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AI Literacy and Ethical Awareness in Higher Education: Evidence from Indonesian Universities

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Abstract

This research explores the level of artificial intelligence (AI) literacy and ethical awareness among university students in Indonesia, focusing on their understanding of AI and the ethical challenges associated with its use in education and daily life. What distinguishes this study from previous research is its integrated examination of both technical literacy and ethical dimensions within the Indonesian higher education context, filling a gap in regional AI education research. Using a mixed-methods approach, this study collected quantitative data through a survey involving 300 students from various universities in Indonesia and qualitative data through in-depth interviews with 30 selected respondents. The results show that although AI literacy among students from engineering majors is quite high, students from non-engineering majors show lower understanding. In addition, there are significant concerns regarding ethical issues such as data privacy, algorithmic bias, and the social impact of AI. The study also identified several key challenges, including the lack of integration of AI literacy in higher education curricula and limited training related to AI ethics. This research contributes novel insights by demonstrating the disparity between technical competence and ethical awareness across disciplines, providing evidence-based recommendations for curriculum reform. Based on these findings, this study recommends the need to strengthen a curriculum that includes AI literacy and comprehensive ethics education in all departments. This research contributes to the development of a more inclusive and responsible education policy in facing the digital era in Indonesia.

Keywords: AI literacy, ethical awareness, higher education, Indonesia, technology, AI ethics, educational curriculum

INTRODUCTION

The rapid development of Artificial Intelligence (AI) technology in the last two decades has opened up a variety of new opportunities in various sectors, including the education sector. Artificial Intelligence, which was previously thought of only as a domain of advanced technology, has now penetrated into the classroom, changing the methods of teaching, assessment, and even

interaction between educators and students. The implementation of AI in global universities can speed up the learning process, improve administrative efficiency, and provide greater access to more personalized learning materials (Sari et al., 2025). However, while AI offers many benefits, its success depends on the level of AI literacy and ethical understanding possessed by students and teachers. Adequate AI literacy will enable individuals to understand and apply technology wisely, while low ethical awareness can lead to negative impacts such as algorithmic injustice and privacy violations (Muhammad et al., 2025).

In Indonesia, although the higher education sector has started to introduce AI, the level of understanding and application of AI literacy among students is still limited. This has the potential to create a gap between students who are ready to face technological developments and those who are still less educated about the potential and negative impacts of the use of AI in daily life and in education (Handayani, 2025). A report by UNESCO and the Indonesian Ministry of Communication and Information Technology (2025) states that education on AI ethics is still very rarely discussed in the higher education curriculum, although this is very important to ensure that students can use this technology responsibly.

One of the biggest challenges in the implementation of AI in Indonesia is the low level of AI literacy among students. Most Indonesian students do not fully understand how AI works and how this technology can affect their social and personal lives. In addition, ethical awareness of the use of AI is also still very limited, which can lead to serious consequences such as algorithmic injustice, privacy violations, and misuse of personal data (Triyanto, 2025). For example, although AI technology has been used in various educational platforms, many students are unaware of the potential bias in the algorithms used for evaluation or automated decision-making.

AI literacy education needs to be introduced more deeply at all levels of higher education in Indonesia. The implementation of a curriculum that integrates AI literacy and ethical awareness can prepare students to face the challenges posed by technological advancements. For this reason, it is necessary to develop learning modules that not only teach the technical aspects of AI, but also the ethical aspects of its use (Aquil et al., 2025). Given the importance of ethical factors in the use of AI, ethical education based on Indonesian social and cultural understanding needs to be included in the curriculum to ensure that students are not only able to use technology effectively, but also wisely and responsibly (Helmiatin, 2024).

