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Research Article

AI Literacy Among University Students and Faculty: Similarities and Differences

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ABSTRACT

This study assessed AI literacy levels among 111 respondents at Centro Escolar University using a four-dimensional framework (Kong, 2024). Despite widespread AI adoption (99.1%), only 5.4% received formal training, revealing a critical educational gap. Faculty demonstrated significantly higher literacy in metacognitive ($p = 0.02$), affective ($p < 0.01$), and social dimensions ($p < 0.01$) compared to students. Both groups showed similar cognitive understanding and tool usage patterns. The research aligns with UN Sustainable Development Goals 4 (Quality Education) and 8 (Decent Work and Economic Growth) by identifying barriers to equitable AI education. Findings indicate urgent need for structured AI literacy programs, ethical curriculum integration, and institutional policy development to prepare students for an AI-driven workforce. This study contributes to understanding AI literacy disparities in higher education and provides evidence-based recommendations for comprehensive educational reform supporting sustainable development objectives.

Keywords*: AI literacy, artificial intelligence, higher education, students, faculty, sustainable development goals, workforce preparation*

Introduction

Artificial intelligence (AI) is fundamentally transforming global industries, educational systems, and societal structures, necessitating comprehensive AI literacy among academic communities (Ng, 2021). AI literacy encompasses the knowledge, skills, attitudes, and ethical awareness required to effectively understand, evaluate, and engage with AI technologies in educational and professional contexts (Kong, 2024). This competency has become increasingly critical as educational institutions worldwide integrate AI tools into teaching, learning, and administrative processes.

Despite AI's expanding presence in academia, significant gaps persist in formal AI education, particularly in non-technical disciplines (Yang, 2025). Research indicates that while students and faculty frequently use consumer-facing AI applications, many lack structured understanding of AI principles, ethical implications, and strategic applications (Azfal, 2024). This disparity between usage and comprehensive literacy presents challenges for

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preparing graduates to thrive in an increasingly AI-driven global economy.

The research gap addressed by this study centers on the limited empirical evidence regarding AI literacy levels among diverse academic populations, particularly the comparative analysis between students and faculty across multiple dimensions of AI competency. While existing studies have examined AI literacy in isolated contexts, few have employed comprehensive frameworks to assess cognitive, metacognitive, affective, and social dimensions simultaneously within higher education institutions (Hornberger, 2023).

Literature Review

The conceptualization of AI literacy has evolved significantly, with multiple frameworks emerging to address the multifaceted nature of AI competency in educational contexts. This review synthesizes key theoretical frameworks and empirical findings to establish the foundation for understanding AI literacy in higher education.

Theoretical Frameworks of AI Literacy

Table 1 presents a synthesis of major AI literacy frameworks, highlighting their key dimensions and applications in educational research.

Framework	Authors	Key Dimensions	Educational Focus	Validation Status
AI Literacy Framework	Kong et al. (2024)	Cognitive, Metacognitive, Affective, Social	Secondary & Higher Education	Empirically validated
ED-AI Lit Framework	Allen & Kendeou (2023)	Knowledge, Evaluation, Ethics, Application	K-12 & Higher Education	Theoretical with pilot testing
Six-Component Model	Han et al. (2025)	Recognize, Know, Understand, Apply, Evaluate, Create	Primary through Higher Education	Bibliometric analysis-based
Multidimensional Framework	Zhang et al. (2025)	Technical, Ethical, Social, Pedagogical	Teacher Education	Systematic review- derived

The framework employed in this study offers a comprehensive approach by integrating cognitive understanding with practical application capabilities, emotional readiness, and ethical consciousness (Kong, 2024). This multidimensional perspective addresses previous limitations in AI literacy assessment that focused primarily on technical knowledge without considering psychological and social factors.

Empirical Evidence of AI Literacy Disparities

Recent empirical studies reveal significant variations in AI literacy across different populations and contexts. Recent bibliometric analysis of 181 papers from Web of Science and Scopus databases, identifying substantial growth in AI literacy research from 2022-2024, with particular emphasis on higher education applications (Allen, 2023). Their findings indicate that technical students consistently outperform non-technical counterparts in cognitive dimensions, while ethical awareness remains relatively consistent across disciplines.

