Research Article

Meta Artificial Intelligence Literacy of University Students: A Comparative Analysis

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Article Info

Abstract

This study aims to find the level of meta-artificial intelligence (AI) literacy in male and female students at the University of Mindanao. First, meta-AI literacy involves a comprehensive understanding, application, evaluation, and ethical usage of AI technologies. The study made use of a quantitative, non-experimental correlational design and gathered data from 325 students through a structured online survey. The survey instrument assessed various aspects of AI literacy, from knowledge, application, and ethics to self-efficacy. The study used stratified sampling for an equal representation of academic levels and genders. To compare the AI literacy scores of male and female students, and test the connection between literacy and academic performance, descriptive statistics, t-tests, and ANOVA were used. Thus, the results showed that AI literacy levels were moderate for both genders, with small differences between male and female students. Female students scored slightly higher in AI ethics, while male students scored very high in AI applications, but these variances were not statistically significant. The study emphasizes the importance of customized teaching methods to enhance AI literacy skills, especially in application, across all student demographics. This research offers valuable insights into AI literacy among university students and presents recommendations for improving AI education within the curriculum.

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Introduction

Artificial intelligence (AI) may be described as "the creation of intelligent machines in the field of science and engineering (Ng et al., 2021). With the use of artificial intelligence in education and employment, it gained attention for its powerful potential to enhance university students' learning capability, which then could affect the fields of different job markets due to the vast ways of using AI once people are educated on artificial intelligence. Studying AI literacy is very significant, especially now that it has made huge progress in different domains, from medical diagnosis to autonomous driving, interactive personal assistance, and image and video generation (Littman et al., 2021). But this study will focus more on the usage of AI in education, how they are used, and its effects. Now, it shows from the past studies that have shown a positive connection between

AI applications and improved academic performance, especially in STEM fields (García-Martínez et al., 2023). Now, AI technologies can shape student's way of learning and enhance their learning capability, with different effects in many contexts (Zheng et al., 2021). Also, AI support systems have become effective in developing students' metacognitive abilities essential for self-regulation (Yang & Xia, 2023). AI's role in higher education also includes nurturing critical and innovative thinking through advanced platforms (Sanabria-Z et al., 2023). These findings highlight AI's potential in education while showing the need to address associated educational and ethical challenges (García-Martínez et al., 2023; Zheng et al., 2021; Yang & Xia, 2023; Sanabria-Z et al., 2023; Obenza-Tanudtanud & Obenza, 2024e).

Previous research has shown the critical role of AI literacy courses in enhancing the understanding of AI concepts of students. Then, a research review of 45 studies involving 70,350 students found that many college students are interested in learning AI, yet their level of knowledge varies greatly. This inconsistency is influenced by their previous experience with software education, which enhances AI literacy, clarifies concepts, and increases confidence in using AI technologies (Lee et al., 2024). Also, problems in promoting AI literacy in the Philippines include not enough technological infrastructure and a gap in access to AI tools, especially in rural barangays and underserved communities (Estrellado, 2023). A study conducted in the Philippines, segmented by demographics such as college, year level, age, and gender, revealed that respondents demonstrated a moderately high level of AI literacy, with consistent knowledge, application, and understanding of AI use and ethics. While academic performance, as measured by GPA, was generally satisfactory, statistical differences in AI literacy were noted based on college and gender, and variations in academic performance were observed across different colleges, year levels, and age groups, indicating a weak positive correlation between AI literacy and academic performance (Asio, 2024). A local study further identifies significant inconsistencies in educational resources across different demographics, with underprivileged groups facing high barriers to quality education and AI literacy. These findings show the urgent need for targeted policy interventions to promote equity and inclusion in educational systems worldwide (Obenza et al., 2024d).

With the different studies on artificial intelligence (AI) adoption in various contexts, the need to identify significant research gaps concerning college students in the Philippines comes. Specifically, examining the demographics of male and female university students in relation to meta-AI literacy can help determine whether differences exist between these two groups and what those differences entail. Understanding the unique higher education context in the Philippines is essential for gaining insights into

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the steps to effectively implement AI technologies in education.

Analyzing Meta AI literacy among male and female university students is important for understanding how educational experiences affect AI knowledge and skills over time. Comparing these groups can provide insights into the effectiveness of current AI curricula and find

gaps in understanding at different academic stages. This analysis can help educators and policymakers in customizing AI education to meet students' evolving needs, ensuring they develop the competencies required to use AI technologies effectively. Overall, this research aims to enhance the AI literacy of the students so they can compete with the AI-driven society.

