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How Does AI Literacy Redefine Social Responsibility? Exploring the Interplay Between Digital Literacy and Ethical Awareness in Shaping Digital Citizenship (PLS-SEM Approach)

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ABSTRACT

The rapid integration of artificial intelligence (AI) into digital learning environments has increased the demand for competencies that support critical, ethical, and responsible technology use. This study examines the influence of AI Literacy, Digital Literacy, and Ethical Awareness on university students' Social Responsibility. Using a quantitative cross-sectional survey, data were collected from 100 students in the Informatics and Computer Education program. The analysis employed Partial Least Squares–Structural Equation Modeling (PLS-SEM). The results reveal that Digital Literacy (β = 0.397; p = 0.001) and Ethical Awareness (β = 0.615; p = 0.000) positively and significantly affect Social Responsibility, whereas AI Literacy demonstrates a negative but significant effect (β = –0.151; p = 0.022). These findings highlight the need for balanced technological and ethical competencies to cultivate responsible digital citizenship. The study suggests integrating ethical and digital literacy training into higher education curricula and encourages future research involving broader samples and longitudinal designs.

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INTRODUCTION

The development of artificial intelligence (AI) in various sectors has influenced the way individuals interact, access information, and utilize digital technology [1]. Although AI has created various opportunities, it has also raised new challenges such as algorithmic bias, information uncertainty, and ethical implications [2]. Amidst these changes, it is important for users to understand how AI works, including how AI systems make decisions and the risks involved in their use [3]. Human-machine interactions also require ethical awareness in order to make responsible digital decisions [4].

AI Literacy encompasses not only technical understanding, but also how users assess the risks and social impacts of technology [5]. When combined with digital literacy, AI Literacy enables individuals to think more critically about digital information [3]. Furthermore, ethical awareness is increasingly important given the potential for privacy violations, bias, and injustice arising from the use of technology [6]. Technological literacy and ethical awareness play a major roles in shaping Social Responsibility as part of digital citizenship in the era of artificial intelligence.

Although research related to digital literacy, AI literacy, and digital ethics has developed, few studies have examined these three variables in a single integrated empirical model. Previous

research related to social media literacy has focused on critical skills, but has not explicitly linked them to ethical social behavior related to AI [1]. Furthermore, studies on AI ethics in education have emphasized normative aspects rather than the role of ethical awareness in social behavior [7]. This indicates a research gap that needs to be analyzed.

With the increasing use of AI in learning and digital activities, the risk of technology misuse is greater when digital literacy and user ethics are low [2]. The use of technology without ethical understanding can lead to violations of academic integrity and digital behavior that does not comply with norms [4]. Therefore, this study is important to analyze how AI Literacy, Digital Literacy, and Ethical Awareness contribute to Social Responsibility.

This study formulates the following three main questions:

1. What is the effect of AI Literacy on Social Responsibility?
2. What is the effect of Digital Literacy on Social Responsibility?
3. Does Ethical Awareness have a significant effect on Social Responsibility?

METHOD

Research Design

This study uses a quantitative approach with a cross-sectional survey design, in which data collection is conducted once on a group of respondents in the same period. This design was chosen because it is suitable for describing the actual conditions of technological literacy and social responsibility behavior of students at the time of the study, while also allowing for empirical analysis of the relationship between variables [3].

The sampling technique used was purposive sampling, which is the selection of respondents based on certain criteria relevant to the research objectives. This method was chosen so that the data collected truly came from individuals who had experience in using digital technology and artificial intelligence, thereby ensuring that the assessments of AI Literacy, Digital Literacy, Ethical Awareness, and Social Responsibility were more valid. The use of purposive sampling also refers to previous research on technology adoption and digital ethics, which emphasizes the importance of selecting respondents who have previous experience with AI in order to provide accurate and meaningful assessments [8]. The data analysis model uses Partial Least Squares – Structural Equation Modeling (PLS-SEM), which is suitable for research with predictive purposes and to test the relationship between latent variables simultaneously. PLS-SEM was chosen because it can estimate complex models and does not require normally distributed data. The use of this method also follows the recommendation [9] that PLS-SEM is very suitable for exploratory research and conceptual model development.

