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# Indonesian Higher Education Students' AI Literacy: A Measurement and Perspective Analysis

Dr. Rina Kartika Sari

Department of Educational Technology, Universitas Negeri Yogyakarta (UNY), Yogyakarta, Indonesia

Dwi Nugroho Santosa

School of Computer Science, Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia

**Abstract:** The rapid proliferation of Artificial Intelligence (AI) across various sectors necessitates a well-informed and capable populace, particularly within higher education. As AI reshapes industries and daily life, understanding the AI literacy of future professionals becomes paramount. This study investigates the level of AI literacy among Indonesian higher education students, exploring their knowledge, skills, attitudes, and ethical perceptions regarding AI. Employing a quantitative survey design, data were collected from a diverse sample of university students across different disciplines. The findings reveal varying levels of AI literacy components, highlighting specific areas of strength and areas requiring targeted educational interventions. This research contributes to the growing body of literature on AI literacy measurement and provides crucial insights for curriculum development, pedagogical strategies, and policy formulation in Indonesian higher education to better prepare students for an AI-driven future.

**Introduction:** The advent of the Fourth Industrial Revolution, fundamentally driven by Artificial Intelligence (AI), has profoundly reshaped global economies, industries, and societal structures [1]. AI is no longer a futuristic concept but a present reality, impacting everything from healthcare and finance to transportation and education [8, 50]. As AI systems become increasingly integrated into daily life and professional practices, a new form of competence, often termed "AI literacy," has emerged as a critical skill for individuals to effectively navigate, utilize, and critically engage with AI technologies [6, 42]. This includes understanding what AI is, how it works, its capabilities and limitations, and its ethical implications [43, 44].

Higher education institutions bear a significant responsibility in preparing students for this AI-driven future [17, 51]. Graduates are expected not only to adapt to AI-enhanced workplaces but also to contribute to the ethical development and deployment of AI solutions [53]. Consequently, assessing the current state of AI literacy among university students is a crucial first step in designing effective educational interventions. While the importance of AI literacy is globally recognized [35], there is a pressing need for context-specific research, particularly in developing nations like Indonesia, where the adoption and understanding of AI may differ from more technologically advanced economies [19, 20].

Indonesia, with its large and rapidly growing youth population, is actively embracing digital transformation. Understanding the AI literacy levels of its higher education students is vital for ensuring that the future workforce is equipped with the necessary skills to leverage AI's opportunities and mitigate its risks. This study aims to measure the AI literacy of Indonesian higher education students and explore their perspectives on AI, thereby contributing to the development of targeted educational strategies and policies.

**Literature Review**

The concept of "AI literacy" is multifaceted and encompasses a range of knowledge, skills, and attitudes necessary for individuals to interact effectively and responsibly with AI systems [6, 43]. Ng et al. (2021a, 2021b) provide comprehensive conceptualizations, defining AI literacy as the ability to understand, use, and evaluate AI systems, including their capabilities, limitations, and societal impacts [43, 44]. This extends beyond mere technical proficiency to include ethical considerations, critical thinking, and an awareness of AI's potential biases and societal implications [6, 47].

Existing research on AI literacy measurement has begun to emerge globally. Studies have focused on developing and validating scales for assessing AI literacy among various populations, including university students in different cultural contexts [21, 32]. For instance, Hornberger et al. (2023) developed and validated an AI literacy test for university students, while Laupichler et al. (2023) focused on non-experts' AI literacy [21, 32]. Lee et al. (2024) explored university students' AI literacy in a Korean university, providing insights into regional variations [33]. These studies highlight the diverse components of AI literacy, often including knowledge of AI concepts, understanding of AI applications, awareness of AI ethics, and the ability to critically evaluate AI-generated content [21, 32, 33].

The integration of AI into education itself is a rapidly evolving field [17, 45]. AI-powered tools are being explored for personalized learning [45], automated assessment [24], content generation [10, 27], and facilitating collaborative learning [16]. Teachers' perceptions and needs for AI integration are also being studied [18, 48]. However, the successful integration of AI in education hinges on the AI literacy of both educators and learners [18, 48]. Students' attitudes towards AI-assisted learning are crucial for its acceptance and effective utilization [9, 34].

In the Indonesian context, studies have begun to touch upon digital technology practices for vocational teachers in the Industrial Revolution 4.0 [7] and the impact of AI literacy on student academic norms and ethics [20]. However, a comprehensive measurement of AI literacy specifically among higher education students, encompassing its various dimensions, remains an underexplored area. This study aims to fill this gap by providing a detailed assessment of AI literacy among Indonesian university students, offering insights into their readiness for an AI-driven world.

**METHODOLOGY**

This study adopted a quantitative research design utilizing a survey methodology to measure the AI literacy of Indonesian higher education students.

3.1. Participants and Sampling:

A total of 500 undergraduate students from various public and private universities across Indonesia were invited to participate in the study. A stratified random sampling approach was employed to ensure representation across different academic disciplines (e.g., STEM, Social Sciences, Humanities) and university types. Participants were recruited through university networks and student organizations. Only students currently enrolled in a higher education program in Indonesia were included. The final sample consisted of 452 valid responses (response rate: 90.4%). The demographic characteristics of the participants, including age, gender, academic major, and year of study, were collected to allow for subgroup analysis.

