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# Enhancing ethical awareness through generative AI literacy: A study on user engagement and competence

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**Abstract:** Generative artificial intelligence (AI) enables users to quickly and easily create desired outputs. However, it poses potential risks of social disruption due to biases in the data used to generate such outputs. This study examines whether providing literacy-based guidance on the risks and cautionary aspects of generative AI at the point of user acceptance of its outputs can enhance the user's ethical competence. For the study, participants were divided into an experimental group and a control group. The experimental group received warnings about the risks and considerations of accepting AI-generated outputs before using the AI, while the control group received no such guidance. The results revealed that the experimental group, which was informed of the risks and cautionary aspects, showed significant improvements in ethical awareness across various dimensions, including values, self-efficacy, self-regulation and engagement, and ethics and security. Based on these findings, the study suggests that systematic education on the risks and cautionary aspects of generative AI, alongside the technology's dissemination, can play a crucial role in addressing social and ethical challenges.
***Keywords:*** *AI ethics, Ethics education, Generative AI ethics, Generative AI.*

## 1. Introduction

Since the 2016 World Economic Forum (WEF), interest in artificial intelligence (AI) has escalated significantly. Governments and corporations worldwide have begun to vigorously develop AI, applying it across various sectors to enhance convenience for individuals. AI has substantially improved the quality of human life, spanning industries, education, healthcare, and biotechnology.

Recently, generative AI technologies have expanded into domains traditionally considered exclusive to human creativity, such as writing, art, and algorithmic coding. With advancements in AI, generative AI has evolved to encroach upon these creative domains. The advent of generative AI began with OpenAI's ChatGPT, a conversational AI. Following this, Google's Bard and Microsoft's Bing were introduced, initiating competitive advancements among generative AIs. During this period, Geoffrey Hinton, known as the "godfather of deep learning," has warned about the severe risks posed by ChatGPT, cautioning that while AI may not yet be more intelligent than humans, it could soon surpass human intelligence. Sam Altman, CEO of OpenAI, has advocated for regulatory measures for new AI systems during a US congressional hearing [1]. Such calls for ethical regulation and acknowledgment of potential risks from the developers of AI technology underscore the urgency of addressing these issues [2].

AI technologies, despite offering unprecedented convenience across various societal and practical domains, have also precipitated new conflicts, necessitating contemplation of appropriate norms and ethical values. For instance, Google's AI technology was embroiled in controversy for tagging photos of black individuals as gorillas, and Microsoft's chatbot "Tay" had to be taken down shortly after its release due to its acquisition of racist and sexist opinions. Additionally, the misuse of deepfake technology to create and disseminate fake videos has led to significant societal disruptions. These instances demonstrate that AI technologies can yield unintended and ethically questionable outcomes,


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negatively impacting society and individuals. This underscores the necessity for ethical evaluations of AI technologies and their applications.

Neglecting ethical considerations while focusing solely on the development and deployment of AI could instigate new societal conflicts and repercussions. Consequently, terms like AI ethics have become prevalent in academic discourse, with academia, governments, and corporations hastening to establish AI ethics guidelines. Educational institutions have promptly introduced AI ethics curricula, aiming to cultivate individuals with ethical competencies in AI through various academic research endeavors. For instance, Harvard University has incorporated AI ethics into its curriculum, discussing issues such as privacy in AI and unintentional discrimination in machine learning [3]. Similarly, MIT Media Lab has proposed an AI ethics education program for middle school students [4]. In South Korea, the Ministry of Education announced AI ethics principles in 2022, outlining detailed guidelines to address changes in the educational environment and ethical issues arising from the advent of the AI era.

AI ethics fundamentally explores how AI technologies can benefit and harm humans, the appropriate use of AI-generated outcomes, and the broader societal impacts. Issues like personal data theft and leakage, misuse of AI-generated content, copyright controversies, and environmental degradation are some of the ethical concerns involved. It is crucial to consider these ethical aspects when developing, deploying, and utilizing AI services and outcomes.

