

*Analysis of Trends in the Use of Generative AI for Learning by Attributes and Characteristics of University Students*

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**Abstract**

The emergence of generative AI may fundamentally change the way humans create, share, and use information. Generative AI has the ability to generate all kinds of content, including text, music, images, and code. This will change our creative activities and may require us to fundamentally rethink our notions of the attribution of the content produced, the handling of personal, privacy, and confidential information, etc. This would bring about a sea change in society. In education, it could even have the potential to dramatically change the nature of existing educational practices, such as customizing teaching materials and enabling adaptive learning that responds to learning needs, progress, and comprehension. On the other hand, generative AI poses new challenges such as piracy, information reliability, and cheating, which require a new framework of educational architecture to address them. To this end, it is necessary to clarify the use of generative AI in learning, technical knowledge of AI, and psychological awareness of AI by the attributes and characteristics of students as learners, and to use the results in future measures. In this study, a comparative analysis of the use, knowledge, and consciousness of generative AI among students from economics university, engineering university, and sports science university was conducted. The results showed that students at engineering universities were the most active in utilizing generative AI for learning activities, using it for a variety of purposes. Conversely, students at sports science university felt most strongly regarding their anxiety about using generative AI in their university learning and research activities.

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## **1. Introduction**

### **1.1. The Social Context Surrounding Generative AI**

Generative AI is rapidly changing our information search behavior. Today, browser software comes bundled with generative AI by default, or can be easily plugged into the browser. Smartphone applications are also available, making it possible to easily access the information output by generative AI from a wide variety of digital devices. As of August 2023, the number of unique users of ChatGPT is reported to be 180.5 million (Tong, 2023). The global AI market value is expected to reach approximately USD 2 trillion by 2030, compared with approximately USD 208 billion in 2023 (Thormundsson, 2023). Thus, despite the expanding market, social institutions related to AI have not been sufficiently responsive to the need to address the associated issues, although the need for such initiatives has been identified.

Some have pointed out that this generative AI has the potential to transform the structure of society as well. For example, Stanford University's (2021) AI100 project predicts that the development of AI will bring about significant transformations in areas such as labor markets, education, and public safety. Nomura Research Institute (2023) defined the emergence of generative AI as the fourth AI boom, noting that the ability to generate language, images, and voice via chat functions has the potential to transform industrial structures. Suzuki (2018) noted that the introduction of AI will drive structural changes associated with technological innovation in various areas of human society, including production, mobility, finance, logistics, medicine, care, and education, and the need to foster science and technology into a culture that enables value creation and innovation, given its impact on social institutions and organizations.

The remarkable spread of generative AI in society may also cause new social problems, and it is necessary to deal with such risks. Kamikawabe (2023), based on the regulatory efforts of the European Union, the United States, and the United Kingdom, discusses the direction of regulatory policy from the "human-centered AI development perspective" of the Japanese government. Idei (2018) discusses the current status and issues of intellectual property rights related to AI products and examines measures to address them in order to realize "Society 5.0" as Japan's vision of an ICT society. Shinpo (2023) mentions that, as the establishment of necessary rules for AI, it is also important to consider legal regulation through the enactment of substantive prohibitions for issues that cannot be compensated by merely examining soft law as principles and guidelines.

### **1.2. Impact of Generative AI on Education and Research Fields**

Generative AI is also impacting the education and research fields. Generative AI has high potential, and its capabilities continue to evolve on a daily basis. For example, ChatGPT-4 has been reported to produce passing-level answers to all US Certified Public Accountant (CPA), Certified Management Accountant (CMA), Certified Internal Auditor (CIA) and Certified Tax Accountant (EA) exams (Jolly, 2023).

Although generative AI can produce highly accurate answers to standardized knowledge-based examinations, it cannot provide accurate answers to non-standardized questions at present. This is because such AI only generates and outputs a certain level of

“plausible sentences” based on probability theory from a vast amount of data collected by large-scale language models (LLMs).

Additionally, it has been indicated that if there is bias in the data used for learning, the resulting output may also be biased (Angwin, Larson, Mattu & Kirchner, 2016). Critical thinking is required to make appropriate judgements regarding the biases produced by such learning algorithms.