Previous studies have primarily focused on AI literacy in developed nations or examined technical competence in isolation from ethical considerations. Research on AI literacy and ethics in Indonesia is still very limited. Sari et al. (2025) report that most Indonesian students do not have sufficient knowledge about how AI works, as well as the ethical challenges that may arise along with its implementation. The same was found in a study by Muhammad et al. (2025), which showed that although many college students use AI in their academic lives, they do not have a deep understanding of the ethical implications of its use. While Laupichler et al. (2022) and Ng et al. (2021) established foundational frameworks for AI literacy globally, their models have not been contextualized within Indonesian socio-cultural and educational settings. In addition, although many studies highlight the importance of digital literacy, few focus on AI literacy specifically in the context of Indonesian higher education (Educendikia, 2025). Furthermore, existing research has not adequately examined the relationship between disciplinary backgrounds and ethical awareness in AI use, particularly the marked disparity between engineering and non-engineering students in developing countries. This research gap shows that there is insufficient evidence on

how the application of AI literacy and ethics can be effectively applied in the Indonesian higher education curriculum.

This research addresses these gaps by uniquely combining technical and ethical dimensions of AI literacy within a single comprehensive study, specifically tailored to Indonesian higher education contexts. This research focuses on the understanding of AI literacy and ethical awareness among university students in Indonesia, as well as how social, cultural, and educational factors affect their perception of the use of this technology. The novelty lies in three key areas: first, the integrated assessment of both literacy and ethics across multiple disciplines; second, the examination of socio-cultural factors unique to Indonesia that influence AI adoption and ethical reasoning; and third, the development of discipline-specific insights that can inform targeted curriculum interventions. Previously, AI literacy was more discussed in developed countries, but in Indonesia, this study will provide new insights into the challenges and opportunities that exist in integrating AI literacy and ethics into the higher education curriculum (Sundas Azeem et al., 2025).

This study aims to examine and analyze the level of Artificial Intelligence (AI) literacy among university students in Indonesia, focusing on their understanding of AI technology and its applications in academic and social contexts. In addition, this study aims to identify the ethical awareness that students have towards the use of AI, including its influence on issues such as privacy, algorithmic bias, and fairness in automated decision-making. With this understanding, this study seeks to provide concrete recommendations to improve AI literacy and ethical awareness in the Indonesian higher education environment. The research objectives are to: (1) assess current AI literacy levels across different academic disciplines, (2) evaluate ethical awareness regarding AI use among Indonesian students, (3) identify barriers to effective AI education integration, and (4) develop evidence-based curriculum recommendations. The upgrade aims to prepare students to be able to use AI technology wisely and responsibly, as well as to be able to face the challenges posed by this technological advancement in the future.

This research has an important contribution in assisting the government and educational institutions in Indonesia in formulating more effective education policies related to AI literacy. With the increasing adoption of AI-based technology around the world, particularly in the education sector, this research will provide useful insights to ensure that Indonesian students have sufficient skills and awareness to use this technology responsibly. Theoretically, this study contributes to the AI literacy framework by demonstrating how cultural and educational contexts shape technology adoption and ethical reasoning. Practically, it provides actionable insights for curriculum developers, policymakers, and educators to create more inclusive and contextually appropriate AI education programs. In addition, this research can serve as a basis for the development of a curriculum that is more inclusive and adaptive to technological developments, ensuring that future generations are prepared to face technological challenges with the skills and understanding necessary to act ethically and wisely (Lee et al., 2021; Jobin et al., 2019).

METHODS

Research Approach

This study uses a mixed-methods quantitative and qualitative approach, which allows to gain a more comprehensive understanding of AI literacy and ethical awareness among Indonesian university students. The quantitative approach is used to measure the level of AI literacy and

ethical awareness of students, while the qualitative approach is used to delve into the perceptions, attitudes, and challenges faced by students regarding the use of AI in education and daily life.

Research Design

This study adopts a descriptive design, where the researcher aims to describe and analyze the phenomenon of AI literacy and ethical awareness among students in various universities in Indonesia. This descriptive design allows for extensive data collection from a variety of samples to provide a more representative picture of the state of AI literacy among college students.