Participant

The participants in this study were 100 active students from the Informatics and Computer Education Study Program (PTIK), Makassar State University. This group was selected based on the characteristics of students who have experience in using digital technology and are directly involved with artificial intelligence (AI)-based applications in learning activities and daily activities. This group was considered relevant because PTIK students generally have a higher level of exposure to technology than the general population, enabling them to provide accurate assessments of AI Literacy, Digital Literacy, Ethical Awareness, and Social Responsibility. Many previous studies in the field of technology literacy and digital ethics have used technology or informatics students as respondents to obtain more representative data regarding AI understanding and digital practices [3].

Population and the methods of sampling Instrumentation

The population in this study was all active students of the Informatics and Computer Engineering Education Study Program. The sampling technique used was purposive sampling, with the following criteria:

1. The population in this study was all active students of the Informatics and Computer Engineering Education Study Program (PTIK) at Makassar State University.
2. Have used or interacted with AI-based technology, such as chatbots, recommendation systems, machine learning-based applications, or adaptive learning platforms.
3. Have experience learning or working with digital devices, so that respondents understand the context of digital literacy and the ethics of technology use.

Instrument

The instrument uses a five-point Likert scale. The AI Literacy indicators are adapted from [10]. The Digital Literacy indicators refer to [11]. The Ethical Awareness indicators are adapted from [12]. The Social Responsibility indicators refer to [13].

Table 1. Instrument

Constructs	Item Code	Statement	Reference
AI Literacy	AIL3	I understand how AI systems learn from data to generate decisions or predictions.	[10]
	AIL4	I am able to assess the positive and negative impacts of AI use on society.	
	AIL5	I feel confident using AI-based tools or applications to assist with my studies or work.	
Digital Literacy	DL1	I am able to search for and find the information I need through digital media.	[11]
	DL4	I am able to create or compile digital content (such as presentations, posters, or learning materials) to convey my ideas.	
	DL5	I implement basic security measures, such as using strong passwords and keeping my digital accounts confidential.	
Ethical Awareness	EA1	I realize that cheating on exams is unethical.	[12]
	EA3	I believe that downloading or using software without permission is unethical.	
	EA4	I understand that using campus facilities for personal gain is inappropriate.	
Sosial Responsibility	SR3	I feel responsible for keeping the environment clean and sustainable.	[13]
	SR4	I try to comply with the rules and social norms that apply in society.	
	SR5	I participate in social or community activities that benefit others.	

Procedures

The procedure followed the digital literacy and AI research flo [3]. Initial validation was conducted by experts before the instruments were distributed.