Furthermore, great care must be taken with the input of personal and sensitive information; although it is stated that no user-specific data are stored in ChatGPT, all conversations between ChatGPT and the user are stored, and these data could be used to improve the language model (OpenAI, 2023). If personal or sensitive information is entered, the risk of such sensitive information being viewed by the development engineers of generative AI cannot be excluded.

Generative AI is thus going to have a significant impact in the fields of education and research. If students are able to use generative AI effectively and appropriately, the effectiveness of education and research will be enhanced. To this end, it is necessary to clarify the current status of educational use of generative AI.

## **2. Literature Reviews**

In order to examine the appropriate use of generative AI in university education, this paper will review previous studies related to this research theme. First, review research initiatives on generative AI by the Japanese government and social organizations. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) (2023) has indicated a direction for handling the educational aspect of generative AI in universities and technical colleges. The MEXT (2023) takes the position that it is important for universities and colleges of technology to respond proactively, including reviewing the contents of the guidelines in light of future changes in circumstances, in accordance with the actual conditions of their respective education. The Personal Information Protection Committee (2023) mentions the need to continue to monitor the use of generated AI, including education, to ensure the proper handling of personal information and to protect the rights and interests of individuals.

University Co-Op (2024) conducted a survey of students and found that although generative AI is gradually becoming popular among students, its use in studies and student life is still in its infancy. The survey revealed that about 30% of students are using interactive AI on an ongoing basis.

Next, turn to research on issues related to the actual usage of generative AI in schools and universities. Fujimura (2023) mentions how generative AI can be effectively used in education, based on the fact that the educational usage of generative AI has been the subject of active debate, including both pros and cons. On the other hand, he points out that there is a lack of research on improving the skills of teachers. Uchida (2023) discusses the impact of generative AI on the work of university faculty members, citing examples from the educational engineering approach, and examines the impact of generative AI on educational activities and countermeasures. Norizoe (2023) clarified students' use of generative AI based on a case study of generative AI use at Kyushu University. He points out the importance of using generative AI as a tool to help learners think for themselves.

However, these previous studies have not focused on trends and attitudes toward the usage of generative AI among university students in their respective areas of expertise, nor on educational issues. If issues in each area of specialization of university students could be highlighted, it would be possible to accurately address the educational issues related to the usage of generative AI in a way that is appropriate for each.

### 3. Survey Methodology

In order to clarify trends in the use and consciousness of generative AI among university students in their respective fields of expertise, as well as educational issues in each field of expertise, this research investigated trends in the usage of generative AI at a sports science university, an engineering university, and an economics university with liberal arts programs. The questionnaire was administered between December 1 to 22, 2023. It was completed using Google Forms. Participants were first- to fourth-year students at each university.

At the sports science university, 152 students were surveyed, with a valid response rate of 149. At the engineering university, 32 students responded to the survey. The economics university received responses from 20 respondents. Answers were provided to 33 questions using a 7-point Likert scale, with free-text, single-choice, and multiple-choice methods interwoven, as appropriate. This survey was conducted in accordance with the ethical code; no personal information of the participants was collected, and no questions that imposed on the individual's privacy were asked.

Item	Contents
Purpose of the survey	Trends in and attitudes toward the use of generative AI by university students by field of expertise
Period of implementation	1 - 22 December 2023
Survey method	Web-based questionnaire using Google Forms
Participants	Sports science university: number of responses: 152, valid responses: 149 Engineering university: 32 Economics university: 20
Answer format	7-point Likert scale, free-text, single-choice, multiple-choice
Number of questions	33

Table 1: Summary of Survey Implementation

### 4. Analysis of Questionnaire Data

#### 4.1. Experience With Generative AI

When asked about the experience of using generative AI among students at each university, 87.5% of the students at engineering university and 60% at economic university used it. On the other hand, the use rate among students of sports science university was 30%, a very low

level compared to other universities. Significant differences ( $<0.01$ ) were also found in the results of the  $2 \times k$   $\chi$ -square test.