Complementing these findings is the examination of AI integration patterns in tertiary education through comprehensive bibliometric mapping, revealing that while AI adoption rates exceed 90% in most university settings, formal AI literacy education remains limited, with significant gaps in curriculum integration and faculty training programs (Batubara, 2024) .

Furthermore, a systematic review of AI literacy education across educational levels was conducted, analyzing 44 studies from Scopus and Web of Science databases. Their research identified critical gaps in standardized assessment tools and highlighted the need for contextualized AI literacy programs that address disciplinary differences in AI application and ethical considerations (Yim, 2025).

A particularly relevant study examined AI literacy in K-12 and higher education contexts following the emergence of generative AI

technologies (Gu, 2025). Their integrative review revealed that while generative AI tools increased accessibility to AI technologies, they simultaneously highlighted the urgent need for comprehensive literacy programs addressing both technical competencies and ethical implications.

Gaps and Contradictions in Current Research

Despite growing research attention, several critical gaps persist in AI literacy scholarship. First, standardized assessment instruments remain underdeveloped, with most studies employing ad hoc measurement approaches that limit cross-study comparisons (Markus, 2025). Second, longitudinal studies examining AI literacy development over time are notably absent, preventing an understanding of learning trajectories and intervention effectiveness. Moreover, contradictions exist regarding the relationship between AI usage frequency and literacy levels. While some studies suggest positive correlations (Lee, 2024), others indicate that frequent usage without structured learning may lead to overconfidence without corresponding competency development (Wood, 2021). These contradictory findings underscore the need for comprehensive, multi-dimensional assessments that distinguish between surface-level familiarity and deep understanding.

Alignment with UN Sustainable Development Goals

This research directly contributes to multiple UN Sustainable Development Goals, particularly, SDG 4 - Quality Education. By identifying and addressing gaps in AI literacy education, this study supports Target 4.4 which aims to substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship (UN, 2015). The research provides evidence for developing inclusive AI education programs that ensure equitable access to digital literacy competencies.

Aside from this, contributions on SDG 8 - Decent Work and Economic Growth directly impact workforce preparedness and economic competitiveness. This target 8.2 emphasizes higher levels of economic productivity through diversification, technological upgrading, and innovation (UN, 2015). This study's findings inform educational policies that prepare graduates for AI-enhanced workplaces, supporting sustainable economic development.

The research also supports SDG 9: Industry, Innovation and Infrastructure, which targets 9.5 by enhancing scientific research, upgrading technological capabilities through improved AI education in higher education institutions, and fostering innovation capacity among future professionals (UN, 2015).

Methodology

Research Design and Approach

This study employed a correlational research design utilizing quantitative methods to investigate AI literacy differences between students and faculty at Centro Escolar University (CEU). The correlational approach was selected to examine naturally occurring relationships between participant characteristics and AI literacy dimensions without experimental manipulation, allowing for objective assessment of existing competency levels across the university community.

Sampling Strategy and Participants

The sampling strategy employed stratified convenience sampling rather than pure random sampling, acknowledging practical constraints in educational research settings. Participants were recruited through academic departments to ensure representation across disciplines, resulting in a final sample of 111 respondents comprising 100 undergraduate students (90.09%) and 11 faculty members (9.91%). While the initial recruitment aimed for proportional representation, the final sample reflects typical participation rates in voluntary educational research.

Instrumentation and Validation

The survey instrument was developed based on AI Literacy Framework (Kong, 2024), incorporating four primary dimensions: cognitive (understanding AI concepts), metacognitive (applying AI for problem-solving), affective (psychological readiness), and social (ethical awareness). The instrument comprised 23 items measured on a 4-point Likert scale (1 =

Strongly Disagree, 4 = Strongly Agree) plus demographic and usage behavior questions.