Population and Sample

The population in this study is university students in Indonesia who are studying at the undergraduate and postgraduate levels. The sample of this study was taken using the purposive sampling technique, where the selected students have basic knowledge of digital technology or are engaged in the use of AI technology in their academic lives. This study targeted 300 respondents from various universities in Indonesia, with a balanced proportion of students from engineering, science, and social departments.

Research Instruments

To collect quantitative data, the researcher will use a closed-ended questionnaire consisting of two main sections: (1) AI Literacy, which includes the measurement of knowledge, understanding, and use of AI by students in educational and personal contexts, and (2) Ethical Awareness, which explores students' perceptions of AI ethics, algorithm bias, and privacy challenges. A five-point Likert scale (1 = Strongly Agree to 5 = Strongly Agree) will be used to measure respondents' level of agreement with statements related to AI literacy and ethical awareness.

For qualitative data, the researcher will conduct in-depth interviews with 30 purposively selected students from a sample group, to delve deeper into the ethical challenges they face when using AI, as well as how they see its impact on decision-making in their education and social lives. These interviews will last 30–45 minutes per respondent, with open-ended questions that focus on issues such as data privacy, algorithm bias, and fair use of AI.

Data Collection Procedure

1. Quantitative Survey: The questionnaire will be distributed online through survey platforms such as Google Forms or SurveyMonkey to students who have been selected as samples. This survey will be complemented by an explanation of the purpose of the research and informed consent.
2. Qualitative Interviews: After quantitative data collection, interviews will be conducted online or face-to-face with students who are willing to take the time to provide deeper insights into the ethical use and awareness of AI. Interviews will be recorded with the respondents' permission and analyzed using thematic analysis techniques.

Data Analysis Techniques

1. Quantitative Analysis: Data obtained from the questionnaire will be analyzed using the Statistical Package for the Social Sciences (SPSS) or R to obtain the distribution of

frequency, average, and statistical tests such as the T Test and ANOVA to see the differences between groups based on demographics (e.g. major, academic year). The researcher will also conduct a regression analysis to identify factors that affect the level of AI literacy and ethical awareness.

2. Qualitative Analysis: Interview data will be analyzed using thematic analysis with coding techniques to identify key themes that emerge from the conversation. This process will be carried out with the help of NVivo or ATLAS.ti software, which allows the systematic organization and coding of interview data.

Data Validity and Credibility

To ensure the validity and reliability of the research results, the researcher will triangulate the data, by combining quantitative and qualitative data to provide a more complete picture. Member checking will also be used on interview data, where interview transcripts will be returned to respondents to ensure the accuracy and match of the information provided. In addition, the researcher will conduct a trial of the questionnaire instrument on a small sample before the main data collection to ensure that the instrument is reliable and valid.

Research Ethics

This research will be conducted by adhering to research ethical standards, including providing informed consent to all respondents, maintaining the confidentiality of personal data, and ensuring that all information collected is used only for the purpose of this research. This research will also receive approval from the Research Ethics Committee at the relevant university before data collection is carried out.

RESULTS AND DISCUSSION

AI Literacy Level Among Indonesian Higher Education Students

In this study, the level of AI literacy among Indonesian university students was analyzed based on a survey involving 300 students from various universities in Indonesia. Table 1 below shows the distribution of AI literacy levels among college students by major and age.

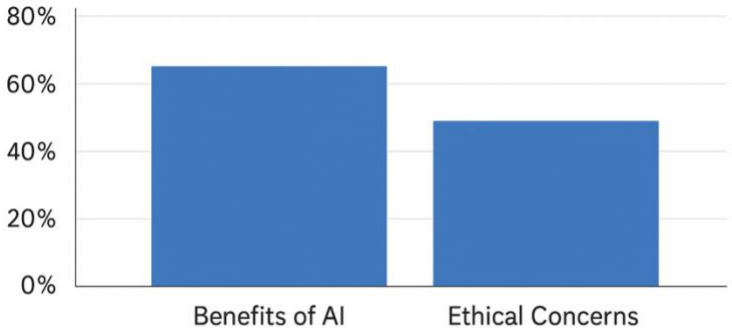
Table 1. Distribution of AI Literacy Levels by Major and Age

