Perspectives of Students with Different Majors on an Artificial Intelligence Literacy Course at a Korean University

Artificial intelligence (AI) literacy is an indispensable skill in the Fourth Industrial Revolution. Many countries and institutions have cultivated specialty and basic AI literacy at various levels to ensure a competitive edge in AI and related fields. Many universities have followed this trend but often suffer from an unsuitable curriculum for AI literacy. This questionnaire-based study determines whether a distinguishable difference in perspective regarding AI literacy education exists in students of various majors. Additionally, this study investigates which majors are more positive, interested, and demanding regarding university AI liberal arts classes to design an effective AI literacy curriculum. The participants are 452 nonscientific or nonengineering undergraduate students who took the 15-week AI liberal arts class at a university in Seoul, Korea, in 2021. The survey was conducted at the end of the semester. The analysis demonstrated that different perspectives exist for various majors and that students in business or economics majors were more interested and positive concerning AI education than those in other majors. Students with arts or physical education majors were least interested in AI literacy. These results highlight the need to design an AI literacy curriculum considering major-specific characteristics to enhance education and student satisfaction with AI education.

Keywords: *Artificial intelligence (AI) literacy, AI education, different perspectives, Artificial Intelligence Education Platforms, Education Policy*

Introduction

With the advent and development of deep learning (DL), attention has been focused on artificial intelligence (AI) technology, and its influence on industries has increased exponentially. Similarly, the competency of science, technology, engineering, and mathematics (STEM) has become a global trend worldwide (Coleman, 2020). Many educational institutions have tried to foster an AI workforce to meet the demand in the field. Many countries have also established policies to promote the cultivation of an AI workforce, focusing on AI literacy education and training high-level AI professionals. In addition, AI literacy, which is an individual's ability to know, use, and evaluate AI by understanding its concepts, applications, and ethics and recognizing changes in culture critically, is essential for this generation to survive in the AI era (Lee & Park, 2021; Yi, 2021).

Governmental AI literacy education has been primarily learned in primary and secondary education in many countries, such as the United States (US), Germany, China, and Korea (Choi & Kim, 2021; Park et al., 2021; Korea Relevant Joint Ministries, 2020), and university-level AI literacy education depends on each university. However, as the awareness of the importance of AI literacy spreads, an

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increasing number of universities worldwide have started to offer AI literary education to nonscience and nonengineering students as a liberal arts class.

The Korean government established the national "software-centered university project" in 2015 and provided funds to selected universities to promote AI education in intensive and liberal arts classes. Primary and secondary AI literacy education is run under a prolonged governmental research and curriculum design. In contrast, the university-level AI literacy education for nonscience and nonengineering often suffers from being set at an inappropriate level or lacking student motivation due to the relatively brief span of planning (Na, 2017; Park & Choi, 2018). Undergraduate students determine their majors, which are closely related to their future careers; thus, AI liberal arts classes must be designed while considering the characteristics of each major to increase interest and learning motivation and enhance student satisfaction with AI literacy education (Seo, 2019).

This paper explores whether a distinct perspective on AI education exists according to undergraduate majors as a precedent to study the design of a major-specific AI liberal arts curriculum. If undergraduate students' perspectives, needs, or interests in AI education differ in various majors, major-specific factors can be applied in the curriculum design of AI liberal arts classes. Consequently, the efficacy of AI liberal arts classes can be maximized. Therefore, this questionnaire-based study aims to discover whether a distinguishable difference in perspective exists regarding AI literacy education in various majors and determine which majors are more favorable and demanding concerning AI literacy education.

Literature Review

Korean Artificial Intelligence Education Policy

In recent years, amid rapid technological development, the Fourth Industrial Revolution (4IR) has become part of daily life. The world is facing a new civilization change—the postmodern 4IR—and the paradigm of digital transformation has extended from the emergence of smartphones, increasing the human resources necessary for technology.

The Korean government announced a plan to create 20,000 jobs in the software sector by promoting software talent and innovative companies through the 4IR era software-job-creation strategy announced in September 2018 (Ministry of Science and Information and Communications Technology [ICT], 2018). In addition, 25 schools were selected in 2018, which was expanded to 40 in 2019, to cultivate 20,000 talent candidates through the software-centered university project. Accordingly, the government aimed to foster practical talent to lead the 4IR from 2018 to 2022.