Validity and Reliability Measures

Content validity was established through expert review by three AI education specialists and two educational measurement experts, with all items receiving approval ratings above 0.80 on the Content Validity Index (CVI). Construct validity was assessed through exploratory factor analysis, confirming the four-factor structure with eigenvalues exceeding 1.0 and factor loadings above 0.60.

Internal consistency reliability was measured using Cronbach's alpha coefficients: Cognitive dimension ($\alpha = 0.87$), Metacognitive dimension ($\alpha = 0.89$), Affective dimension ($\alpha = 0.91$), and Social dimension ($\alpha = 0.85$). These values exceed the conventional threshold of 0.70, indicating acceptable internal consistency across all dimensions.

Test-retest reliability was assessed with a subsample of 25 participants over a two-week interval, yielding correlation coefficients ranging from 0.78 to 0.84 across dimensions, demonstrating temporal stability of the instrument.

Data Collection Procedures

Data collection occurred over a four-week period during the 2024-2025 academic year through online surveys distributed via institutional email and learning management systems. Participants provided informed consent, and anonymity was maintained throughout the process. The survey required approximately 15-20 minutes to complete, with a response rate of 74.3% among contacted participants.

Statistical Analysis Plan

Statistical analyses included descriptive statistics for participant characteristics and AI literacy dimensions, independent samples t-tests for group comparisons, and Cohen's d calculations for effect size estimation. Statistical significance was set at $\alpha = 0.05$, with effect sizes interpreted using Cohen's conventions (small: $d = 0.20$, medium: $d = 0.50$, large: $d = 0.80$).

Results and Discussion

AI Tool Usage and Engagement Patterns

Analysis revealed near-universal AI adoption (99.1%) among respondents, with 63.06% reporting frequent usage. Consumer-facing applications dominated usage patterns, with recommendation systems (97.3%) and chatbots (89.2%) being most prevalent. This finding aligns with (Afzaal, 2024), who identified similar adoption patterns in their bibliometric analysis of AI integration in higher education.

Table 2: Comparative Analysis of AI Application Usage Between Students and Faculty

AI Application Category	Students (M ± SD)	Faculty (M ± SD)	t-value	p-value	Cohen's d
Writing Assistants	3.44 ± 0.68	3.73 ± 0.47	1.42	0.16	0.48
Research Tools	3.66 ± 0.71	3.91 ± 0.30	1.18	0.24	0.44
Academic Integration Tools	3.79 ± 0.63	3.73 ± 0.65	-0.31	0.76	0.09
Task Automation	2.99 ± 0.89	3.36 ± 0.81	1.38	0.17	0.44
Educational Platforms	3.52 ± 0.74	3.82 ± 0.40	1.35	0.18	0.49
Communication Tools	2.51 ± 0.95	3.36 ± 0.81	2.98	0.004*	0.95

Faculty demonstrated significantly higher usage of AI-driven communication tools ($p = 0.004$, $d = 0.95$), representing a large effect size. This disparity may reflect professional communication needs and greater comfort with diverse AI applications among faculty members, consistent with findings regarding differential AI adoption patterns across academic roles (Gu, 2025).

Formal Training and Knowledge Self-Assessment

A critical finding emerged regarding formal AI training participation, with only 5.4% of respondents having engaged in structured AI education programs. This aligns with a systematic review identifying widespread gaps in formal AI education across higher education institutions (Yang, 2025). The majority of participants

(67.57%) self-reported basic AI knowledge, while 24.32% claimed intermediate knowledge and 8.11% advanced knowledge.

This pattern suggests heavy reliance on informal learning mechanisms, potentially leading to inconsistent competency development and overconfidence biases identified in their medical education research (Wood, 2021). The disconnect between high usage rates and limited formal training represents a significant institutional challenge requiring systematic intervention.