	None experienced	Experienced	Percentage	P-value
Sports Science Univ. (n=149)	105	44	30%	$<0.01$
Engineering Univ. (n=32)	4	28	87.5%	
Economics Univ. (n=20)	8	12	60%	

Table 2: Experience with generative AI

#### 4.2. Fear of Relying on Generative AI

Students at each university were asked a question to clarify their perceptions of whether or not they would be likely to rely on a generative AI. The students were asked to answer on a 7-point Likert scale (1: not at all agree, 2: mostly disagree, 3: somewhat agree, 4: undecided, 5: somewhat agree, 6: quite agree, and 7: completely agree).

The analysis showed that students in engineering (5.15) and economics (4.15) universities were more concerned that they might rely on generative AI, while students in sports science (3.5) were less aware of the possibility of relying on generative AI. A Mann-Whitney U-test was conducted and found a significant difference ( $p=0.03$ ) among the three. In particular, the students in the engineering university had higher negative attitudes.

	Average Rating	P-value
Sports Science Univ. (n=149)	3.5	0.03
Engineering Univ. (n=32)	5.15	
Economics Univ. (n=20)	4.15	

Table 3: Fear of relying on generative AI

#### 4.3. Expectations of Increased Intelligence Through Generative AI

Students from each university were asked about their expectations regarding whether or not a generative AI would enhance their intelligence, using a 7-item Likert scale. The results of the analysis showed a tendency to believe that a generative AI would enhance their knowledge among students in the engineering university (4.4) and the economics university (4.6). On the other hand, students in the sports science university (2.95) showed lower expectations. A significant difference ( $<0.01$ ) was also indicated in the Mann-Whitney U-test.

	Average Rating	P-value
Sports Science Univ. (n=149)	2.95	$<0.01$
Engineering Univ. (n=32)	4.4	
Economics Univ. (n=20)	4.6	

Table 4: Expectations of increased intelligence through generative AI

#### 4.4. Perceptions of the Accuracy of the Content Output by the Generative AI

Students from each university were asked about their attitudes toward the accuracy of the output of the generative AI, using a 7-item Likert scale. The results of the analysis showed that students in engineering university (4.05) and economics university (3.65) tended to rate the accuracy of the output results of the generative AI higher than those in sports science university. A significant difference ( $<0.01$ ) was also indicated in the Mann-Whitney's U test.

	Average Rating	P-value
Sports Science Univ. (n=149)	2.25	
Engineering Univ. (n=32)	4.05	$<0.01$
Economics Univ. (n=20)	3.65	

Table 5: Perceptions of the accuracy of the content output by the generative AI

#### 4.5. Recognition That the Data You Entered Is Being Analyzed

Students at each university were asked to identify whether or not they were aware that providers of generative AI use the input data to analyze its content and use it to improve their services. The results showed that students in engineering university had the highest level of consciousness, with 90.1% of students aware of the system. Students in the economics university was 65% aware. On the other hand, students at the sports science university had a lower level of consciousness at 37.6%. However, a  $2 \times k$   $\chi$ -square test on the responses of the three universities yielded a result (0.52) that was not significant among the three.

	Did not recognize	Recognized	Percentage	P-value
Sports Science Univ. (n=149)	93	56	37.6%	
Engineering Univ. (n=32)	3	29	90.6%	0.52
Economics Univ. (n=20)	7	13	65%	

Table 6: Recognition that the data you entered is being analyzed

#### 4.6. Acceptance of the Use of Input Data for Analytical Purposes

Students at each university were asked questions using a 7-point Likert scale to assess the acceptability of the providers of generative AI to use the input data and analyze its content. The results of the analysis showed that students from the sports science university (3.51) were more accepting of their input being analyzed for data than students from the engineering university (2.47) and the economics university (2.9). A Mann-Whitney U-test also showed a significant difference ( $<0.01$ ).

	Average Rating	P-value
Sports Science Univ. (n=149)	3.51	
Engineering Univ. (n=32)	2.47	$<0.01$
Economics Univ. (n=20)	2.9	

Table 7: Acceptance of the use of input data for analytical purposes

#### 4.7. Concerns Regarding the Use of Generative AI

Students at each university were asked using a 7-point Likert scale to determine whether or not they were concerned about the use of generative AI in their university learning and research activities. The results showed that students in the sports science university (3.89) were the most anxious, followed by students in the economics university (3.15), who were more conscious of the issue. The least anxious were the students of engineering university (2.81). A Mann-Whitney U-test also showed a significant difference ( $<0.01$ ).

