# AI ETHICS AND GOVERNANCE IN KOSEN

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**This study aims to design and practice AI ethics pedagogical contents, referring to the AI Ethics and Governance in Singapore, to make a standard of AI ethics education in The National Institute of Technology (KOSEN). Generative AI (Gen AI) has been developing rapidly and influencing our work and lifestyles. However, the cultivation of our ethical mind for AI is insufficient to govern this technology. This study examines how the author incorporates AI ethics into courses in KOSEN, emphasizing its relevance in the current education system. It references the way AI ethics certification is being integrated into teaching and learning in Singapore's polytechnics, including Temasek Polytechnic (TP). The subject aims to equip students with critical thinking skills to assess AI applications responsibly. Upon successful completion, students receive an AI Ethics & Governance Certification at Associate Level from SCS. Deriving the concept, system, and materials from the AI ethics education in Singapore, the author developed his materials and gave lectures on AI ethics during the course on engineering ethics and a seminar in the Department of Electrical and Computer Engineering (ECE) in NIT Wakayama. As for the teaching concept, we focused on the AI ethics guidelines drafted since 2017 in Japan and the cases featuring each guideline, such as automatic driving technology. Moreover, we posed the moral agent and patient as the discussion matter. In addition to these contents, we created question forms as teaching aids. According to the students' answers to the questions, especially to the rate gap of correct answers between groups, we can suppose the teaching materials are effective in our AI ethics education. The materials also seem to be good viewpoints to introduce the problematics of AI Ethics. However, they are not enough to show students overall AI ethics. Finally, we show horizons to develop AI ethics education in KOSEN.**

***Keywords:*** *Engineering ethics, AI ethics guidelines, Certification program, Teaching materials*

## Introduction

### 1 AI ethics guidelines in Japan and Singapore

#### 1-1 Japan

Gen AI, developing rapidly and influencing our work and lifestyles, can help us do our daily tasks efficiently. As AI technologies advance unprecedentedly, so do the ethical considerations and governance challenges associated with their deployment. However, the cultivation of our ethical mind for AI is insufficient to govern this technology. Designing an educational program on AI ethics for young Gen AI users is a pressing matter.

Since 2017, AI ethics guidelines have appeared in Japan. The first ethical guidelines issued by the Japanese Society for Artificial Intelligence include nine principles: contribution to humanity, abidance of laws and regulations, respect for the privacy of others, fairness, security, act with integrity, accountability and social responsibility, communication with society and self-development, and abidance of ethics guidelines by AI. The Japanese government also issued guidelines "Social Principles of Human-Centric AI" in 2019, which include seven principles: the human-centric principle, the principle of education/literacy, the principle of privacy protection, the principle of ensuring security, the principle of fair competition, the principle of fairness, accountability and transparency, and the principle of innovation. Fukuoka (2022) indicates that the former is mainly applied to researchers for AI while the latter is inclusive guidelines for all AI developers and users. Their policies have a commonality despite such a difference between them. These guidelines are the fundamental basis to refer to in AI ethics education.

#### 1-2 Singapore

In Singapore, the progress in AI ethical guidelines is similar to Japan's or advanced further. The government proactively introduced governance frameworks for data and AI from as early as 2012. SCS (Singapore Computer Society), the leading infocomm and digital media society for industry professionals, leaders, students, and tech enthusiasts, launched AI Ethics and Governance Body of Knowledge (BoK) Version 1.0 in 2020. After the appearance of Gen AI like Chat GPT developed by Open

AI, SCS issued BoK Version 2.0 in 2023 with 100 chapters spread out in 10 sections. It has four pillars that address the ethical issues of AI adoption: internal governance, human-centricity, operations management, and stakeholder communications (SCS, 2024).

Japan and Singapore started working on their strategy for AI ethics in the 2010s, but show different practices of AI ethics education as we see below.

