E-ISSN : 2988-1986
https://ejournal.cahayailmubangsa.institute/index.php/kohesi

Kohesi: Jurnal Multidisiplin Saintek
Volume 10 No 8 Tahun 2026

AN ANALYSIS OF INDONESIAN COMPUTER SCIENCE STUDENTS' PERCEPTIONS OF ETHICAL ISSUES AND BIAS IN LOCAL LANGUAGE AI MODELS

Alfandi[1], Kahfi Lanang[2], M. Ramdan[3], M. Giopani Batubara[4]
Informatics Engineering Study Program
Kaputama College of Informatics and Computer Management, Binjai City
Veteran Street No. 4A-9 A, Binjai City 25656 Binjai North Sumatra

Email : fandyal100@gmail.com[1], kahfilanang84@gmail.com[2], ramdan14112001@gmail.com[3], muhammadgiopani05@gmail.com[4]

ABSTRACT

Artificial Intelligence (AI) systems that support local languages have grown rapidly in Indonesia, yet concerns about ethical use and inherent bias remain underexplored—especially among future technology professionals. This study investigates how Indonesian Computer Science students perceive ethical issues and algorithmic bias in AI models trained on local language data. Using a mixed-methods approach, a structured survey and in-depth interviews were conducted with 250 undergraduate students from multiple universities across Indonesia. Quantitative analysis measured levels of awareness, perceived risk, and ethical concern, while qualitative insights captured students' reflections on fairness, transparency, and social impact. Results show that although most participants recognize the potential benefits of AI for local language processing, there is a significant gap in understanding how bias can affect underserved communities and reinforce harmful stereotypes. Additionally, many students expressed a desire for ethics education to be better integrated into computer science curricula. These findings highlight the need for more comprehensive ethical frameworks tailored to regional contexts, and suggest that enhancing ethical literacy among future engineers is essential for the responsible development of AI technologies. This research contributes to ongoing discussions about AI governance and supports the design of pedagogical interventions to foster more ethically informed practitioners.

Keywords: *Artificial Intelligence Ethics, Algorithmic Bias, Local Language AI Models, Student Perception, Computer Science Education, Indonesia*

Article History
Received: Januari 2026
Reviewed:Januari 2026
Published: Januari 2026

Plagiarism Checker No 235
Prefix DOI : 10.8734/Kohesi.v1i2.365
Copyright : Author
Publish by : Kohesi

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License

1. Introduction

The development of Artificial Intelligence (AI) systems that support local languages has become a strategic priority in Indonesia, driven by the need to enhance digital inclusion and preserve linguistic diversity. Local language AI models offer significant potential to bridge communication gaps and expand access to digital technologies for diverse communities. However, localization does not inherently ensure ethical neutrality. Unequal representation of cultural values, regional dialects, and social structures in training data may introduce ethical risks and algorithmic bias into AI systems.

Algorithmic bias remains a critical concern in AI development, as biased outputs can result in unfair treatment, inaccurate representations, and the exclusion of certain groups. In the context of local language AI, such bias may be less visible yet more impactful, given its direct interaction with users' cultural identities and social norms. If these ethical challenges are not adequately addressed, they may undermine public trust and hinder the sustainable adoption of AI technologies.

Educational institutions play a vital role in preparing future AI practitioners to address these challenges. While technical competencies are central to computer science curricula, ethical considerations are often treated as supplementary rather than integral components of AI education. This imbalance may lead to graduates who are technically proficient but insufficiently equipped to recognize and mitigate ethical risks in real-world AI applications.

Given these conditions, it is essential to examine how Computer Science students perceive ethical issues and algorithmic bias in AI systems, particularly those involving local languages. Understanding students' perspectives can reveal existing educational gaps and inform curriculum development, ultimately supporting the advancement of ethically responsible AI practices within the Indonesian context.

2. Materials and Methods

2.1. Research Approach

This study adopts a mixed-methods approach to examine Indonesian Computer Science students' perceptions of ethical issues and bias in local language AI models. Quantitative data were collected through a structured five-point Likert scale questionnaire measuring ethical awareness, perceived algorithmic bias, trust in AI systems, and perceived developer responsibility. To enrich these findings, semi-structured interviews were conducted to explore students' experiences and ethical reflections in greater depth. The integration of quantitative and qualitative methods enables methodological triangulation, enhancing the validity and reliability of the results while providing both statistical trends and contextual understanding of students' ethical perceptions.