From this result, it can be inferred that in sports science university, where the percentage of students using generative AI is low, there is a lack of knowledge and experience in how to use such AI in education. This is supported by the fact that students in engineering university, which use the most generative AI and learn in an environment that is most conducive to using it, have the lowest sense of anxiety. In order to remove their sense of insecurity, it may be necessary for them to try using generative AI and experience its advantages and disadvantages.

	Average Rating	P-value
Sports Science Univ. (n=149)	3.89	
Engineering Univ. (n=32)	2.81	$<0.01$
Economics Univ. (n=20)	3.15	

Table 8: Concerns regarding the use of generative AI

#### 4.8. Expectations of What Generative AI Can Do for My Future

For students at each university, questions were asked using a 7-item Likert scale to assess whether or not they believed that generative AI would be useful for their future. The results showed that students in engineering university (5.38) had the highest expectations, followed by students in economics university (4.7). In contrast, students in the sports science university (3.94) had the lowest expectations for being useful in the future. There was also a significant difference ( $<0.01$ ) in the Mann-Whitney U-test.

Students at engineering university are likely to have a high positive attitude toward the use of AI, since they have acquired knowledge and skills related to ICT technologies, including AI, and are planning to use them in their future careers. In contrast, students in sports science university is not currently engaged in learning sports science-related subjects using AI or in enhancing their competitive skills using AI, which may be the reason for this.

However, in sports science and athletics, AI has been used to improve athletic performance by analyzing exercise data, and such technology has already been introduced in top-level consultative organizations. It can be inferred that the introduction of such ICT technology at the undergraduate level will have a positive impact on the expectation that AI will be useful for one's future.

	Average Rating	P-value
Sports Science Univ. (n=149)	3.94	
Engineering Univ. (n=32)	5.38	<0.01
Economics Univ. (n=20)	4.7	

Table 9: Expectations of what generative AI can do for my future

## 5. Discussion

The highest percentage of students at engineering university (87.5%) used generative AI, followed by economics university (60%). On the other hand, the rate of use among students of sports science university was 30%, which was extremely low compared to other universities. The use rate for engineering university students is considered to be high because they are studying and researching AI technology. In contrast, sports science university students study and research mainly sports science skills, and thus have fewer opportunities to experience the latest technology.

Regarding the concern about over-reliance on generative AI, engineering university students had the highest concern, followed by economics university, and sports science university students had the least concern about relying on generative AI. Since many students at engineering universities actually use generative AI, it can be assumed that many of them are familiar with its usefulness. This is believed to be the reason for this ranking of the concern.

With regard to expectations for increasing the intelligence of the generative AI and to the accuracy of the content output by the generative AI, the results also showed a high level of concern among engineering and economics universities, and a low level of concern among sports science university students. It can be inferred that the students' responses to these questions also reflect the fact that they have actually used AI to generate AI, and thus tend to be able to envision its future possibilities, and that they are conscious of the level of quality of the output.

Conversely, students at sports science university felt most strongly regarding their anxiety about using generative AI in their university learning and research activities, followed by students at economics and engineering universities. In this result as well, it is thought that the anxiety about a technology they have never used before may have led to this difference in consciousness.

## 6. Conclusion

Currently, generative AI is permeating the field of education and research at universities, raising concerns not only about the possibilities of using it, but also about the various educational risks involved. Such trends are likely to vary within each university's field of expertise.

In order to examine such questions in depth, this study surveyed students in sports science, engineering, and economics universities to determine trends in the usage of generative AI and their attitudes toward it. The results of the survey showed that students in sports science university tended to be more negative in their attitudes toward generative AI than students in other universities. One reason for this may be that the usage rate of generative AI by sports



science students is extremely low compared to other universities. If the use of generative AI becomes more widespread among sports science students, their acceptance of generative AI may also increase. If they can utilize generative AI favorably and appropriately, it may have positive consequences for their future. This will be the subject of the next research project.

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