## 2 AI ethics education in Japan and Singapore

### 2-1 Japan

In Japan, elementary and junior high schools offer moral education based on government guidelines for education. High schools and KOSEN colleges also have ethics courses. As for AI ethics education, however, the government has not revised the guidelines, schools have not developed contents about AI, and teachers have not made any course plans for AI ethics.

KOSEN is actually conscious of AI education. The Minister of Education and Science established the Approved program for Mathematics, Data science, and AI Smart Higher Education. The subjects of data ethics and AI social principles are necessary to satisfy the conditions of this program. 57 KOSEN colleges, including NIT Wakayama, were approved for it as of 2024. Despite this program, it seems to be insufficient to practice AI ethics education.

Figure 1 shows how many NIT colleges offer AI ethics in their curriculum in 2024. In this survey, we supposed that KOSEN colleges give lectures on AI ethics mainly in the subjects of AI/Informatics (n=42), Social Science including Philosophy, Ethics, and Social Affaire (n=49), and Engineering Ethics (n=65). We counted the number of AI ethics when we found the expression “AI ethics” or a similar word on syllabus of these subjects. 14.3% of AI or Information courses, 12.2% of Ethics or Social Studies, and only 7.4% of Engineering Ethics offer discourse on AI ethics respectively. NIT colleges give few AI ethics courses, even though they are institutes of technology, as Souma (2018) says. We need therefore to elaborate on the AI ethics education for KOSEN.

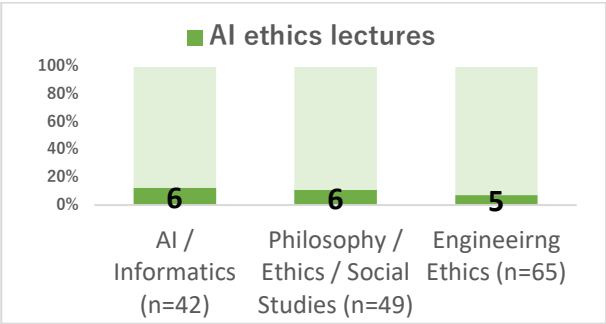


Figure1 The number of AI ethics lectures over all syllabus in the KOSEN curriculum

### 2-2 Singapore

In Singapore, AI ethics certification is being integrated into teaching and learning in Singapore’s polytechnics, including TP. This initiative is a collaboration between the SCS and the schools in Singapore. TP has introduced AI ethics to all second-year students in the School of Informatics & IT. It is delivered as a term/semester subject for one diploma, while for other diplomas, it is offered as an online self-directed learning module. It covers key AI considerations and concerns, including algorithmic bias, data privacy, security threats, job displacement, ethical decision-making, and the broader impact on societal values and trust. The subject aims to equip students with critical thinking skills to assess AI applications responsibly. Upon successful completion, students receive from SCS an AI Ethics & Governance Certification at Associate Level, which is the second level of the certificate hierarchy (Figure 2). To date, over 800 students from the School of IIT at TP have attained this certification, strengthening their readiness for ethical AI implementation.


Figure 2 Five certification levels in Singapore

Japan’s effort to integrate AI ethics in education seems to be behind that of Singapore in the viewpoint of its practice. This is why we refer to the educational system in Singapore to consider AI ethics education in KOSEN.

## Materials and Methods

We repeated the input on AI ethics and output to students as the following process chart (Figure 3). We designed trials A and B as our research program on AI Ethics.

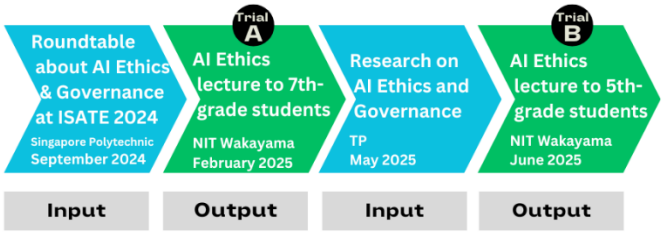


Figure 3 Process chart of AI Ethics and Governance research with TP

### 1 Trial A in NIT Wakayama in February 2025

We examine how one of the authors incorporates AI ethics into an engineering ethics course in KOSEN, emphasizing its relevance in the current education system.