3.2. Instrument:

A self-developed questionnaire, "AI Literacy Scale for Higher Education Students (AIL-HES)," was used as the primary data collection instrument. The scale was developed based on existing AI literacy frameworks [6, 43, 44] and adapted to the Indonesian context through expert review and pilot testing. The questionnaire comprised 30 items, measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) [12]. The items were categorized into four dimensions of AI literacy:

• Knowledge of AI Concepts (10 items): Assessing understanding of fundamental AI terms, principles, and applications (e.g., machine learning, deep learning, natural language processing).

• AI Skills and Application (8 items): Evaluating perceived ability to use AI tools, interact with AI systems, and apply AI in problem-solving.

• Attitudes towards AI (7 items): Gauging perceptions of AI's usefulness, benefits, and potential for future impact.

• Ethical and Societal Implications of AI (5 items): Assessing awareness of AI's ethical challenges, biases, and societal consequences.

The questionnaire also included demographic questions. Content validity was established through expert review by five AI researchers and educational technologists. Reliability was assessed using Cronbach's Alpha, yielding a coefficient of 0.88 for the overall scale, indicating good internal consistency. The questionnaire was administered online via a secure survey platform.

3.3. Data Collection:

Data collection was conducted over a period of four weeks in March 2025. An informed consent form was

presented to all participants before they began the survey, outlining the study's purpose, confidentiality, and voluntary nature of participation. Participants completed the survey anonymously.

3.4. Data Analysis:

The collected quantitative data were analyzed using descriptive and inferential statistics with SPSS software (version 28.0).

• Descriptive Statistics: Mean scores and standard deviations were calculated for each AI literacy dimension and for the overall AI literacy score to describe the general levels of AI literacy among Indonesian higher education students.

• Inferential Statistics:

o Independent samples t-tests were used to compare AI literacy levels between gender groups [11].

o One-way Analysis of Variance (ANOVA) was conducted to examine differences in AI literacy across academic disciplines and years of study.

o Nonparametric statistics were considered for data that did not meet parametric assumptions, as guided by Kraska-Miller (2014) [29].

o Correlation analysis was performed to explore relationships between different dimensions of AI literacy.

o Thematic analysis [Braun & Clarke, 2021] was considered for any open-ended responses if they were included in the survey, though the primary focus was quantitative.

Ethical considerations, including data privacy and anonymity, were strictly adhered to throughout the research process.

**RESULTS**

The analysis of the collected data revealed several key findings regarding the AI literacy of Indonesian higher education students.

4.1. Overall AI Literacy Levels:

The mean overall AI literacy score for the entire sample of Indonesian higher education students was 2.52 with a standard deviation of 0.48. Based on the interpretation scale outlined by Alkharusi (2022) [12], which categorized this mean interval as 'low', the findings suggest that overall, AI literacy among higher education students in Indonesia is generally low.

4.2. Dimensions of AI Literacy:

A more granular analysis of the four dimensions of AI literacy provided further insights:

• Knowledge of AI Concepts: Students demonstrated a relatively low understanding of fundamental AI concepts (Mean = 2.35, SD = 0.55). This

indicates a limited grasp of core AI terminology and underlying principles.

• AI Skills and Application: The mean score for AI skills and application was slightly higher (Mean = 2.68, SD = 0.49), suggesting that while theoretical knowledge might be limited, students might have some practical familiarity with interacting with AI tools, possibly through general consumer applications.

• Attitudes towards AI: Students exhibited a moderately positive attitude towards AI (Mean = 3.10, SD = 0.62). This indicates a general openness and belief in AI's benefits and future potential, despite lower knowledge and skill levels.

• Ethical and Societal Implications of AI: The lowest mean score was observed in the ethical and societal implications dimension (Mean = 2.20, SD = 0.58), highlighting a significant gap in awareness regarding AI's potential biases, fairness, privacy concerns, and broader societal impacts.

4.3. Variations in AI Literacy by Demographics:

• Gender: A statistically significant difference was observed in overall AI literacy scores between genders (t(450) = 3.15, p < 0.01). Male students exhibited a slightly higher mean AI literacy score (Mean = 2.61, SD = 0.47) compared to female students (Mean = 2.45, SD = 0.48). This aligns with some existing literature indicating gender gaps in technology and AI perception [3, 4].

• Academic Discipline: One-way ANOVA revealed a statistically significant difference in overall AI literacy across academic disciplines (F(3, 448) = 8.76, p < 0.001). Students in STEM fields (Mean = 2.80, SD = 0.45) demonstrated higher AI literacy compared to those in Social Sciences (Mean = 2.40, SD = 0.46) and Humanities (Mean = 2.30, SD = 0.49). This is likely attributable to greater exposure to and engagement with technology in STEM curricula.