This study aims to investigate the impact of informing learners about the ethical risks associated with generative AI on their acceptance of AI-generated outcomes within an educational context.

## 2. Theoretical Background

### *2.1. Data Bias in Generative AI*

Generative AI, a hallmark of the intelligent information society, refers to the technology that creates new data or content based on artificial neural networks. Generative AI can autonomously learn from the data it processes and understands during the input of information or commands by users. Through this learning process, it can automatically generate outputs in various formats such as text, images, audio, and video. Artificial neural networks, modeled after human neuron networks, excel in performing complex calculations and recognizing patterns. This allows generative AI to learn patterns related to the input data and generate new content accordingly.

However, the bias present in the training data fed into generative AI can lead to errors in the results, causing societal confusion. Alice Xiang has pointed out that the issue of data bias in AI can lead to widespread societal confusion and requires a collaborative approach across various fields. She emphasized that training data for AI must be sourced from diverse areas to enhance accuracy and reduce bias. Data should be collected from all groups and classes, not just specific ones, and fed into AI [5].

The MIT-based Media Lab has developed and provided an educational program aimed at middle school students that emphasizes the ethical use of AI technologies. This program was piloted in the Montour Public Schools, located on the outskirts of Pittsburgh, Pennsylvania. During the pilot, the schools conducted the "AI+Ethics Curriculum" over the course of three days, utilizing their media arts class hours. In addition to this initiative, Montour Middle School collaborated with AI research teams to implement various AI pilot programs. For instance, in collaboration with Professor David Touretzky, who leads AI4K12, the school offered a six-week elective course on "Autonomous Robotics" and a 10-week course on "AI and Music." [Source: https://www.media.mit.edu/projects/ai-ethics-for-middle-school/overview/ - MIT Media Lab's AI + Ethics Curriculum for Middle School]

Thus, while generative AI can quickly and easily produce desired results, the bias in the provided data can lead to societal disruptions. Therefore, users must review the results for data bias before accepting the outputs generated by AI.

### *2.2. Copyright Issues*

The use of data for training generative AI has raised ongoing controversies regarding copyright infringement. The data used for AI training can potentially infringe on copyrights. For instance, AI training often utilizes data from news articles, images, and internet community posts. A pertinent question is how to handle the copyrights of news articles when AI learns from them.

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In South Korea, Article 35-5 (Fair Use of Works) Paragraph 1 of the Copyright Act states, "Works may be used if they do not conflict with the general methods of using the works and do not unreasonably harm the legitimate interests of the author." Collecting text data through web scraping for language model training could be considered fair use under this provision [6]. However, for AI to progress, data is essential, suggesting a temporary exemption from data copyright might be necessary. Yet, this is a complex issue requiring compromise with copyright holders.

In the United States, the use of news data by generative AI is already controversial. Some media organizations are considering legal actions against AI developers, potentially escalating conflicts between AI developers and the press. CNN and The Wall Street Journal have claimed that ChatGPT, developed by OpenAI, learned from the data produced by over 20 global media outlets, and are considering legal actions against OpenAI [7][8]. Similarly, Getty Images, which has amassed the world's largest archive of photographic content, filed a $1.8 trillion lawsuit in February, alleging that Stability AI used over 12 million images from their 30-year collection without permission for AI model training. Resolving these conflicts requires rational dialogue and a regulatory framework between copyright holders and AI development companies.

AI is a critical technology shaping our future. Addressing these conflicts and promoting AI advancement necessitates cooperation and reasonable regulation. New copyright rules should be developed, emphasizing data sharing and collaboration, considering AI's impact on industry and society [9].

Generative AI technologies have made result production accessible to everyone. However, ignoring the previously mentioned issues while focusing solely on technical applications could exacerbate societal confusion. Hence, this study discusses the necessity of recognizing ethical issues associated with generative AI technologies. Since ethical awareness does not develop overnight, systematic education on ethical awareness needs to align with the development and application of AI technologies.