Starting with human resource development related to software and AI, universities have provided various channels to train AI professionals by creating AI-related departments and expanding them, allowing private AI experts to serve as teachers, and expanding AI education and research programs. In addition, AI literacy education is mandatory for public officials and is necessary to strengthen teachers' software and AI capabilities. Standards for teacher qualifications have

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been announced, requiring them to complete AI-related content in the process of training and appointing teachers at universities, colleges, and graduate schools (Ministry of Science and ICT, 2019). The university provides AI classes for students majoring in AI and other majors, strengthening basic education for AI to support the growth of talent in 2020 by establishing and offering majors.

Korea's Ministry of Science and ICT began to realize software professional workforce training, software-specialized educational environment, software value diffusion, and software talent training through selected software-oriented universities in 2015. A total of 40 universities, including five universities selected by the Ministry of Science and ICT in 2019, have focused on education by merging AI learning with selected majors to foster human resources in the AI field along with the fundamental goal of software education innovation (Kang, 2019).

Foreign Artificial Intelligence Education Policy

Selected country's cases for training software AI employees are reviewed in this section. For the first time in history, the US has designated "AI and autonomous and unmanned systems" as administrative research and development priorities in its 2019 fiscal year budget request. The US administrations and institutions have begun applying AI in earnest to improve the provision of government services to US citizens. On February 12, 2019, the US federal government announced the "American AI Initiative" strategy to increase the nation's capabilities for AI. On December 8, 2020, the US House of Representatives adopted a resolution that expanded the use of AI education as an AI national strategy. Education programs have expanded the number of educators in charge of science and technology engineering, AI ethics education, engineering classes, AI-related qualification training, and programs to promote diversity in AI personnel (Kim, 2021).

China recognizes AI as a national strategic industry, and the government is taking the lead in establishing policies and making large-scale investments. In November 2017, the Next Generation AI Development Planning Committee, a public-private cooperation organization, was established to manage AI investment. In April 2018, the International Development Plan for AI Talent at Chinese University was announced to focus on fostering talent in the AI field. With the content published in April 2019, AI development was promoted in the field of higher education, emphasizing the importance of a step-by-step AI education system (Ministry of Education, 2018). The 2020 Education Informatization and Cybersecurity Work Tips stated that it would continue to promote an AI curriculum. As the government's active interest and related policies have been continuously announced, AI education in China is rapidly spreading (Ministry of Education, 2019).

Japan's status of fostering AI education emphasizes the importance of securing technological competitiveness in AI since 2017 and accelerates AI technological innovation. The government-level AI Strategy 2019 was established at the Integrated Innovation Strategy Promotion Meeting in April 2019. The core

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of this strategic plan is to foster 250,000 AI personnel annually to receive AI education for all college students regardless of whether the students are in liberal arts or natural sciences and to foster talent by strengthening double majors in AI (Yoo, 2019). High schools plan to implement basic data science and AI practice classes and increase the number of universities adopted as test subjects in the college entrance exam. In higher education, the standard curriculum of universities has been developed and implemented, and courses at the professional education level have been introduced (Kitagawa, 2020).

Germany announced its 12 "KI-Strategie" in November 2018. Specific details from the German Ministry of Education and Research (BMBF, 2018) include attracting AI experts from all over the world to Germany, building the latest foundation for AI research, and supporting civil society networks for AI utilization. The content related to AI convergence education is "strengthening vocational education and securing professional manpower and experts" (Kim, 2021). This approach includes plans to provide basic education on AI to elementary and secondary school students in 2018–2019, organize it as part of the curriculum, and expand the number of university professors in the field of AI. As of 2020, 75 bachelor's and master's degree courses in AI majors were offered nationwide, with 192 AI professors. The German Ministry of Education and Research ranked fifth in AI research and publications and has supported fostering AI as a competitive research field (BMBF, 2020).

Artificial Intelligence Platform Survey

Coding and noncoding platforms can be used for AI education. Coding platforms include Entry, Genie, Mblock, Machine Learning for Kids, and AI4children.org. Noncoding platforms include AI Oceans, Easy Deep, MS Lobe, Teachable Machine, and Dining. Several platforms facilitate understanding AI, for example, various graphical user interface-based, educational programming language-based, coding-based, and noncoding-based platforms (Oh, 2017). Table 1 lists platforms heavily used in the US.