Materials and Methods

The study uses a quantitative research design to examine Meta Artificial Intelligence Literacy among university students, comparing males and females. The quantitative research approach uses systematic gathering, understanding of data, and examination. These are usually acquired by conducting surveys or experimental studies. Also, it is a systematic approach to observe the relationship between variables to create objective hypotheses (Creswell & Creswell, 2023). This method aims to identify potential differences in meta-AI literacy due to different levels of educational experience, exposure to AI-related coursework, and access to technological resources. By comparing these groups, the study seeks to uncover how academic progression and access to educational tools influence AI literacy, making this research design highly appropriate for the investigation.

A 5-point Likert scale (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, and 5 – Strongly Agree) with 33 questions related to the use and application of AI, knowledge, and understanding of AI, and ethics in AI was used. The instrument was adapted from a previous study by Carolus et al. (2023), which focused on meta-AI literacy.

The instrument was modified by tailoring specific questions to align with the academic context of university students, ensuring it addressed variations in coursework, resource access, and levels of AI exposure. Psychometric validation was conducted to ensure that these modifications maintained the instrument's reliability and

validity. A more thorough explanation of these changes is provided in Appendix A.

A pilot test of the modified instrument was conducted to evaluate its reliability and validity. This involved a smaller subset of 30 students representing different year levels and colleges at the University of Mindanao. Results from the pilot test showed Cronbach's alpha value of 0.89 and McDonald's omega coefficient of 0.87, indicating strong internal consistency. Based on these results, minor revisions to question phrasing were made to improve clarity and relevance. This refinement ensured that the instrument effectively captured the desired aspects of meta-AI literacy before the full-scale survey.

The respondents chosen for the main survey were students of the University of Mindanao in the Philippines, focusing on comparing Meta Artificial Intelligence Literacy between male and female students. A total of 325 participants were selected and consented to participate in an online survey conducted during the first semester of the academic year 2024-2025.

Stratified sampling was used to establish an appropriate respondent pool, where participants had to meet the following criteria: they must be bona fide students currently enrolled for the semester, possess an internet connection and a device, and be willing to participate in the online survey. An analysis of the participant's demographic characteristics was conducted to

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highlight the diverse range of colleges and year levels within the institution, thereby providing a comprehensive representation of the student population.

Data analysis involved descriptive statistics to summarize demographic characteristics (male and female) and mean distributions for AI literacy scores. Specific descriptive statistics included means, standard deviations, and frequency distributions. Analysis of Variance (ANOVA) was used to compare the means of different groups, ensuring assumptions of normality and homogeneity of variance were met. Additionally, t-tests were performed to explore significant differences between male and female students (Field, 2018).

Consent from all participants was obtained, and confidentiality was maintained following ethical guidelines. The study also acknowledges

limitations, such as self-reported data biases, potential sampling biases, and the limited generalizability of findings to other populations or educational contexts. By addressing these elements, the analysis aims to provide a comprehensive understanding of the state of AI literacy among university students and inform recommendations for enhancing AI education within the curriculum.

Null Hypothesis (H_0): There are no significant differences in AI literacy levels between male and female college students across the dimensions of ethics, detection, understanding, and application of AI.

Alternative Hypothesis (H_1): There are significant differences in AI literacy levels between male and female college students across the dimensions of ethics, detection, understanding, and application of AI.

Results and Discussion

The descriptive statistics table provides a detailed overview of AI literacy and its components among a substantial sample of 325 college students. The overall AI literacy mean score is 3.48, indicating that students generally have a moderate understanding of AI. The median (3.50) and mode (3.00) values are closely aligned with the mean, suggesting that most students fall within a similar range of literacy. With a standard deviation of 0.698, the scores are relatively concentrated around the mean, reflecting slight variability. This indicates that while most students are somewhat knowledgeable about AI concepts, there are few who significantly deviate from this average, highlighting potential gaps in understanding that could be addressed to improve overall AI literacy.

AI literacy is a set of core competencies that users need to effectively interact with and critically evaluate AI, and design considerations to create

learner-centered AI technologies (Long & Magerko, 2020). It includes knowing and understanding AI, applying AI, evaluating AI application, and AI ethics, with applying AI having a significant, positive effect on the other dimensions (Zhao et al., 2022).