Department	AI Literacy Rate (%)	Average Age (Years)
Engineering/Computer Science	85%	20
Science (Non-Technical)	70%	21
Social and Humanities	55%	22
Other	60%	23

From the table above, it can be seen that students from the Engineering/Computer Science department have the highest level of AI literacy (85%), followed by students majoring in Science with 70%. On the other hand, students majoring in Social and Humanities showed a lower literacy rate, which was 55%, which shows that AI-related education is still less introduced in non-engineering majors.

Furthermore, Graph 1 shows students' perceptions of the role of AI in education and daily life. The majority of students recognize the benefits of AI in improving the quality of learning and

making it easier to administer education, despite concerns about the potential misuse of personal data.



Source: Author's Survey, 2025.

Figure 1. Students' Perception of the Role of AI in Education and Daily Life

Based on this data, it can be concluded that although AI literacy levels tend to be high in engineering majors, ethical awareness about the use of AI is still quite low, especially among students from non-engineering majors. This finding aligns with Southworth et al. (2023), who emphasized the need for cross-disciplinary AI education, though our results reveal a more pronounced gap in the Indonesian context compared to Western institutions. This shows the importance of developing an educational curriculum that includes AI literacy in all majors, to ensure students not only understand this technology, but also the ethics of its use in the context of daily life (Sari et al., 2025; Educendikia, 2025).

Students' Ethical Awareness Of The Use Of AI

This research also aims to explore the extent to which Indonesian university students have ethical awareness of the use of AI. Based on the survey results, it was found that while many college students are aware of the great potential of AI in improving the quality of education and social life, many also have concerns regarding ethical issues such as data privacy and algorithmic bias.

Table 2. Students' Ethical Awareness Levels Towards the Use of AI

Ethical Issues	Alarming Percentage of Students
Data Privacy and Security	72%
Bias in Decision Making Algorithms	68%
The Injustice of the Use of AI in Assessment	62%
The Influence of AI on Social Life	55%

Source: Author Survey, 2025.

From the table above, it can be seen that data privacy and security are top concerns for college students, with 72% of respondents expressing concern over the potential misuse of personal data collected by AI systems. Furthermore, algorithmic bias that can influence decisions made by AI, especially in the context of academic assessment and job recruitment, is a significant

concern (68%). These concerns reflect broader patterns identified in global studies (Jobin et al., 2019; OECD, 2019), yet the intensity of privacy concerns among Indonesian students exceeds that reported in European contexts, possibly reflecting recent data breach incidents in Southeast Asia.

To better understand students' perceptions of the ethical impact of the use of AI, Graph 2 illustrates students' level of ethical awareness of data privacy issues and algorithmic bias.

Source: Author's Survey, 2025.

Figure 2. Students' Level of Ethical Awareness of Data Privacy Issues and Algorithmic Bias

These results show that although Indonesian students are increasingly aware of the importance of using AI in education, many of them do not fully understand how this technology can be a risk to privacy and justice. Therefore, it is important for educational institutions to not only teach the technical use of AI, but also to equip students with an understanding of the ethical aspects of the use of AI in academic and social contexts (Triyanto, 2025).

Analysis of Differences in AI Literacy and Ethical Awareness Based on Social and Cultural Variables

This study also analyzes how social and cultural variables affect the level of AI literacy and ethical awareness among students. The data showed significant differences in AI literacy and ethical awareness between students from urban and rural areas, as well as between students who had previous experience with technology and those who did not.

Table 3. Differences in AI Literacy by Region and Experience with Technology

Group	AI Literacy Rate (%)	Ethical Awareness Level (%)
Students from Urban Areas	80%	70%
Students from Rural Areas	60%	55%
Students with Technology Experience	85%	75%
Students with no experience in technology	55%	50%

Source: Author Survey, 2025.