The author has given courses on engineering ethics to seventh-grade students of the Advanced Course since 2023. In February 2024, 22 students, including a student

from Thailand, participated in the course. In the first half of a 90-minute lesson, the author lectured on the theory of normative ethics, meta-ethics, and applied ethics, bioethics, environmental ethics, and information ethics included. In the last half, students struggled with case studies, discussing the background, concerns, and facts of the cases, and forming their opinions about them. At the last moment of the class, they handed in a communication paper on which they write their comments about the lecture and case.

Of the 15 times classes, the lecturer assigned the last two classes to information ethics and AI ethics. He deals with the topic of automatic driving vehicles and questions about the moral agent and patient posed by Coekelbergh (2020): can AI be a moral agent and moral patient as humans? In the author's case, just half of the students answered positively to the question, and the other half negatively. This controversial issue enabled students to think about the conditions of moral agents and to understand what kind of problems AI ethics includes.

The author has developed questions about AI ethics for the purpose to evaluate the students' understanding and the effectiveness of questions themselves. Table1 in Appendix shows questions created and delivered to students with Microsoft Teams. They include three knowledge-based questions with an answer (Q1-1, Q1-2, Q1-3), which evaluate students' knowledge, and two thinking-based questions without rigid solutions, which ask students to choose an answer close to their thinkings. The first ones are supposedly suitable for estimating to what extent students understand the problems of AI ethics, and the last one is for letting students consider the issues deeply.

2 Trial B in NIT Wakayama in June 2025

After the research on AI Ethics in Singapore held in May 2025, the author added the topics and contents on AI ethics. And he gave a lecture to seven fifth-year students of the Department of ECE in June 2025. In the first half of the lesson, he lectured on the purpose of the lecture, social issues about Gen AI, and the outline of AI ethics guidelines. In the last half, he talked about the similarities and differences of AI ethics guidelines, the case study related to each principle of the guidelines, which students discussed on one, and the essential question on AI ethics as he dealt with it in the Engineering Ethics course. At the last moment of the class, students answered twenty-five questions, (Appendix Table 1), include the former ones, partly referring to the AI and Ethics course at TP.

Thirty-seven second-year students of the Department of ECE also answered twenty questions in June 2025. They did not answer the last five questions which ask them the impressions on the lecture because they did not take the lecture on AI ethics. The purpose of this test is to acquire the answer data of students who did not take a lecture on AI ethics. Comparing the rates of correct answers, we could analyse the lecture the author gave was effective to enhance the knowledge of AI ethics to students and cultivate their way of thinking about AI ethics.

## Results and Discussion

1 Trial A in February 2025

Students answered the questions described in Table 1 in the Appendix. We obtained the results in Figures 4 and 5 in the Appendix.

The rate of correct answers is 0.983 (59/60) for the knowledge-based questions (Figure 4). Students had enough knowledge about the issues of SNS advertisements, search engines, and automatic driving accidents reported in the media, and responded to the questions successfully.

According to students' answers to the semi-open questions (Figure 5), most students (83.3%) think the singularity will arrive in the future (Q2-1). All students consider that we should not treat AI as a thing because of either their empathy with AI or their moral nature (Q2-2). The lecture on the moral agent and patient that the author gave before the questions supposedly incited students to think that AI is not just a thing. This trial clarified that lectures on the latest AI examples lead students with little knowledge about AI ethics to become sophisticated.

2 Trial in NIT Wakayama in June 2025

Fifth-year Students answered all questions described in Table 1 in the Appendix. Second-year students did twenty questions, except the final five. We achieved the results shown in Figures 6 - 14 in the Appendix.