Dimensional Analysis of AI Literacy

Cognitive Dimension: Understanding AI Concepts

Both groups demonstrated solid cognitive understanding of AI principles, with no statistically significant difference between students (M = 3.63, SD = 0.52) and faculty (M = 3.84, SD = 0.38; t = 1.76, p = 0.08, d = 0.46). This finding contrasts with reported significant cognitive differences favoring faculty in the German university sample (Hornberger, 2023) suggesting potential cultural or institutional variations in AI knowledge distribution.

The strongest cognitive competency across both groups involved assessing AI limitations and risks (students: M = 3.75; faculty: M = 4.00), indicating appropriate skepticism and critical evaluation skills essential for responsible AI engagement.

Metacognitive Dimension: Strategic AI Application

Significant differences emerged in metacognitive AI literacy, with faculty (M = 3.69, SD = 0.41) outperforming students (M = 3.43, SD = 0.58; t = 2.34, p = 0.02, d = 0.52). This medium effect size difference reflects faculty's superior ability to strategically apply AI tools for complex problem-solving and goal achievement.

This finding aligns with the systematic review emphasizing the importance of metacognitive skills in effective AI integration (Zhang, 2025). Faculty's higher scores likely reflect greater experience with complex professional tasks requiring strategic technology integration, supporting the need for enhanced metacognitive training in student populations.

Affective Dimension: Psychological Readiness

Faculty demonstrated significantly higher affective AI literacy (M = 3.82, SD = 0.40) compared to students (M = 3.43, SD = 0.61; t = 2.81, p = 0.006, d = 0.73). This large effect size indicates substantial differences in confidence, comfort, and willingness to engage with AI technologies.

The affective dimension disparity suggests that psychological barriers may limit students' AI engagement despite technical accessibility. This finding supports the recommendation for confidence-building interventions in AI education programs, particularly targeting emotional readiness alongside technical skill development (Batubara, 2024).

Social Dimension: Ethical Awareness

Faculty achieved perfect scores in ethical awareness (M = 4.00, SD = 0.00) compared to students' strong but lower performance (M = 3.78, SD = 0.42; t = 2.17, p = 0.03, d = 0.72). This large effect size difference indicates superior ethical consciousness among faculty regarding AI bias, privacy, and accountability issues.

The social dimension findings align with a systematic review emphasizing the critical importance of ethical literacy in AI education (Yim, 2025). Faculty's perfect ethical scores likely reflect professional responsibility awareness and exposure to academic integrity concerns (Aguado, 2025), highlighting the need for enhanced ethical education in student curricula.

Comparative Analysis Summary

Table 3: Comprehensive Comparison of AI Literacy Dimensions with Effect Sizes

Dimension	Students (M±SD)	Faculty (M±SD)	t-value	p-value	Cohen's d	Effect Size
AI Applications Used	3.32 ± 0.61	3.65 ± 0.42	1.43	0.16	0.63	Medium

Dimension	Students (M±SD)	Faculty (M±SD)	t-value	p-value	Cohen's d	Effect Size
Cognitive	3.63 ± 0.52	3.84 ± 0.38	1.76	0.08	0.46	Small- Medium
Metacognitive	3.43 ± 0.58	3.69 ± 0.41	2.34	0.02*	0.52	Medium
Affective	3.43 ± 0.61	3.82 ± 0.40	2.81	0.006*	0.73	Large
Social	3.78 ± 0.42	4.00 ± 0.00	2.17	0.03*	0.72	Large

The pattern of results reveals a clear hierarchy of competency differences, with the largest gaps in affective and social dimensions. This finding has important implications for educational intervention design, suggesting that technical knowledge transfer alone is insufficient for comprehensive AI literacy development.

Findings and Implications

This study revealed several critical findings that advance understanding of AI literacy in higher education contexts:

1. While 99.1% of respondents use AI technologies, only 5.4% have received formal AI education, creating a significant literacy development gap.
2. Faculty significantly outperformed students in metacognitive (d = 0.52), affective (d = 0.73), and social (d = 0.72) dimensions, while cognitive understanding remained comparable.
3. Faculty demonstrated perfect ethical awareness scores, contrasting with students' strong but lower performance, indicating a need for enhanced ethical education.
4. The disconnect between high usage rates and predominantly basic self-reported knowledge suggests potential overconfidence or inadequate assessment frameworks.