2.2. Research Questions

Based on the research objectives and identified gaps in existing literature, this study is guided by the following research questions:

1. RQ1: How do Indonesian Computer Science students perceive ethical issues in AI models designed for local language processing?
2. RQ2: To what extent are students aware of potential algorithmic bias in local language AI models?
3. RQ3: What ethical concerns do students associate with the deployment of local language AI systems in society?
4. RQ4: How do educational experiences in computer science influence students' awareness of ethics and bias in AI development?
5. RQ5: What expectations do students have regarding the integration of AI ethics into computer science curricula?

2.3. Research Design and Objects

This study employs a cross-sectional design within a mixed-methods framework to capture students' perceptions of ethical issues and algorithmic bias in local language AI models at a single point in time. The research objects are undergraduate Computer Science and Informatics students from higher education institutions in Indonesia, selected due to their exposure to AI-related coursework such as artificial intelligence, machine learning, and natural language processing.

The study focuses on students' ethical awareness, attitudes, and judgments toward AI systems processing Indonesian and other local languages, rather than evaluating technical system performance. Participants were recruited using purposive sampling to ensure basic familiarity with AI technologies, while interview participants were selected to represent diverse academic levels and institutional backgrounds, enabling both general and in-depth analysis.

2.4. Data Collection

Data collection was conducted in two sequential phases in accordance with the mixed-methods design, as illustrated in Figure 1. Quantitative data were collected through an online survey distributed to undergraduate Computer Science students from multiple universities in Indonesia using a web-based questionnaire to ensure accessibility and anonymity. Participants were recruited through academic networks and university communication channels over a four-week period, with informed consent obtained prior to participation. Data validation was performed by excluding incomplete or inconsistent responses to ensure data quality.

Following the quantitative phase, a subset of respondents was selected for the qualitative stage based on predefined criteria. Semi-structured online interviews were conducted via video conferencing platforms, each lasting approximately 20–30 minutes, and audio-recorded with participants' consent. Finally, quantitative and qualitative findings were integrated to provide a comprehensive understanding of students' perceptions of ethical issues and bias in local language AI models.

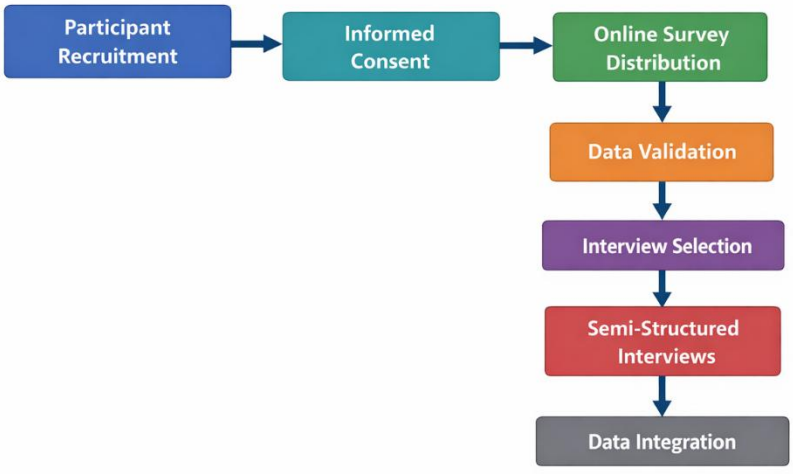


Figure 1 Overview of the data collection procedures

2.5. Research Instruments

Two primary research instruments were employed: a structured questionnaire and a semi-structured interview guide. The questionnaire assessed students' perceptions of ethical issues and algorithmic bias in local language AI models, covering demographics, exposure to AI coursework, ethical awareness, perceived bias, trust in AI systems, and attitudes toward ethics education, using a five-point Likert scale. Questionnaire items were adapted from relevant literature to suit the context of local language AI applications.

The semi-structured interview guide was designed to explore students' experiences, ethical interpretations, and views on developer and institutional responsibility. Its open-ended format enabled in-depth exploration while remaining aligned with the study's research objectives.