Table 1. *Artificial Intelligence Education Platforms*

Platform	Development	Purpose
Teachable Machine*	Google (US)	A web-based tool that makes creating machine learning models fast, easy, and accessible to everyone
Deep Dream Generator**	Google (US)	It synthesizes AI support tools and photographs to create other visual content
Machine Learning for Kids***	IBM (UK)	An environment for creating machine learning models that classify text, numbers, or images

*https://teachablemachine.withgoogle.com/ ** https://deepdreamgenerator.com/
*** https://machinelearningforkids.co.uk/

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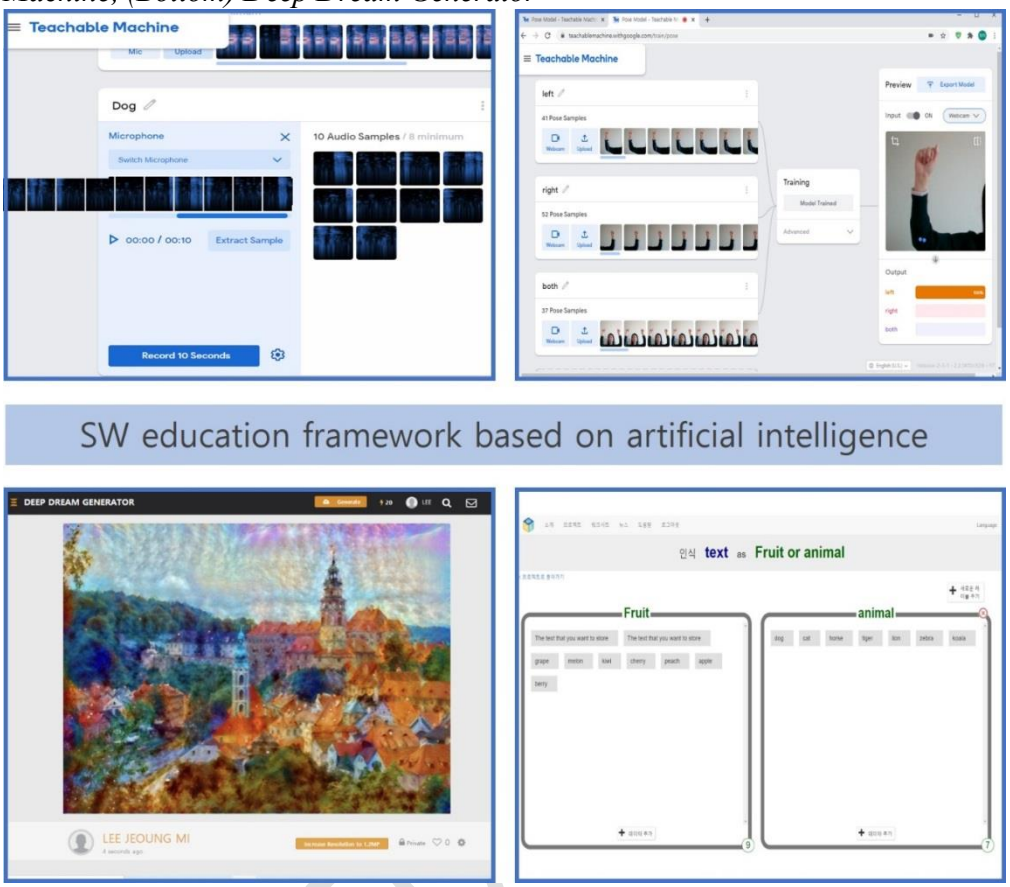
Figure 1. *Artificial Intelligence Platform Practice Cases: (Top) Google Teachable Machine, (Bottom) Deep Dream Generator*



The author has experienced various AI platforms to assist AI learning, such as Deep Dream, Teachable Machine, Machine Learning for Kids, and Word Cloud. Training classes for image, audio, and pose analyses were conducted step by step on the Teachable Machine site, providing higher satisfaction than the data analysis. In related reports, work has been submitted with various concepts, such as recognizing the types of Korean, Chinese, and Japanese characters, distinguishing painting styles, learning sign language, and recognizing animals. Various AI education platforms are necessary to increase class participation and the comprehension of students who are not majoring in AI.