The rate of correct answers by the fifth-year students is 98.1% (103/105) for the knowledge-based questions (Figure 6). The results of both Trial A and B seem to indicate that students update their knowledge about AI. However, the rate of correct answers by second-year students is 70.6% (357/555), significantly lower than Advanced Course students and 5-year students. Second-year students missed many questions, especially questions 5 (The Japanese Society for Artificial Intelligence formulated ethical guidelines for Generative AI in 2021) and 14 (Explainable AI, which is called "E-AI," is an important technology to secure accountability and transparency). The issue year of the ethical guidelines was 2019, and we call Explainable AI not "E-Ai" but "X-AI". The supposed reason for the rate gap between fifth-year and second-year students is that the author gave a lecture to fifth-year students before questions while second-year students answered the questions without any prior lessons. If our supposition is correct, we can conclude the lectures were effective in learning AI ethics principles.

The results of the semi-open questions answered by second and fifth-year students show the same tendency as those of the Advanced Course students. Most students (85.7%) believe in the singularity (Q2-1), and all students hope not to treat AI as a mere thing (Q2-2). Moreover, most students (92.9%) believe that AI ethics principles are necessary (Q2-3, Q2-4). All students are skeptical of the potential of AI in the political field. (Q2-5).

Finally, all fifth-year students replied that AI ethics is essential and that they acquired helpful knowledge and viewpoints of AI through the lectures (Q3-4, Q3-5).

## Conclusions

In this study, we examined the concepts and contents to design an AI ethics lecture. It is always challenging to integrate a variety of the latest knowledge about AI ethics in a short lecture. We hope to spare more time for AI ethics education as our society becomes aware of the importance of AI-related matters.

We showed examples of AI ethics lectures implemented in a brief session. Explanations on AI ethics guidelines and case studies on them were the main topics. We created questions to check the degree of students' understanding. Knowledge-based questions could estimate their input on AI ethics issues in the lecture. Thinking-based questions enabled students to expand their viewpoints to gain insight into the nature of AI.

These trials were still insufficient in material creation. We continue to follow the cutting-edge AI technology and invent methods for teaching AI ethics and governance applicable to the technology. For continued research, we exhibit perspectives on AI ethics education in KOSEN.

(1) Creating teaching material

In corporations with polytechnics in Singapore that have struggled with this theme, we can develop materials and systems for AI ethics education. We regard the questions posed in Table 1 as an achievement of teaching materials, taking into consideration the exams for the certificate program in Singapore.

(2) Fostering critical thinking

We discuss the nature of AI ethics with students to deepen their critical thinking ability. The guideline of human centricity, for example, is an essential topic in AI ethics. Students will argue how to protect human rights and ensure privileges for humans in a society where AI has a strong influence. However, we criticize if we must presuppose human centricity as one of the main pillars of AI ethics. Some insist that an AI-centric policy must make our society more convenient and comfortable. This kind of thought experiment can enable students to meditate on the importance of AI ethics guidelines and the nature of AI ethics itself.

(3) Reuniting the KOSEN network

We will need to elaborate on an AI Ethics and Governance approval program among KOSEN colleges, similar to that of SCS, as AI is increasingly prevalent in our society. We will be able to share the educational materials with NIT colleges that aim to implement AI ethics courses.