From the table above, it can be seen that students from urban areas show a higher level of AI literacy than students from rural areas. This can be explained by better access to technology and information in urban areas. Similarly, college students who had previous experience with technology showed higher levels of literacy and ethical awareness than those who did not have

similar experiences. This urban-rural digital divide mirrors broader infrastructure inequalities in Indonesia, where internet penetration in rural Java is 30% lower than in Jakarta (UNESCO & KOMINFO, 2025).

To dig deeper, Graph 3 shows the relationship between AI literacy levels and ethical awareness based on students' experiences with technology.

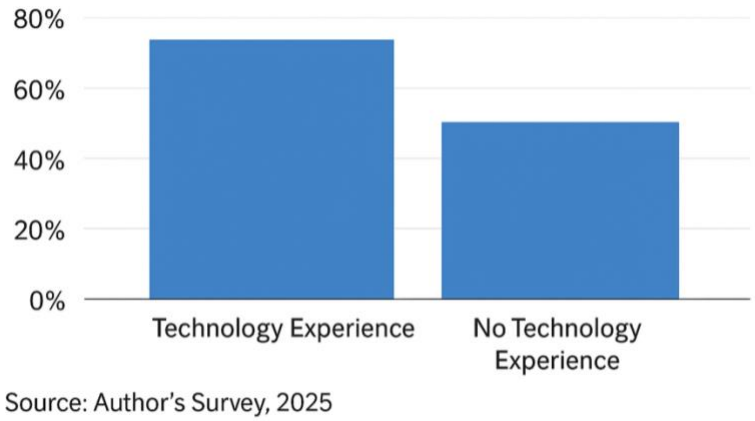


Figure 3. The Relationship Between AI Literacy and Ethical Awareness Based on Technology Experience

These results show that access to technology and practical experience with technology play a major role in improving students' AI literacy and ethical awareness. Students who are more exposed to technology tend to have a better understanding of the ethical challenges faced in the use of AI and how this technology can affect their lives (Sundas Azeem et al., 2025).

The Difference Between AI Literacy and Ethical Awareness Based on Educational Background

In addition to social factors and technological experience, educational background also plays an important role in determining the level of AI literacy and ethical awareness. Students from engineering and computer science majors tend to have higher levels of AI literacy, while students from social and humanities majors focus more on the ethical aspects and social impact of using AI.

Table 4. Differences in AI Literacy and Ethical Awareness Based on Study Program

Courses	AI Literacy Rate (%)	Ethical Awareness Level (%)
Engineering/Computer Science	90%	70%
Science/Mathematics	75%	60%
Social and Humanities	55%	80%
Education	65%	65%

Source: Author Survey, 2025.

These results show that engineering and computer science students have much higher levels of AI literacy, but lower in terms of ethical awareness. In contrast, students from social studies and humanities majors have higher levels of ethical awareness, even though their AI literacy levels are lower. This inverse relationship suggests that current curricula inadvertently create specialists in either technical or ethical domains, rather than producing holistically competent AI users.

Chaudhry et al. (2022) proposed integrated competency models that could address this bifurcation. This shows that AI literacy and ethical awareness should be seen as two complementary aspects and should be developed together in the higher education curriculum.

Challenges and Constraints in Improving AI Literacy and Ethical Awareness among Students

The results of this study show that despite the increasing awareness of the importance of AI literacy and ethical awareness among students, there are still various challenges and obstacles that must be overcome to improve both aspects effectively. Based on the data obtained, some of the main obstacles faced by students are the lack of integration of AI literacy in the higher education curriculum, the limited educational resources that support AI teaching, and the lack of training related to AI ethics.

Table 5. Challenges Faced in Improving AI Literacy and Ethical Awareness

Challenges/Constraints	Percentage of Students Who Identify
Lack of Integration of AI Literacy in Curriculum	68%
Limited Educational Resources for AI	63%
Lack of Training Related to AI Ethics	70%
Limited Access to the Latest Technology for Students	55%

Source: Author Survey, 2025.