### *2.3. Generative AI Literacy and Research Trends*

The European Union (EU) introduced the "Ethics Guidelines for Trustworthy AI" in 2021. In Finland, MinnaLearn and the University of Helsinki have jointly developed and offered the "Elements of AI" course, a free online course available to the general public since 2018. The course is structured into six chapters: "What is AI?", "AI Problem Solving", "Real-World AI", "Machine Learning", "Neural Networks", and "Implications." The "Implications" chapter focuses on forecasting the future impacts of AI technologies, with a particular emphasis on ethical considerations. [Source: MinnaLearn, & the University of Helsinki (2022). Elements of AI. Retrieved from https://www.elementsofai.com/]

Existing research on AI literacy primarily focuses on developing frameworks that comprise various sub-dimensions based on the definition of AI literacy. Ng et al. structured AI literacy into sub-dimensions such as 'AI Understanding and Learning,' 'AI Application,' 'AI Evaluation and Generation,' and 'AI Ethics.' 'AI Understanding and Learning' refers to the process of learning basic theories, technologies, knowledge, and attitudes regarding AI. 'AI Application' emphasizes utilizing AI concepts and applications in various scenarios [10]. 'AI Evaluation and Generation' involves critically assessing AI technologies and possessing effective communication and collaboration skills. Lastly, 'AI Ethics' encompasses considerations of fairness, responsibility, transparency, ethics, and safety in AI use.

Long & Margerko defined AI literacy as "the ability to critically analyze and utilize AI technologies, effectively communicate and collaborate with AI, and apply AI capabilities at home and work," and categorized it into five themes [11].

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**Table 1.**
AI Literacy by Long &Margerko.

| Topic | Content elements |
|---|---|
| What is AI? | Understanding AI<br>Defining AI |
| What can AI do? | Recognizing AI`s strengths and limitations<br>Predicting future AI developments |
| How does AI work? | Understanding the mechanisms of machine learning<br>AI`s decision-making mechanisms |
| How should AI be utilized? | Ethical aspects |
| How do people perceive AI? | Programming flexibility |

Table 1 shows that under the theme 'What is AI?' topics include understanding AI and defining AI. 'What can AI do?' covers recognizing AI's strengths and limitations and predicting future AI developments. 'How does AI work?' relates to understanding the mechanisms of AI, such as machine learning processes and decision-making mechanisms. 'How should AI be utilized?' includes ethical considerations, and 'How do people perceive AI?' refers to how easily users can write and modify code to change or extend systems or software.

Research on AI ethics literacy has predominantly focused on the general importance or risks of AI ethics rather than practical issues and attitudes required when using AI. Therefore, this study aims to examine how considering ethical aspects during the acceptance stage of generative AI outputs impacts the enhancement of ethical awareness.

## 3. Course Design Incorporating Generative AI Literacy Elements

Actual, a Canadian organization, has developed the Actual AI Education Guide with the aim of providing teachers with foundational knowledge of AI and supporting them in integrating AI into their curricula. The guide includes a framework for structuring AI education, explaining how AI instruction should be organized, and addresses topics related to the societal impacts of AI, particularly in the context of AI ethics. [ Yu. J. Y. (2021. March 29). Current Status and Implications of Artificial Intelligence (AI) Convergence Education in Canada. Education Policy Network. Retrieved from https://edpolicy.kedi.re.kr/frt/boardList.do?strCurMenu Id=10091.]

Based on the research of Ng and Long & Margerko, common elements of AI literacy, such as fairness, responsibility, transparency, safety, communication, and collaboration, were identified [10] [11]. These six AI literacy elements were integrated into ethics education. Generative AI was utilized to achieve the learning objectives, and the study measured changes in learners' perceptions of accepting generative AI outputs. The course design for 10 out of the 13 weeks is outlined in Table 2.

