Zhu, L. C., & Cui, Q. (2023). Development and validation of a digital literacy scale in the artificial intelligence era for college students. *KSII Transactions on Internet and Information Systems, 17*(8), 2241-2258. https://doi.org/10.3837/tiis.2023.08.016

Kang, H. Y. (2022). A study on digital and AI literacy education to prepare for the future. *Journal of Digital Contents Society, 23*(6), 1067-1075. https://doi.org/10.9728/dcs.2022.23.6.1067

Kim, K., & Kwon, K. (2023). Exploring the AI competencies of elementary school teachers in South Korea. *Computers and Education: Artificial Intelligence, 4*, 100137. https://doi.org/10.1016/j.caeai.2023.100137

Kim, S. W., & Lee, Y. (2022). The artificial intelligence literacy scale for middle school students. *Journal of the Korea Society of Computer and Information, 27*(3), 225-238. https://doi.org/10.9708/jksci.2022.27.03.225

Kim, Y., Kim, H., & Ahn, H. (2022). A study on AI literacy of university students in language and language education. *The Journal of the Korea Contents Association, 23*(1), 165-174. https://doi.org/10.5392/JKCA.2023.23.01.165

Kong, S. C., Cheung, W. M. Y., & Zhang, G. (2021). Evaluation of an artificial intelligence literacy course for university students with diverse study backgrounds. *Computers and Education: Artificial Intelligence, 2*, 100026. https://doi.org/10.1016/j.caeai.2021.100026

Laupichler, M. C., Aster, A., Schirch, J., & Raupach, T. (2022). Artificial intelligence literacy in higher and adult education: A scoping literature review. *Computers and Education: Artificial Intelligence,* 3, 100101. https://doi.org/10.1016/j.caeai.2022.100101

Lei, H., Xiong, Y., Chiu, M. M., Zhang, J., & Cai, Z. (2021). The relationship between ICT literacy and academic achievement among students: A meta-analysis. *Children and Youth Services Review, 127*, 106123. https://doi.org/10.1016/j.childyouth.2021.106123

Li, Y., & Lee, Y. J. (2024a). Case study on pre-service teachers' perception of AI education and AI teaching efficacy at a Chinese university. *Journal of AI Humanities, 16*, 53-81. https://doi.org/10.46397/JAIH.16.2

Li, Y., & Lee, Y. J. (2024b). Exploring Korean university students' perceptions of Artificial Intelligence (AI) education. *Journal of the Korea Academia-Industrial Cooperation Society, 25*(3), 251-260. https://doi.org/10.5762/KAIS.2024.25.3.251

Ng, D. T. K., Lee, M., Tan, R. J. Y., Hu, X., Downie, J. S., & Chu, S. K. W. (2023). A review of AI teaching and learning from 2000 to 2020. *Education and Information Technologies, 28*(7), 8445-8501. https://doi.org/10.1007/s10639-022-11491-w

Park, H., Kim, H. S., & Park, H. W. (2021). A scientometric study of digital, ICT, information, and media literacy. *Journal of Data and Information Science, 6*(2), 116-138. https://doi.org/10.2478/jdis-2021-0001

Touretzky, D., Martin, F., Seehorn, D., Breazeal, C., & Posner, T. (2019). Special session: AI for K-12 guidelines initiative. In *Proceedings of the 50th ACM Technical Symposium on computer science education* (pp. 492-493). ACM. https://doi.org/10.1145/3287324.3287525

Visvizi, A. (2021). Artificial intelligence (AI): Explaining, querying, demystifying. In A. Visvizi, & M. Bodziany (Eds.), *Artificial intelligence and its contexts: Security, business and governance* (pp. 13-26). Springer. https://doi.org/10.1007/978-3-030-88972-2_2

Yang, C. (2022). The effect of AI learning program on AI attitude and literacy of gifted children in elementary schools. *Journal of The Korean Association of Information Education, 26*(1), 35-44. https://doi.org/10.14352/jkaie.2022.26.1.35

Yi, Y. (2021). Establishing the concept of AI literacy. *Jahr–European Journal of Bioethics, 12*(2), 353-368. https://doi.org/10.21860/j.12.2.8