2.6. Data Analysis Methods

Quantitative survey data were analyzed using descriptive and inferential statistics to summarize demographic characteristics and perception trends, including means, standard deviations, and frequency distributions, as well as to examine relationships between AI exposure, ethical awareness, and bias perception. Instrument reliability was assessed using Cronbach's alpha.

Qualitative interview data were analyzed through thematic analysis. Transcripts were coded to identify recurring themes related to ethical concerns, bias awareness, and educational expectations. Quantitative and qualitative findings were then integrated through methodological triangulation to enhance interpretive depth and validity.

2.7. Model Training

Although this study does not focus on developing or benchmarking a new artificial intelligence model, an overview of AI model training concepts is included to provide contextual grounding for participants' perceptions. The discussion of model training is essential to ensure that respondents share a common understanding of how bias and ethical issues may emerge during AI development.

In this research context, AI models refer to local language natural language processing (NLP) systems, such as text classification, chatbot, and language generation models trained on Indonesian or regional language datasets. These models typically employ supervised or semi-supervised learning approaches, where large-scale textual data are used to train algorithms to recognize linguistic patterns.

Bias may be introduced during the training phase through several mechanisms, including imbalanced datasets, limited representation of dialects, and culturally biased annotations. Participants were provided with simplified explanations and examples of model training processes—such as data collection, preprocessing, training, and evaluation—prior to completing the survey and interviews. This approach ensured that students' responses were informed by a consistent conceptual framework rather than purely abstract assumptions.

By framing model training as a contextual reference, this study emphasizes how students interpret ethical risks associated with AI development processes, rather than evaluating the technical performance of specific trained models.

2.8. System Design

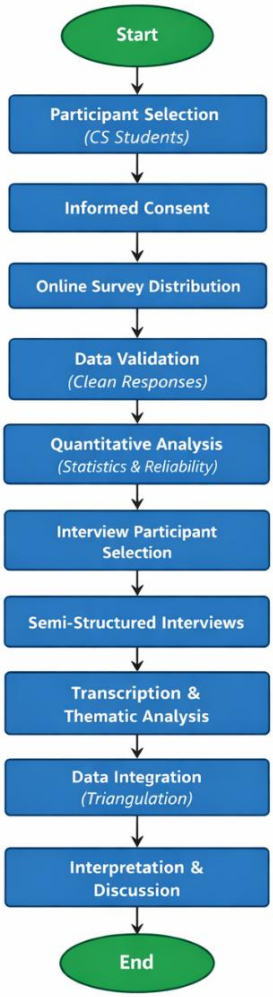


Figure 1. Flowchart

The system design in this study refers to a conceptual research framework for data collection and analysis, rather than the development of a functional AI application. It integrates quantitative and qualitative components in a structured mixed-methods workflow.

The system consists of three main components:

1. Data Input Module, which includes the online questionnaire and interview recordings collected from participants;
2. Processing Module, where survey data are cleaned, coded, and statistically analyzed, while interview transcripts undergo thematic coding;
3. Output Module, which generates analytical results in the form of statistical summaries, thematic patterns, and interpretive findings.

The workflow begins with participant recruitment and informed consent, followed by survey administration and validation. Selected respondents then participate in interviews to complement and explain quantitative results. This integrated design supports methodological

triangulation, enhances research reliability, and remains flexible for future extensions such as longitudinal studies or ethics-focused educational interventions.

3. Result and Discussion

3.1 Quantitative Results

The quantitative analysis is based on valid responses collected from undergraduate Computer Science students across multiple universities in Indonesia. Overall, the results indicate a moderate to high level of awareness regarding ethical issues in artificial intelligence, particularly in relation to fairness, data privacy, and responsible use of AI technologies.

Category	Description	Frequency	Percentage (%)
Gender	Male	132	52.8
	Female	118	47.2
Academic Year	Year 1–2	86	34.4
	Year 3–4	164	65.6
AI Course Experience	Yes	189	75.6
	No	61	24.4

Table 1. Demographic Profile of Respondents

Table 1 presents the demographic characteristics of the respondents. Most participants were in their third or fourth academic year and had prior exposure to AI-related courses. This indicates that the majority of respondents possessed foundational knowledge relevant to the topic of AI ethics and bias, supporting the validity of the perception analysis.