## Acknowledgements

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## Appendix

| | Knowledge-based questions |
|---|---|
| 1 | (1) Advertisements we usually see on the shopping site like Amazon or on the SNS like Facebook are pop-up at total random, without intervention of AI. |
| | (2) Search engine by Google is powered by AI. |
| | (3) There is no report on the accident of automatic driving vehicles in the US. |
| | (4) In Singapore, the AI Ethics and Governance certificate program aims to help students enhance their sense of AI ethics. |
| | (5) The Japanese Society for Artificial Intelligence formulated ethical guidelines for Gen AI in 2021. |
| | (6) Guidelines for AI ethics have been created in the U.S., Europe, and China. |
| | (7) It is common in the world to draft not human-centric but AI-centric ethical principles in the purpose of developing AI. |
| | (8) "Tay" is a chatbot developed by Microsoft and repeated hate speech on Twitter (X). |
| | (9) Correctional Offender Management Profiling for Alternative Sanctions (COMPAS), developed by Northpointe (now Equivant), has not caused any problems, and people use it more and more. |
| | (10) AI is a tool with low environmental impact. |
| | (11) The fatal crash accident of Uber's self-driving car in 2018 suggests that we need to incorporate human support into the AI system to secure safety. |
| | (12) We do not have to respect privacy when we deal with big data, because we utilize data after we remove personal information from them. |
| | (13) Amazon's AI for human resource recruitment, which could evaluate personnel data and score it in a few seconds, tended to devalue the candidature whose resume includes a word related to woman. |
| | (14) Explainable AI, which is called "E-AI," is an important technology to secure accountability and transparency. |
| | (15) "Watson", IBM Japan's personnel evaluation system introduced in 2019, was an explainable AI system, so IBM did not have to disclose its information when it was required to do so. |

| | |
|---|---|
| 2 | **Thinking-based questions** |
| | (1) What do you think about the possibility of AI?<br>a. AI will not go beyond human intelligence. The AI system will be somewhat convenient but not wiser than humans.<br>b. AI will be the "superintelligence" beyond human intelligence shortly.<br>c. AI independent of human beings will govern humankind both mentally and physically.<br>d. Another opinion. |
| | (2) If you see a dog-model robot with AI treated violently, what do you think about it?<br>a. It did not have any choice but to be treated in such a way because there should have been any reason.<br>b. I feel nothing because both robots and AI are things.<br>c. We should not treat AI robots in such a way because they resemble dogs, and we get sad when we see a dog treated violently.<br>d. We should not treat AI robots in such a way because treating a thing violently damages our morality: we should be kind to everything.<br>e. Another opinion. |
| | (3) Most AI ethics guidelines feature the human-centric principle, which leads us to think that we should govern and utilize AI to develop human society, while such principles may prevent AI from developing itself. What do you think about the human-centric principle?<br>a. We need not any principles which prevent AI from developing itself, because AI will learn everything by itself.<br>b. We should keep the human-centric principle because, though there is room to abandon it in the future, we are not sure to what extent AI will be able to develop itself.<br>c. AI can go out of control easily as chatbot Tay showed, so we should develop and utilize AI keeping the human-centric principle.<br>d. We should never abandon the human-centric principle. We should limit the role of AI as a tool for our lives and work.<br>e. Another opinion. |
| | (4) The transparency principle is one of the most general AI ethics guidelines and conceives the idea that AI judgements should be explainable. What do you think about the need for the principle?<br>a. We need the transparency principle because we must explain the reason for AI judgement when we do our jobs using AI.<br>b. We need the transparency principle because AI as a black box is unpleasant to utilize.<br>c. We should not require the transparency principle only for AI because the human mind is not transparent. Some people hold unclear minds or explain their intentions unclearly.<br>d. We do not need the transparency principle for the rapid development of AI because extremely complicated algorithms boost high-performance AI.<br>e. Another opinion. |
| | (5) Some argue that we should leave AI to international politics because human politics causes wars and conflicts in the world. What do you think about it?<br>a. We should leave AI to politics because we expect the world AI governs will be a peaceful world.<br>b. We can leave AI to the politics as long as super AI appears in the future. We do not have super AI. It also seems to be complicated to create it.<br>c. We should reflect opinions of AI in politics in a condition that human politicians make final judgments.<br>d. We should not leave AI to politics. AI is not excellent for understanding human politics or geopolitics.<br>e. Another opinion. |
| 3 | **Questionnaires** |
| | (1) Have you ever used AI-powered software or applications?<br>a. Yes b. No |
| | (2) Which is the application you have used?<br>a. Chat GPT b. Grammarly c. Copilot<br>d. Gemini e. Other |
| | (3) Do you think you should start your professional life after studying AI ethics guidelines?<br>a. Yes, we should learn AI ethics because the era when everyone uses AI to work naturally will arrive soon.<br>b. Yes, we should learn the issues related to AI because we live in a society where people utilize it even though I do not use AI.<br>c. No, our common sense enables us to solve problems related to AI. We can make ethical decisions, though we do not have specific knowledge of ethics and morals.<br>d. No, AI ethics is a special subject reserved for experts, and we should not be involved in the arguments about AI issues. |
| | (4) Have you got helpful knowledge of AI through this lecture?<br>a. Yes b. No |
| | (5) Have you had any points of view to consider AI ethics deeply through this lecture?<br>a. Yes b. No |