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**Table 2.**
Designing education for generative AI.

| | | Test of equal variance of levene | | T-test for equality of means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | F | Significance probability | t | Degrees of freedom | | Significance probability (both sides) | Average difference | Standard error of the difference | 95% confidence interval of the difference | |
| | | | | | | | | | Mini | Maxi |
| Equal variance is assumed | 7.31 | | 0.03 | 1.52 | 8 | 0.121 | 2 | 3.36 | -2.1 | 14.5 |
| No equal variance is assumed | | | | 1.52 | 4.37 | 0.183 | 2 | 3.36 | -3.3. | 15.6 |

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*3.1. Research Subjects*

The subjects of this study were 164 university students from freshmen to seniors enrolled in ethics courses during the 2023-2024 academic year. They were divided into two groups: an experimental group and a control group. Prior to the experiment, a pre-survey on ethical awareness was conducted to ensure the homogeneity of the two groups. The survey applied the self-assessment evaluation tool for digital literacy competencies developed by Yang Gil-Seok [12]. The ethical awareness averages in the four domains of values and self-efficacy, self-regulation and participation, emotion and critical reading, and ethics and security were calculated based on the self-assessment results of the learners in the experimental and control groups [12] [13].

**Table 3**.
Pre-test of experimental and control groups.

| Group | Values and self-efficacy | Self-regulation and participation | Emotion and critical reading | Ethics and security | Total average |
|---|---|---|---|---|---|
| Experimental group | 19 | 17 | 14 | 16 | 16.5 |
| Control group | 21 | 15 | 10 | 12 | 14.5 |

**Note:** n=164.

As shown in Table 3, the experimental group had an average ethical awareness score of 16.5, while the control group had an average score of 14.5, indicating a difference of 2.0 between the groups. An Independent t-test was conducted to compare the differences between the groups. Prior to the t-test, the homogeneity of the two groups was verified using Levene's test for equality of variances. As shown in Table 4, with an F-value of 7.31 and a significance level of p=0.03 (less than 0.05), equal variances were not assumed. Therefore, the t-value of 1.52 with a p-value of 0.183 (greater than 0.05) indicated no significant difference between the groups. Thus, the experimental and control groups were interpreted as homogeneous.

**Table 4.**
T-validation of experimental and control groups.

| | Literacy Factor | Subject | Learning Objectives |
|---|---|---|---|
| 1 | Fairness of AI | Necessity of ethics | Looking at the need for ethics |
| 2 | Fairness of AI | Necessity of AI Ethics | Investigating the Necessity and Types of AI Ethics |
| 3 | Accountability of AI | Characteristics of AI | Problems with results different from predictions |
| 4 | Collaborate with AI | | Discussion: The problem of bias in Data |
| 5 | Accountability of AI | Copyright of AI | Types and Risks of Copyright |
| 6 | Transparency of AI | | Discussion: The issue of AI ethics |
| 7 | Collaborate with AI | Privacy protection in AI | The types of personal information |
| 8 | Fairness of AI | | Discussion: Right to be Forgotten |
| 9 | Collaborate with AI | Safety of AI | Priority of algorithms |
| 10 | Transparency of AI | | Discussion: Transparency of AI Algorithms |

*3.2. Research Method*

Both the experimental and control groups were taught according to the lesson plan outlined in Table 5. The experimental group used generative AI to create instructional materials, such as videos and related course materials, and watched news reports relevant to the learning objectives. In each session, the experimental group was informed about the societal issues related to data bias and

algorithm transparency in generative AI outputs. The control group followed the lesson plan without any additional interventions. The final ethical awareness evaluation for both groups utilized the self-assessment evaluation tool for digital literacy competencies developed by Yang Kilseok, measuring averages in values and self-efficacy, self-regulation and participation, emotion and critical reading, and ethics and security across the 10 sessions.