Students typically see AI as a useful, effective tool that improves their educational methods. Nevertheless, preserving academic honesty requires upholding principles such as truthfulness, openness, and appropriate attribution when utilizing AI in the educational setting (Sariyasa & Monika, 2023). Using proactive strategies, from having clear policies to offering training on the ethical use of AI, can greatly minimize academic dishonesty in universities (Cotton et al., 2023). Despite the potential benefits of AI technologies such as enhancing research efficiency and academic writing, problems still arise due to authenticity,

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credibility, and fake research (Lin, 2023; Dergaa et al., 2023).

For people to identify AI uses and evaluate their consequences, a deep understanding of AI systems in different situations is crucial for AI literacy (Carolus et al., 2023). These abilities level up both efficient usage of AI technologies and encourage analytical thinking, moral reflections, and teamwork between humans and AI systems (Carolus et al., 2023; Cetindamar et al., 2022; Allen et al., 2023). Comprehensive knowledge of the principles and mechanisms of AI systems is needed to assess their impact and make proper decisions about their utilization (Carolus et al., 2023; Allen et al., 2023).

The results of Cronbach's alpha and Mcdonald's omega, with a sample of 325 college students from the University of Mindanao, showed that each component was highly reliable and consistent. AI literacy Cronbach's alpha was 0.917 which shows an excellent consistency for the other components measured (Tavakol & Dennick, 2011). Each component of AI literacy demonstrated strong reliability, wherein Ethics scored 0.910, Detection 0.899, Understanding 0.890, and Application achieved the highest score of 0.928. These scores tell us that the components of AI literacy are well-defined and are

consistently understood by the respondents. This aligns with the previous study of Zhao et al. (2022) where there is importance to the multidimensional nature of AI literacy.

Additionally, when it comes to McDonald's Omega, AI literacy had a reliability of 0.926. While the components' reliability are: Ethics at 0.921, Detection at 0.912, Understanding at 0.904, and Application having the highest reliability, 0.935. These reliability scores surpassed the 0.70 threshold that is commonly accepted and tells that these components are very suitable for more exploration (Dunn et al., 2014). These high scores for each component tell that the university students have a clear understanding of AI. This aligns with Long & Magerko (2020) contemporary discussions about the importance of fostering AI literacy in educational settings.

Also, the findings confirm the components of Meta AI literacy among university students and give a good starting point for more exploration of Meta AI literacy in different educational contexts. These clear insights from this analysis can help teaching strategies, and curriculum development for making sure that students are well and ready for them to use AI technologies in their academic and future path.

Table 1: Cronbach Alpha

	Cronbach's α	McDonald's ω
AI Literacy	0.917	0.926
Ethics	0.910	0.921
Detect	0.899	0.912
Understanding	0.890	0.904
Application	0.928	0.935

Table 2 Analyzes AI literacy through four indicators: ethics, detection, understanding, and application. The ethics component shows a high mean score of 3.60, showing that students have a better awareness of ethical issues regarding AI,

but the moderate standard deviation of 0.809 shows that it varies per student. This result agrees with the study of Obenza et al. (2024c) about AI literacy among college students, wherein a mean of 3.41 in AI ethics component showing that

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college students have high awareness in AI ethics. The detection component; the ability to identify AI usage, has a bit lower mean of 3.41 and a higher deviation of 0.853, showing a wide range of abilities in recognizing AI usage. For the understanding component, students' mean turned similar to ethics with a mean of 3.60 but with a deviation of 0.787, showing consistency. The results were similar to the study of Obenza et al. (2023a), wherein participants have a high perception and understanding of AI, specifically ChatGPT. Now, the application component has

the lowest mean of 3.32, showing that students might lack the ability to make use of AI knowledge practically. It also has the highest deviation of 0.871, indicating that there is a high difference in the students about the abilities to apply AI concepts. This shows that there is a need to teach the students better in this component in order to boost their skills. Now, the AI application result contradicts Obenza et al. (2023b) wherein college students have a high belief in their ability to make use of AI effectively.

Table 2: Descriptives

	N	Mean	Median	Mode	SD
AI Literacy	325	3.48	3.50	3.00	0.698
Ethics	325	3.60	3.67	3.00	0.809
Detect	325	3.41	3.33	3.00	0.853
Understanding	325	3.60	3.67	3.00	0.787
Application	325	3.32	3.33	3.00	0.871

The group descriptive by gender provides a comparative analysis of AI literacy and its components across male and female students. In terms of overall AI literacy, female students have a mean score of 3.47 with a standard deviation of 0.680, while male students score slightly higher, with a mean of 3.51 and a standard deviation of 0.738. The mean difference between genders is negligible at -0.0408, indicating that there is only a slight disparity in AI literacy levels, with both groups showing similar variability in their scores.