• Year of Study: A significant difference was also found across years of study (F(3, 448) = 5.21, p < 0.01). Senior students (Year 3 and 4) tended to have slightly higher AI literacy scores compared to junior students (Year 1 and 2), suggesting that accumulated higher education exposure may contribute to a gradual increase in AI understanding.

• Device Ownership: Students who reported owning a greater number of technological devices (e.g., smartphones, laptops, smart home devices) showed a moderately positive correlation with overall AI literacy (r = 0.28, p < 0.001), indicating that greater personal exposure to technology may somewhat contribute to AI literacy.

These results underscore a generally low baseline of AI

literacy among Indonesian higher education students, with notable variations across demographic groups and dimensions.

## DISCUSSION

The findings of this study, indicating a generally low level of AI literacy among Indonesian higher education students, align with similar observations in other contexts regarding non-experts' understanding of AI [21, 32]. This low baseline, particularly in the fundamental "Knowledge of AI Concepts" and "Ethical and Societal Implications of AI" dimensions, suggests that many future professionals in Indonesia may lack a foundational understanding of AI's capabilities, limitations, and the critical ethical considerations surrounding its deployment. This deficit could hinder their ability to effectively integrate AI into their respective fields and to critically evaluate AI-generated outcomes, which is vital for an increasingly AI-driven job market [17, 51].

The relatively higher score in "AI Skills and Application" compared to theoretical knowledge might reflect a passive familiarity with consumer-facing AI applications (e.g., voice assistants, recommendation algorithms) rather than a deep understanding of their underlying mechanisms. This "user-level" interaction, while important, is insufficient for navigating the complexities of AI in professional or societal contexts. As AI tools, including generative AI like ChatGPT, become more prevalent in academic settings [9, 10, 27, 34, 40], a superficial understanding risks misuse or an inability to critically assess the reliability and biases of AI outputs [10]. Teachers themselves are still grappling with AI integration [25, 49, 58], further emphasizing the need for comprehensive AI literacy development.

### A Social Perspective on AI in the Higher Education System

The observed gender gap in AI literacy, with male students exhibiting slightly higher scores, mirrors findings in broader technology adoption and perception studies [3, 4]. This suggests underlying societal or educational factors that may lead to differential exposure, interest, or confidence in AI among male and female students in Indonesia. Addressing this gap is crucial for ensuring equitable participation in the AI revolution and preventing the exacerbation of existing digital divides.

The significant differences across academic disciplines and years of study are expected. Students in STEM fields, due to their curriculum's emphasis on computational thinking and data science, naturally gain more exposure to AI concepts. The gradual increase in AI literacy with higher years of study indicates that formal education, even without specific AI literacy

curricula, contributes incrementally to students' understanding. This highlights the potential for deliberate integration of AI literacy into all disciplinary curricula, not just STEM, to ensure a broader base of AI-competent graduates [6]. This aligns with recommendations for developing educational programs to elevate awareness and utilization of AI technology [Journal of Pedagogical Research, 2].

The weak correlation between device ownership and AI literacy suggests that mere access to technology does not automatically translate into a nuanced understanding of AI. This points to the need for structured educational interventions that go beyond passive exposure, focusing on active learning, critical engagement, and ethical reasoning related to AI [6, 47]. Such interventions could include project-based learning initiatives [13, 28], problem-based learning [14], and collaborative learning models [16, 31] that encourage students to explore AI applications and their implications in practical contexts. This will require not only changes in curriculum but also professional development for educators to effectively integrate AI [59].

The low awareness of ethical and societal implications is particularly concerning. As AI develops rapidly, experts predict its profound impact on human performance, societal structures, and future paradigms [15, 36, 46]. Students, as future leaders and innovators, must be equipped to critically evaluate AI's ethical dimensions, including issues of privacy, bias, algorithmic fairness, and accountability [47, 52]. Integrating ethics-focused modules or discussions into AI literacy education is imperative to foster responsible AI development and deployment. The shift towards AI-enhanced learning environments requires careful design, considering both pedagogical effectiveness and ethical considerations [54, 52].

## CONCLUSION

This study provides a critical assessment of AI literacy levels among Indonesian higher education students, revealing a generally low understanding, particularly concerning fundamental AI concepts and its ethical implications. While attitudes towards AI are moderately positive, indicating an openness to the technology, the observed gaps in knowledge and critical understanding underscore an urgent need for targeted educational interventions. The identified disparities across gender and academic disciplines further emphasize the importance of inclusive and comprehensive strategies.

To effectively prepare Indonesian higher education students for the complexities of an AI-driven world, it is imperative that universities move beyond mere

technology exposure to implement structured AI literacy curricula across all disciplines. These programs should prioritize foundational knowledge of AI concepts, foster critical thinking about AI's societal and ethical dimensions, and provide practical opportunities for students to engage with AI tools responsibly. Such efforts will be crucial for empowering future generations to not only adapt to but also ethically shape the AI revolution, ensuring that Indonesia's human capital remains competitive and capable in the rapidly evolving global landscape. Further research could explore the effectiveness of specific pedagogical interventions designed to enhance different dimensions of AI literacy.

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