Research Design

Participants

The participants in this study were Korean undergraduate students at a university in Seoul, South Korea. Most were first-year students not majoring in science or engineering, such as those from the Colleges of Humanities (HM), Social Sciences, Law, Business Administration (BA), Economics and Commerce (EC), Arts, Design, and Physical Education. They took the 15-week introductory AI liberal arts requirement class during one semester from September to

December 2021. The total number of students was 518, but 66 incomplete questionnaires were excluded. Therefore, 452 responses were analyzed in this study. Table 2 describes the detailed information of the participants.

Table 2. *Detailed Information of Participants*

Gender	Grade	College of							
		HM	**SS**	**Law**	**BA**	**EC**	**Arts**	**Design**	**PE**
Male	1	31	9	38	64	18	12	0	5
	2	1	1	1	2	0	2	0	0
	3	2	2	0	7	0	2	0	1
	4	2	0	0	0	0	1	0	0
	N/R	1	0	0	0	0	0	0	0
Female	1	80	20	31	37	17	19	0	6
	2	1	0	0	1	0	3	2	0
	3	6	2	0	6	0	3	1	2
	4	3	2	1	3	0	1	0	0
	N/R	0	0	0	3	0	0	0	0
Total	452	127	36	71	123	35	43	3	14

Source: Humanities (HM), Social Sciences (SS), Business Administration (BA), Economics and Commerce (EC), Physical Education (PE), no response (NR)

Curriculum of the Artificial Intelligence Liberal Arts Class

First-year undergraduate students majoring in nonscience or nonengineering degrees are required to take an introductory AI liberal arts class. The class prerequisite is an introductory Python programming class. This AI course is a 15-week, three-credit class comprising two 90-min classes per week. The learning goals of the introductory AI liberal arts class are to (1) understand basic concepts of AI and machine learning (ML), (2) explore various ML platforms applied to up-to-date DL technologies, and (3) code simple ML programs using the Python language. Primarily, most of these students are majoring in nonscience and nonengineering fields; therefore, the class content is focused on understanding the fundamental concepts of AI, ML, and DL and using easily accessible AI technologies and platforms rather than programming. The weekly class content is as follows: the basic concepts of AI, ML, and DL; various AI examples, such as the Deep Dream Generator, AI ethics, and Google Teachable Machine projects; basic text analysis practice using Machine Learning for Kids; and relatively simple ML programming using Python and the scikit-learn library.

Questionnaire

The questionnaire was answered online from December 1 to 7, 2021. It measured students' perspectives regarding AI education after taking the 15-week AI liberal arts class. The questionnaire included nine closed questions: three

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questions on personal information and six 5-point Likert-scale questions from 1 (strongly disagree) to 5 (strongly agree) on AI liberal arts education. Table 3 presents the question content. The scoring method for analysis was that a higher score indicates a more positive perspective concerning the AI liberal arts class.

Table 3. *Survey Questions*

No.	Questions
1	Gender
2	College department
3	Grade
4	I know the basic concepts of AI after taking the class.
5	I know the basic concepts of machine learning after taking the class.
6	I think that the AI liberal arts class should be mandatory at the university.
7	I am interested in taking AI liberal arts classes, although it is not mandatory.
8	I think that the AI liberal arts class is helpful in my career.
9	I think that my major is related to AI and software.

Statistical Analysis

The data were compiled and analyzed using Microsoft Office Excel 2019. The mean (M) and standard deviation (SD) were calculated, and the one-way analysis of variance (ANOVA) test and two-tailed t-test were used to determine the significant differences between groups. A p-value of less than .05 was considered significant.

Results

The number of students in each college was not balanced; thus, similar majors were grouped, resulting in four groups: HM, business and economics (BE), law and social sciences (LS), and arts and physical education (AP). Table 4 presents the descriptive statistics of the four groups. The mean value of six questions (Qs) was above 3.0 with a range of 0 to 5, but the mean scores of Q7 and Q9 were lower, at 3.29 and 3.14, respectively. Thus, students thought the AI liberal arts class was interesting but not essential to their respective majors. The BE group scored ighest on all questions out of the four groups. The mean scores for Q6 and Q8 in the BE group were above 4.00. This result suggests that the majors in the BE group deal with big data and ML techniques and that the BE students realize the necessity and importance of AI education.