Variable	Mean	Std. Deviation
Ethical Awareness	4.12	0.61
Bias Awareness	3.98	0.67
Trust in AI Systems	3.54	0.72
Importance of Ethics Education	4.36	0.58

(Scale: 1 = Strongly Disagree, 5 = Strongly Agree)

Table 2. Descriptive Statistics of Ethical Awareness and Bias Perception

As shown in Table 2, respondents demonstrated a high level of ethical awareness (M = 4.12) and strong recognition of the importance of ethics education in computer science curricula (M = 4.36). However, trust in AI systems scored comparatively lower, suggesting that ethical and bias concerns may influence students' confidence in AI technologies, particularly those processing local language data.

3.3 Relationship Between AI Education and Ethical Awareness

Figure 2 presents a comparison of ethical awareness scores between students who have completed AI-related coursework and those who have not. Students with prior exposure to AI courses demonstrate consistently higher levels of ethical awareness, indicating a positive association between formal AI education and ethical understanding.

The observed difference suggests that structured AI learning environments play a significant role in enhancing students' ability to recognize ethical risks and algorithmic bias in AI development. This finding reinforces the importance of integrating ethical considerations into technical AI curricula to better prepare students for responsible AI practice.

3.4 Integrated Discussion

The quantitative findings demonstrate that Indonesian Computer Science students generally possess strong ethical awareness, particularly regarding the societal implications of AI technologies. However, the lower trust scores indicate persistent concerns about transparency and fairness in AI systems. These concerns are further supported by qualitative insights, where students emphasized the risk of bias in local language AI models due to limited representation of dialects and cultural diversity.

The combined results suggest that ethical awareness alone is insufficient without technical understanding of how bias emerges during model training. Therefore, embedding ethics into AI-focused coursework may bridge this gap and better prepare students to develop responsible AI systems.

4. Conclusion

The conclusions in this study are:

1. Ethical Awareness of AI Bias
   - The study shows that Indonesian Computer Science students generally recognize ethical issues and algorithmic bias in local language AI models, although the depth of understanding varies among individuals.
2. Impact of AI Education
   - Students with prior exposure to AI-related coursework demonstrate higher levels of ethical awareness, indicating that formal AI education positively influences ethical understanding in AI development.
3. Curriculum Integration Needs
   - The findings suggest that ethical considerations should be systematically embedded within AI and computer science curricula, rather than treated as supplementary or optional topics.
4. Expectations of Ethical Responsibility
   - Qualitative results reveal that students expect stronger ethical accountability from AI developers and educational institutions, emphasizing the need for clearer ethical guidelines and context-aware learning materials.

5. Research Limitations and Future Directions
   - This study is limited by its cross-sectional design and reliance on self-reported data; future research should employ longitudinal approaches, broader samples, and experimental ethics-focused interventions.
6. Implications for Local Language AI Development
   - Overall, the study highlights the importance of integrating ethical awareness into both AI education and the development of local language AI systems to promote responsible, inclusive, and trustworthy AI practices in Indonesia.

5. References

[1] Bender, E. M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). On the dangers of stochastic parrots: Can language models be too big? *Proceedings of the ACM Conference on Fairness, Accountability, and Transparency (FAccT)*, 610–623.

[2] Buolamwini, J., & Gebru, T. (2018). Gender shades: Intersectional accuracy disparities in commercial gender classification. *Proceedings of the Conference on Fairness, Accountability and Transparency*, 77–91.

[3] Mehrabi, N., Morstatter, F., Saxena, N., Lerman, K., & Galstyan, A. (2021). A survey on bias and fairness in machine learning. *ACM Computing Surveys*, 54(6), 1–35.

[4] Suresh, H., & Guttag, J. V. (2021). A framework for understanding sources of harm throughout the machine learning life cycle. *ACM Conference on Equity and Access in Algorithms*, 1–9.

[5] UNESCO. (2022). *Recommendation on the Ethics of Artificial Intelligence*. Paris: UNESCO Publishing.

[6] Russell, S., & Norvig, P. (2021). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson Education.

[7] Brynjolfsson, E., & McAfee, A. (2017). Machine, Platform, Crowd: Harnessing Our Digital Future. New York: W. W. Norton & Company.