Table 1 Questions about AI Ethics, composed by 15 knowledge-based questions, five thinking-based questions, and five questionnaires. In Trial A, students answered only the questions of 1-(1), 1-(2), 2-(1), 2-(2), and 2-(3). In Trial B, fifth-year students answered all questions, and second-year students answered except 3-(1) to 3-(5).

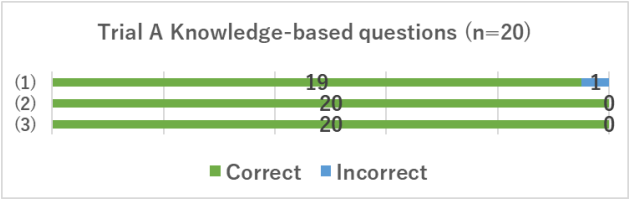


Figure 4 Students' answers to the knowledge-based questions in Trial A (Advanced Course students)

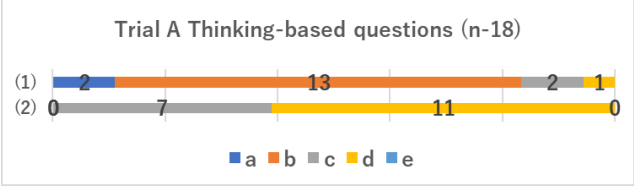


Figure 5 Students' answers to the thinking-based questions in Trial A (Advanced Course students)

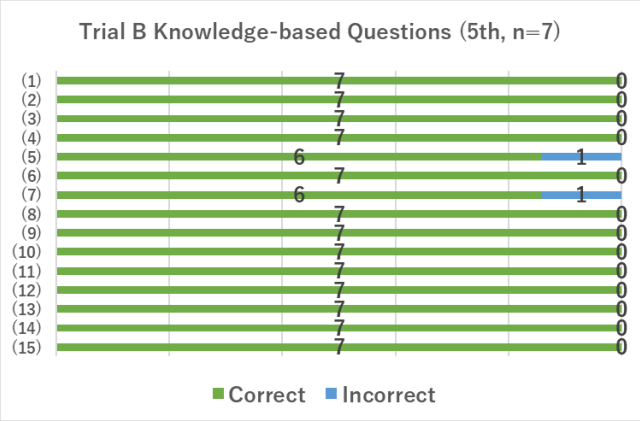


Figure 6 Students' answers to the knowledge-based questions in Trial B (5th-year students)

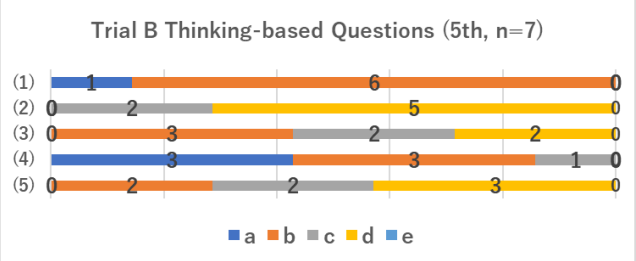


Figure 7 Students' answers to the thinking-based questions in Trial B (5th-year students)