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Table 4. *Descriptive Statistics for the Four Groups*

Group	No.	Q4		Q5		Q6		Q7		Q8		Q9	
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
HM	127	3.63	0.94	3.45	0.95	3.48	1.20	3.08	1.37	3.56	1.12	2.61	1.26
BE	158	3.95	0.78	3.87	0.83	4.12	1.05	3.78	1.23	4.03	1.08	3.92	1.16
LS	107	3.83	1.00	3.66	1.10	3.89	1.14	3.31	1.38	3.46	1.24	2.90	1.38
AP	60	3.65	1.02	3.30	1.12	3.20	1.13	2.38	1.15	3.07	1.21	2.60	1.28
Total	452	3.79	0.92	3.63	0.99	3.76	1.17	3.29	1.37	3.63	1.19	3.14	1.39

Source: humanities (HM), business and economics (BE), law and social sciences (LS), arts and physical education (AP)

Difference Analysis in Groups Using the Analysis of Variance

In this section, ANOVA tests were conducted to determine whether any differences in perspective exist regarding AI education in the groups. As presented in Table 5, significant differences exist among the groups for every question. The differences in understanding the AI class (Q4 and Q5) were smaller than the differences in the necessity and importance of the AI class (Q6, Q7, Q8, and Q9).

Table 5. *Analysis of Variance Test Results for Q4 to Q9*

		Sum Sq.	Df	Mean Sq.	*F*-value	*p*-value
Q4	Treatment	8.396	3	2.799	3.358	.019*
	Residuals	369.255	443	0.834		
	Total	377.651	446			
Q5	Treatment	19.698	3	6.566	6.936	.0001**
	Residuals	424.114	448	0.947		
	Total	443.812	451			
Q6	Treatment	50.565	3	16.855	13.242	$2.7x10^{-8}$**
	Residuals	566.410	445	1.273		
	Total	616.976	448			
Q7	Treatment	93.247	3	31.082	18.553	$2.33x10^{-11}$**
	Residuals	748.855	447			
	Total	842.102	450			
Q8	Treatment	48.192	3	16.064	12.244	$1.03x10^{-7}$**
	Residuals	586.442	447	1.312		
	Total	634.634	450			
Q9	Treatment	155.303	3	51.768	32.617	$4.41x10^{-19}$**
	Residuals	709.446	447	1.587		
	Total	864.750	450			

Source: *$p < .05$, **$p < .001$

Excel does not offer a post hoc analysis between groups; thus, further ANOVA tests were performed for the HM, LS, and AP groups. The BE group was excluded because the mean score for the BE group was much higher. As represented in Table 6, no between-group differences were found for Q4, Q5 (understanding the AI class), and Q6 (relevance of the AI to the major). Thus, only BE group students have different perspectives on understanding the AI class and

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the relevance of the AI class to their majors. This result could be because the BE group students take basic Python programming, data analysis, and AI classes as part of their majors, apart from this AI liberal arts class, and various AI algorithms are applied in many BE-related career fields. Thus, they have more input on basic AI fundamentals and AI methodologies from both the liberal arts and major-specific classes. However, students in the HM, LS, and AP groups usually learn AI fundamentals only from this liberal arts class, not from the departments of their majors.

Table 6. *Analysis of Variance Test Results for the HM, LS, and AP Groups*

		Sum Sq.	Df	Mean Sq.	*F*-value	*p*-value
Q4	Treatment	2.506	2	1.253	1.309	.272
	Residuals	275.665	288	0.957		
	Total	278.172	290			
Q5	Treatment	5.591	2	2.796	2.575	.078
	Residuals	315.905	291	1.086		
	Total	321.497	293			
Q9	Treatment	5.636	2	2.818	1.646	.195
	Residuals	498.364	291	1.713		
	Total	504.000	293			

Notes: No between-group difference

As reported in Table 7, Q6, Q7, and Q8 display significant differences even between the HM, LS, and AP groups. Thus, more detailed analyses are necessary.