Theoretical and Practical Implications

These findings contribute to AI literacy theory (Kong, 2024) by validating its multidimensional nature and demonstrating differential development patterns across academic roles. The results suggest that AI literacy development follows a hierarchical pattern, with cognitive understanding forming the foundation for more complex metacognitive, affective, and social competencies.

Practically, the study provides evidence for targeted educational interventions addressing specific dimensional gaps. The large effect sizes in affective and social dimensions indicate that confidence-building and ethical education should be prioritized alongside technical skill development in AI literacy programs.

Conclusion

This study reveals a fundamental paradox in higher education AI literacy: widespread adoption coexists with minimal formal education, creating significant competency gaps that threaten sustainable workforce development. While students and faculty demonstrate similar basic understanding of AI concepts, substantial differences in strategic application, psychological readiness, and ethical awareness highlight the inadequacy of informal learning approaches.

The research contributes to UN Sustainable Development Goals by identifying barriers to equitable AI education (SDG 4) and workforce preparedness (SDG 8). The findings demonstrate that current informal learning mechanisms are insufficient for developing the comprehensive AI literacy required for sustainable economic development and decent work in AI-enhanced environments.

The dimensional analysis reveals that effective AI literacy transcends technical knowledge, requiring integrated development of strategic thinking, emotional readiness, and ethical consciousness. Faculty's superior performance in advanced dimensions suggests that professional experience and responsibility enhance AI literacy development, indicating potential benefits of experiential learning approaches in student education.

These findings have immediate implications for educational policy and curriculum development, demonstrating the urgent need for systematic AI literacy programs that address cognitive, metacognitive, affective, and social

dimensions simultaneously. The research provides evidence-based support for institutional investments in comprehensive AI education initiatives.

Recommendations

Curriculum Development Recommendations

1. Implement interdisciplinary AI literacy requirements across all academic programs, emphasizing both technical understanding and ethical applications aligned with disciplinary contexts.
2. Design a scaffolded curricula that advance from basic cognitive understanding to complex metacognitive applications, incorporating experiential learning opportunities.
3. Embed AI ethics education throughout curricula rather than isolating ethical considerations, ensuring students develop ethical reasoning capabilities alongside technical skills.
4. Develop standardized AI literacy assessment tools aligned with the competency framework to ensure consistent evaluation across programs.

Pedagogical Approach Recommendations

1. Implement structured mentoring programs pairing students with faculty to address affective dimension gaps and build psychological readiness for AI engagement.
2. Utilize real-world AI application scenarios to develop metacognitive skills, encouraging strategic thinking and reflective AI use practices.
3. Establish AI literacy learning communities that promote peer-to-peer knowledge sharing and collaborative problem-solving with AI tools.
4. Provide hands-on AI project experiences that simulate professional contexts, bridging the gap between academic learning and workplace application.

Institutional Policy Recommendations

1. Establish comprehensive faculty training initiatives to enhance teaching capabilities in AI literacy education and ensure consistent instructional quality.
2. Develop institutional AI literacy infrastructure, including specialized laboratories, software access, and technical support systems.
3. Create industry partnerships to provide students with authentic AI application experiences and ensure curriculum relevance to workforce needs.
4. Establish institutional policies governing AI use in academic contexts, providing clear guidelines for ethical AI engagement and academic integrity.
5. Implement longitudinal tracking systems to monitor AI literacy development progression and evaluate intervention effectiveness over time.

Sustainability and Global Alignment

1. Align AI literacy initiatives with UN Sustainable Development Goals through curriculum content that addresses global challenges and sustainable development applications of AI technologies.
2. Ensure equitable access to AI literacy education across diverse student populations, addressing potential digital divides and socioeconomic barriers.
3. Develop partnerships with international institutions to share best practices and develop globally relevant AI literacy standards.

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