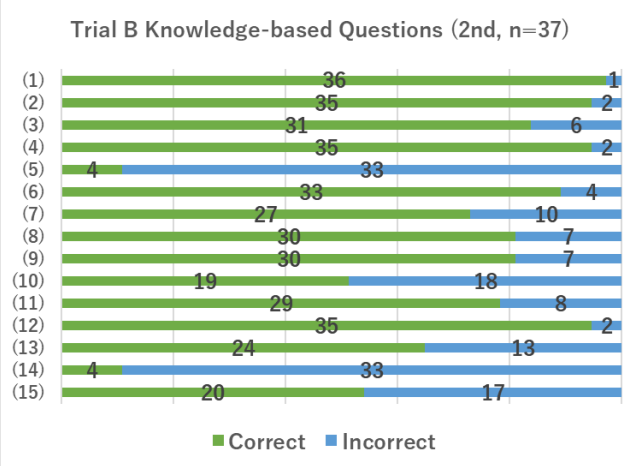


Figure 8 Students' answers to the thinking-based questions in Trial B (2nd-year students)

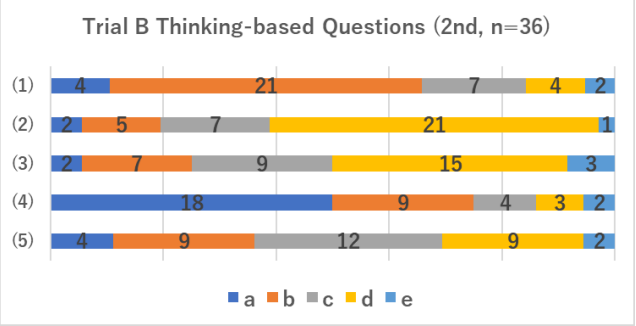


Figure 9 Students' answers to the thinking-based questions in Trial B (2nd-year students)

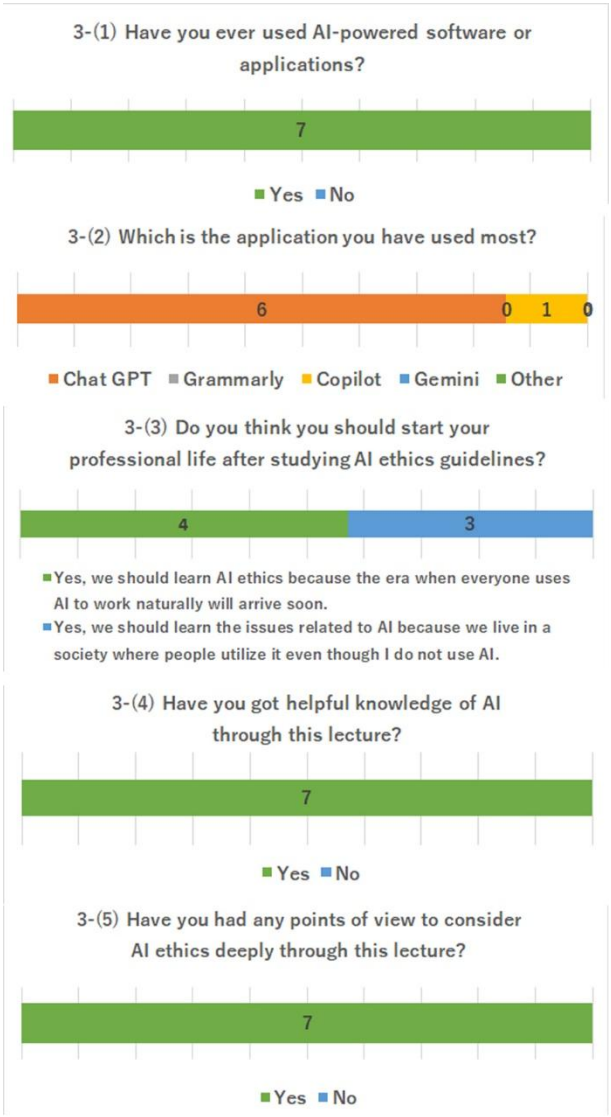


Figure 10 Students' answers to the questionnaire in Trial B (5th-year students)