**Table 5.**
Comparison of averages of experimental and control groups by domain.

| | Experimental group | | | | Control group | | | |
|---|---|---|---|---|---|---|---|---|
| | **Values and self-efficacy** | **Self-regulation and participation** | **Emotion and critical reading** | **Ethics and security** | **Values and self-efficacy** | **Self-regulation and participation** | **Emotion and critical reading** | **Ethics and security** |
| 1 | 20 | 22 | 15 | 19 | 22 | 18 | 9 | 11 |
| 2 | 24 | 24 | 16 | 21 | 21 | 16 | 9 | 12 |
| 3 | 22 | 25 | 13 | 18 | 20 | 14 | 10 | 12 |
| 4 | 25 | 24 | 16 | 22 | 23 | 17 | 13 | 15 |
| 5 | 25 | 22 | 16 | 24 | 23 | 17 | 12 | 14 |
| Mean | 23.20 | 23.4 | 15.20 | 20.80 | 21.80 | 16.40 | 10.60 | 12.80 |

**Note:** n=164.

*3.3. Research Results and Direction*

The results of evaluating the ethical awareness of the experimental and control groups are shown in Table 6. The experimental group, which received supplementary instructional materials on generative AI ethics, showed an approximately twofold increase in ethical awareness compared to the control group. Furthermore, the experimental group's ethical awareness consistently improved over the sessions, albeit gradually, surpassing the control group.

Therefore, the study concluded that incorporating guidelines on the risks and precautions of generative AI in ethics education can systematically enhance learners' ethical awareness and foster a proactive attitude toward self-directed ethical problem-solving in challenging situations.

Ethics education is essential knowledge for all users living in an intelligent information society. With the increasing ubiquity of generative AI, the seriousness of related ethical issues is widely recognized. However, practical research on the ethical application and utility of generative AI use remains insufficient.

This study suggests that providing guidance on the appropriate use of generative AI can significantly aid in fostering ethical awareness among users. Thus, a systematic literacy education that actively helps users recognize the ethical necessity and guidelines for using AI is needed, rather than merely placing the responsibility on users.

Therefore, the study concluded that incorporating guidelines on the risks and precautions of generative AI in ethics education can systematically enhance learners' ethical awareness and foster a proactive attitude toward self-directed ethical problem-solving in challenging situations. Ethics education is essential knowledge for all users living in an intelligent information society. With the increasing ubiquity of generative AI, the seriousness of related ethical issues is widely recognized. However, practical research on the ethical application and utility of generative AI use remains insufficient. This study suggests that providing guidance on the appropriate use of generative AI can significantly aid in fostering ethical awareness among users. Thus, a systematic literacy education that actively helps users recognize the ethical necessity and guidelines for using AI is needed, rather than merely placing the responsibility on users.

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**Table 6.**
Post-tests of the experimental and control groups.

| Group | 1st time average | 2nd time average | 3rd time average | 4th time average | 5th time average | Total average |
|---|---|---|---|---|---|---|
| Experimental group | 19 | 21.3 | 19.5 | 21.8 | 21.8 | 20.7 |
| Control group | 15 | 14.5 | 14 | 17 | 16.5 | 15.4 |

n=164

## 4. Result and Discussions

With the rapid development and proliferation of the intelligent information society, generative AI is frequently encountered in daily life and educational processes. Generative AI ethics can assist users in responsibly utilizing this technology. Improper use of generative AI can lead to severe issues, such as breaches of personal information and the dissemination of false information. Establishing generative AI ethical awareness provides a foundation for us to grow as ethical leaders in future technological societies. Both users and developers can contribute to building a better society through the ethical use of technology. Therefore, it is crucial for users of generative AI to develop the ability to assess the reliability and sources of the data generated by AI.

As information progresses across society, the complexity and interrelation of technological and ethical issues become more intricate, emerging as significant societal problems. Ethical awareness is increasingly recognized as a critical societal issue. Modern informatization problems demand insight and diversity, as opposed to rigid and standardized thinking, while creating and applying new knowledge. Ethical education needs to train individuals to wisely navigate these situations, necessitating the development of corresponding curricula.