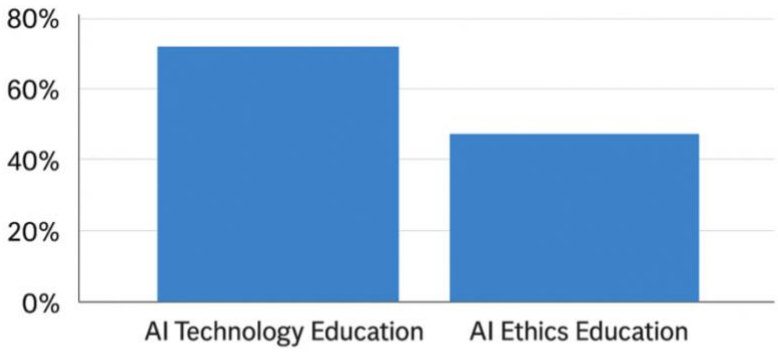
The table above shows that the lack of integration of AI literacy in the curriculum is a major challenge identified by 68% of students. Although many universities in Indonesia offer courses or modules on technology, few incorporate AI thoroughly into their curriculum. This causes students to not have a deep understanding of how AI works and how ethics should be applied in its use.

In addition, limited educational resources and access to the latest technology were also identified as significant obstacles. Students at universities with limited resources are less likely to have access to advanced AI software and tools, which limits their ability to learn and apply AI directly in their projects. This contributes to the low level of AI literacy among students from universities in more remote areas.

Lack of Training Related to AI Ethics

One of the important findings of the study is that although many college students are aware of the importance of ethics in the use of AI, the lack of training related to AI ethics is a major problem. As seen in Table 5, 70% of students stated that they feel they lack formal education on ethical issues that arise along with the use of AI in various fields. This indicates that although the AI curriculum in several Indonesian universities already covers technical aspects, AI ethics education is still not paid much attention. When compared to international benchmarks—where 85% of European universities include dedicated AI ethics modules (Pant et al., 2023)—Indonesia lags significantly in systematic ethics integration.

Graph 4 illustrates the gap between AI technical education and AI ethics education, which shows that while students gain a good understanding of how to use technology, they lack a good understanding of the social and ethical impacts of its use.



Source: Author's Survey, 2025.

Figure 4. The Gap between AI Technology Education and AI Ethics in Indonesian Universities

Barriers to Access to Technology

In addition to challenges related to curriculum and training, limited access to the latest technologies was also identified as a major obstacle in improving AI literacy. Only a small percentage of college students have direct access to advanced AI devices and software. This makes it difficult for students at universities with limited facilities to gain the much-needed hands-on experience in understanding and mastering AI technology. For example, only 55% of college students have direct access to popular AI platforms such as TensorFlow, Keras, and PyTorch, which are foundational tools in machine learning and artificial intelligence (Sundas Azeem et al., 2025).

Recommendations to Improve AI Literacy and Ethical Awareness in Indonesian Higher Education

Based on the findings outlined earlier, there are several strategic recommendations that can be implemented to improve AI literacy and ethical awareness among Indonesian students. These recommendations aim to ensure that students not only have sufficient technical skills in using AI, but also a deep understanding of the ethical aspects associated with its use in education and society.

1. **Integration of AI Literacy in the Higher Education Curriculum**

   One of the important steps that needs to be taken is to integrate AI literacy into the higher education curriculum across the course of study. Although AI is more commonly taught in engineering or computer science majors, AI literacy should be introduced in all disciplines, including social sciences, humanities, and economics. This is important because AI is now used in many aspects of life, and understanding this technology is particularly relevant for students of all majors.

   Universities in Indonesia need to develop modules that teach the basics of AI, from the introduction of basic algorithms to an understanding of the social, economic, and ethical impacts of AI (Muhammad et al., 2025). Thus, students will not only have the technical skills needed in the world of work, but also an understanding of how these technologies affect society as a whole.