Table 7. *Analysis of Variance Test Results for the HM, LS, and AP Groups*

		Sum Sq.	Df	Mean Sq.	*F*-value	*p*-value
Q6	Treatment	19.780	2	9.890	7.260	.0008**
	Residuals	393.710	289	1.362		
	Total	413.490	291			
Q7	Treatment	33.659	2	16.830	9.524	$9.85x10^{-5}$**
	Residuals	514.218	291	1.767		
	Total	547.878	293			
Q8	Treatment	10.100	2	5.050	3.623	.028*
	Residuals	405.601	291	1.394		
	Total	415.701	293			

Notes: Difference

Difference Analysis on Q6, Q7, and Q8 Using the T-test

For further analyses of Q6, Q7, and Q8, two-tailed t-tests were conducted on every group pair for each question, assuming variance heteroscedasticity. Tables 8, 9, and 10 list the t-test results and p-values for Q6, Q7, and Q8, respectively. No difference in perspective was found between the students in the HM and AP groups and between those in the BE and LS groups on Q6 regarding whether the

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AI liberal arts class should be mandatory at the university. The students in the BE and LS groups more strongly agree regarding the mandatory AI liberal arts class at the university than those in the HM and LS groups. The BE students, as mentioned, take various AI-related courses in their major, and the law department recently offered an AI-related course, AI and Legal Argumentation; thus, the students in the BE and LS groups are more favorable toward a mandatory AI course. However, students in the HM and AP groups have little access to AI-related courses in their majors, and this might affect their attitudes toward a compulsory AI liberal arts class.

Table 8. *P-value for Every Paired t-test on Q6*

	HM	BE	LS
BE	$4.85x10^{-6}$***		
LS	.0096*	.0935	
AP	.1197	$3.41x10^{-7}$***	.0003**

Notes: *p < .05, **p < .001, ***p < .0001; humanities (HM), business and economics (BE), law and social sciences (LS), arts and physical education (AP)

In contrast, the responses to Q7 and Q8 differed from those to Q6. Both Q7 and Q8 were asked to establish students' interest in AI and self-development or careers in the AI field. These two questions are related to the learning motivation in the AI class. The participants in the HM and LS groups do not exhibit a statistical difference. The results of Q7 and Q8 indicate that BE students are strongly interested in the AI class and AI-related careers and that AP students are the least interested in the AI class and AI-related careers.

Table 9. *P-value of Every Paired t-test on Q7*

	HM	BE	LS
BE	$9.35x10^{-6}$***		
LS	.2033	.0044*	
AP	.0004**	$2.37x10^{-12}$***	$7.97x10^{-6}$***

Notes: *p < .05, **p < .001, ***p < .0001; humanities (HM), business and economics (BE), law and social sciences (LS), arts and physical education (AP)

Table 10. *P-value of Every Paired t-test on Q8*

	HM	BE	LS
BE	.0004**		
LS	.5164	.0001**	
AP	.0088*	$4.18x10^{-7}$***	.0485*

Notes: *p < .05, **p < .001, ***p < .0001; humanities (HM), business and economics (BE), law and social sciences (LS), arts and physical education (AP)

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Conclusion

In conclusion, the results of this study reveal that university students' perspectives on AI liberal arts classes differ according to their majors. Though various college departments demonstrated negligible differences in understanding the AI class content, such as the basic AI and ML concepts, students majoring in BA or EC understand the AI fundamentals best because they can learn the AI and ML basics, including Python programming in their major courses, apart from this AI liberal arts class. The most significant differences in perspective in the college departments were found for questions on their interest in and the necessity of AI education. Students with majors in AP were least interested in AI literacy, and students majoring in BA or EC, with AI-related major courses, were more interested in and motivated to attain AI education.

As university-level AI literacy education has become essential in South Korea, this finding can facilitate the design of AI liberal arts classes according to the major in universities. For example, more AI fundamental education, including Python coding, can be provided for students with business or economics majors. In contrast, experience and practice in AI technologies using various platforms without coding, such as Google Teachable Machine, Orange3, or Neural Network Machine, can be more appropriate for students in AP. It is also critical to motivate students to learn about AI at various levels according to their majors. Various pedagogical methods can be adopted in AI courses to maintain long-term interest in and motivation to take AI courses: collaborative learning, project-based learning, problem-based learning, or capstone design projects, whose effectiveness has been proven in STEM education (Holik & Sanda, 2023; Zeid, 2020). For further study, the perspective change before and after the AI class should be explored to determine the effectiveness of AI education and demonstrate the importance of AI education.

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