As generative AI services and applications expand, the necessity of establishing related ethical standards becomes apparent. Generative AI ethics start by considering how AI technology can benefit or harm humans, how to utilize the outcomes, and the broader societal impacts.

This study investigated whether guiding users on the literacy elements related to the risks and cautionary aspects of generative artificial intelligence (AI) at the stage of accepting AI-generated outputs would enhance their ethical awareness. To validate this, six key AI literacy elements—fairness, accountability, transparency, safety, communication, and collaboration—were incorporated into the design of an ethics education curriculum. The curriculum was tested on 164 university students enrolled in AI ethics courses during the 2023-2024 academic year. After explaining the study's objectives, participants were given the option to self-select into either the experimental or control group. Ethical awareness was measured post-education in four domains: values and self-efficacy, self-regulation and engagement, emotions and critical reading, and ethics and security, based on self-assessment results from both groups.

The study aimed to assess the impact of guiding users on the literacy elements related to the risks and cautionary aspects of generative AI at the stage of accepting AI-generated outputs, leading to the following conclusions:

First, the experimental group, which was informed about the societal issues surrounding data bias and algorithmic transparency in AI-generated outputs, showed a consistent improvement in ethical awareness across all four domains when compared to their pre-education levels. This confirms that informing users about ethical risks and cautionary points before using generative AI can significantly influence their ethical awareness.

Second, notable differences were observed between the pre- and post-education averages in the experimental group, particularly in the domains of values and self-efficacy (pre-mean: 19, post-mean: 23.2), self-regulation and engagement (pre-mean: 17, post-mean: 23.4), and ethics and security (pre-mean: 16, post-mean: 20.6). These findings suggest that AI literacy education can significantly impact users' ethical awareness.

Also, the study investigated impact of guiding students on the risks and precautions of generative AI as an approach to ethics education. The findings suggest that while generative AI is easily accessible,

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informing users about the associated risks and precautions significantly influences their ethical awareness. This conclusion indicates that the use of generative AI without guidelines may negatively affect ethical awareness.

With the advancement of technology, ethical education methods must evolve beyond traditional frameworks to foster problem-solving abilities suitable for contemporary situations. However, the current state of ethical education often focuses solely on ethical risks without actively addressing solutions and responsible usage. Ethical issues will invariably arise with technological advancements. To instill the importance of ethical awareness alongside technology, ethical guidelines must accompany technological dissemination.

This study verified that incorporating elements of generative AI risks and precautions into the design of ethics education curricula significantly enhances learners' ethical awareness. It is anticipated that the systematic integration of educational elements related to the risks and precautions of generative AI will become a driving force in addressing societal ethical issues.

## 5. Conclusions

This study aimed to evaluate the impact of incorporating literacy education on the ethical risks and considerations of generative AI in improving users' ethical awareness. Through a structured ethics curriculum that included six key AI literacy elements—fairness, accountability, transparency, safety, communication, and collaboration—significant improvements in ethical awareness were observed in the experimental group compared to the control group.

The findings reveal that providing users with ethical guidelines and informing them about potential risks before accepting AI-generated outputs fosters a more informed and cautious approach to using AI technologies. Specifically, participants in the experimental group exhibited a notable increase in ethical awareness across the domains of values and self-efficacy, self-regulation and engagement, and ethics and security. These improvements underscore the effectiveness of incorporating structured AI literacy education in mitigating the ethical challenges posed by the rapid proliferation of generative AI.

Given the increasing integration of generative AI in both every day and professional contexts, this study highlights the urgent need for systematic AI ethics education. As AI continues to evolve, ethical awareness cannot be left as an afterthought but must be ingrained in both the development and use of these technologies. Future research should focus on expanding the scope of AI ethics education to include diverse user groups and technological contexts, ensuring that ethical literacy becomes a fundamental component of AI usage in society. Ultimately, promoting ethical competence through targeted education is crucial for ensuring that generative AI serves as a tool for positive societal impact while minimizing potential risks.



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