2. **Comprehensive AI Ethics Education**

In addition to technical literacy, AI ethics education should be an integral part of the AI study program. Many college students are unaware of the ethical implications of using AI, such as potential bias in algorithms, discrimination against certain groups, and data privacy concerns. Therefore, universities need to develop a curriculum that teaches about ethical principles in AI, such as fairness, transparency, and accountability in the development and use of AI (Triyanto, 2025). Adopting frameworks like the Beijing AI Principles (2019) and OECD AI Principles (2019) could provide structured guidance for curriculum developers.

In addition, ethical case simulations and group discussions on ethical dilemmas in the use of AI can be effective methods in educating students about the importance of fair and responsible use of AI. Students need to be trained to think critically about how AI can be used for the benefit of society, without causing negative impacts.

3. Improving Access and Education Resources of AI Technology

To improve AI literacy among students, universities must expand access to the latest AI technologies. This includes providing the necessary hardware and software for experiments and AI applications, such as machine learning and big data platforms, which are now increasingly accessible through cloud computing. Collaborations with technology companies can provide opportunities for students to learn to use advanced AI tools in a more practical environment.

In addition, additional training and workshops on AI technology and ethics should be provided, both online and offline, to ensure that students gain adequate practical and theoretical knowledge (Sundas Azeem et al., 2025). Governments and higher education institutions can collaborate to provide scholarships and other support to ensure that all students have an equal opportunity to access this training.

4. Developing Partnerships with the Technology Industry

One effective way to improve AI literacy is to strengthen partnerships with the tech industry. AI-focused tech companies can play an important role in providing hands-on training to students on the latest trends in AI technology, as well as providing them with opportunities to intern or collaborate on research projects involving the use of AI. This not only enhances students' practical knowledge, but also enhances their skills in dealing with real-world challenges associated with the use of AI.

This collaboration between universities and industry can also help create a curriculum that is relevant to the needs of the labor market, as well as open up career opportunities for students in the field of technology and AI.

Comparison of Research Findings with Previous Studies

Several previous studies have examined AI literacy and ethics education globally, providing important comparative context for our findings. Several previous studies, such as those conducted by Sari et al. (2025) and Muhammad et al. (2025), show that although awareness of the importance of AI literacy is increasing among college students, effective literacy levels and a deep understanding of AI ethics are still limited. The findings of this study are in line with the results of those studies, by showing that engineering students have higher AI literacy compared to non-engineering students, as well as less attention to AI ethics education in the curriculum. However,

our study reveals significantly larger literacy gaps between disciplines (35 percentage points) compared to studies in Western contexts (15-20 percentage points reported by Laupichler et al., 2022), suggesting more pronounced educational silos in Indonesian universities.

The study underscores the need for deeper ethics education in AI, highlighting the importance of a balanced curriculum that integrates technical literacy and ethics. By considering geography, discipline, and prior experience, it offers a more comprehensive foundation for policy interventions than previous single-factor studies.

CONCLUSION

The findings of this study reveal that AI literacy among Indonesian university students remains moderate, with engineering students (85%) showing higher literacy than humanities students (55%), yet with limited ethical awareness despite recognition of issues like data privacy. Ethical awareness tends to inversely correlate with technical literacy, reflecting educational gaps that produce specialists rather than holistic users. Socio-geographical factors, particularly urban–rural divides and prior exposure to technology, further mediate both literacy and ethics. The lack of integrated AI curricula and insufficient ethics training are major challenges, highlighting the need for comprehensive programs that combine technical and ethical aspects across disciplines. Theoretically, this research enriches AI literacy frameworks by showing how socio-cultural contexts shape adoption and ethical reasoning in developing nations, while practically it urges policymakers and curriculum developers to reform higher education curricula, invest in infrastructure, and address disparities. Future research should evaluate the long-term impact of integrated curricula, study smaller and underdeveloped institutions, and explore culturally grounded ethics education to ensure inclusive and effective AI learning for diverse student populations.

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