When examining the individual components of AI literacy, female students have a mean score of 3.61 (SD = 0.802) in ethics, slightly surpassing male students, who score 3.58 (SD = 0.825). The differences in knowledge of AI ethics are minimal, and variability is comparable between genders. This suggests that female students could be more considerate ethically in terms of fairness and equality, while male students tend to use AI

with less consideration (Ghotbi, 2021). In the detection component, males have a mean of 3.48 (SD = 0.884) compared to females' 3.38 (SD = 0.838), which suggests that male students exhibit slightly stronger detection abilities, albeit with greater variability. For understanding AI concepts, both genders report similar mean scores (females: 3.59, males: 3.62), with minimal differences observed. Although both genders have the same mean score, male students tend to have more confidence and see relevance in AI, which shows that they are more ready and potentially understand AI more than female students. Finally, in the application component, males have a mean of 3.37 (SD = 0.927), slightly higher than females at 3.30 (SD = 0.844). This suggests that many male students could excel in AI application skills when it comes to effective use, even though the mean is still comparable to female students. Although males report greater confidence in their application abilities, the

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difference remains small, and variability is notably higher among male students, similar to

Dai et al. (2020) findings on students' readiness for the artificial intelligence age.

Table 3: Group Descriptives

	Gender	N	Mean	SD	SE
AI Literacy	Female	801	3.47	0.680	0.0240
	Male	360	3.51	0.738	0.0389
Ethics	Female	801	3.61	0.802	0.0283
	Male	360	3.58	0.825	0.0435
Detect	Female	801	3.38	0.838	0.0296
	Male	360	3.48	0.884	0.0466
Understanding	Female	801	3.59	0.758	0.0268
	Male	360	3.62	0.850	0.0448
Application	Female	801	3.30	0.844	0.0298
	Male	360	3.37	0.927	0.0489

The independent samples t-test was conducted to compare male and female students' mean AI literacy scores. The results showed a t-statistic of -0.922 with 1159 degrees of freedom and a p-value of 0.357. This indicates that the difference in AI literacy between genders is not statistically significant. The p-value may be described as the low variations in AI literacy scores could be due to random fluctuation.

Additionally, the mean difference in AI literacy scores is calculated to be -0.0408, with a standard error of 0.0443. This low mean difference further

strengthens the t-statistic result wherein the AI literacy between genders is not significant. Thus, these findings show that male and female students show comparable AI literacy, and any differences are not related to their differences in knowledge. But Ng et al. (2023), Yau et al. (2022), and Kimiafar et al. (2023) results of their studies oppose this study's result. Lee et al. (2021) state that a possible reason for this is because AI literacy does not directly connect with the student's readiness to study AI. Rather, confidence and the usefulness of AI for their goal is what connects them.

Table 4: Independent Samples T-Test

		Statistic	df	p	Mean difference	SE difference
AI Literacy	Student's t	-0.922	1159	0.357	-0.0408	0.0443

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Conclusion

The results of this comparative analysis show that there are no significant gender differences in AI literacy among college students. Both male and female students exhibit moderate levels of AI literacy, with similar scores across various components, including ethics, detection, understanding, and application. Although males score slightly higher on average, these differences are not statistically significant based on the t-test results.

The findings suggest that college students, regardless of gender, possess comparable levels of AI literacy. The moderate levels of literacy across all dimensions indicate the need for further educational interventions to enhance students' AI knowledge and skills, particularly in the areas of AI application, where students report lower confidence.

This study has several limitations that should be considered, including the sample of 325 students being drawn from a single university to participate, which may not accurately reflect the broader population. Also, this study lacks control over external factors, such as varying access to AI resources among students, which could create a skewing effect on the results by influencing their familiarity with or exposure to AI technologies.

This study provides a valuable baseline for understanding AI literacy among college students, highlighting areas where support is needed to enhance competencies. Future research could delve deeper into how AI literacy intersects with disciplines such as ethics or psychology, offering interdisciplinary exploration and a more nuanced understanding of the topic. Expanding the scope to diverse educational contexts would further enrich these findings and broaden their applicability.

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