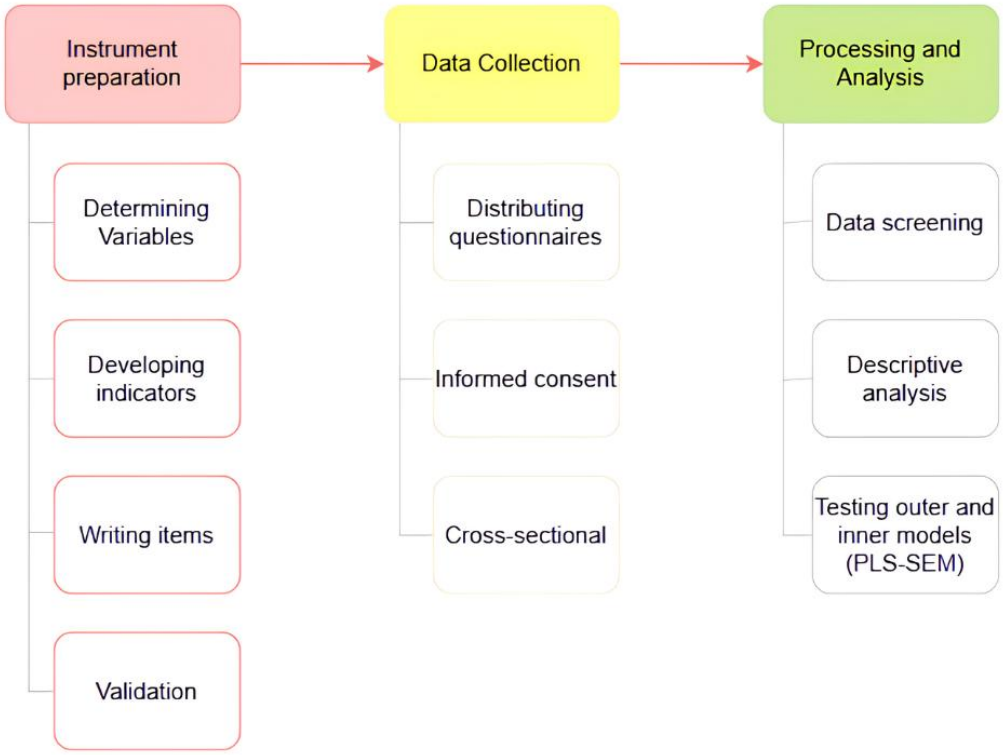

Figure 1. Research procedure

This study began with the development of research instruments, starting from determining variables, constructing indicators, writing items, and conducting expert validation to ensure clarity and content relevance. Data collection was carried out online using written consent in a cross-sectional design, and incomplete responses were removed prior to descriptive analysis. The next stage employed PLS-SEM to evaluate the measurement and structural models, including assessments of outer loadings, composite reliability, AVE, and HTMT, following recommended guidelines in variance-based SEM [14].

Data Analisis

Data analysis in this study was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the help of SmartPLS software. PLS-SEM was chosen because it is capable of handling research models with complex latent variables and a relatively small sample size, and has high effectiveness in predictive analysis in exploratory research [9].

RESULTS AND DISCUSSION

Measurement of Construction

This study measures four main constructs, namely AI Literacy (AIL), Digital Literacy (DL), Ethical Awareness (EA), and Social Responsibility (SR). Indicators for each construct were adapted from relevant literature to ensure conceptual clarity and alignment. The measurement model was evaluated using the PLS-SEM approach to assess indicator reliability and construct validity. The evaluation included examining outer loadings, composite reliability, AVE, and discriminant validity following established guidelines for variance-based SEM, particularly for discriminant validity through the HTMT criterion [15] and contemporary best practices for validating PLS-SEM measurement models [16]. The visualization of indicator relationships for each construct is presented in Figure 2 below.

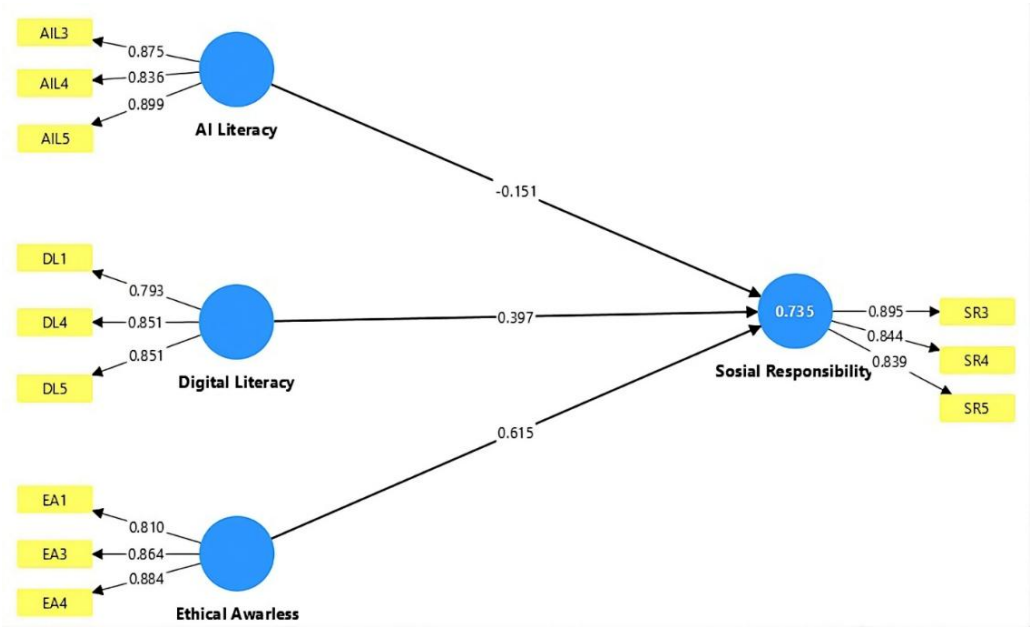

Figure 2. Outer Model

Figure 2 shows the results of the reliability and construct validity tests. All constructs in this study have outer loading values above 0.70, so each instrument is considered to have reflected its construct well. Thus, convergent validity has been fulfilled because it is also supported by AVE values above 0.50. In addition, all constructs met the reliability criteria because they had Cronbach's Alpha and Composite Reliability values above 0.70, so that the research instruments could be declared reliable and internally consistent. Furthermore, discriminant validity was also fulfilled, indicating that each construct was different from one another and did not overlap in concept. This reinforces that the measurement quality in this model is good and capable of accurately explaining the variables under study.

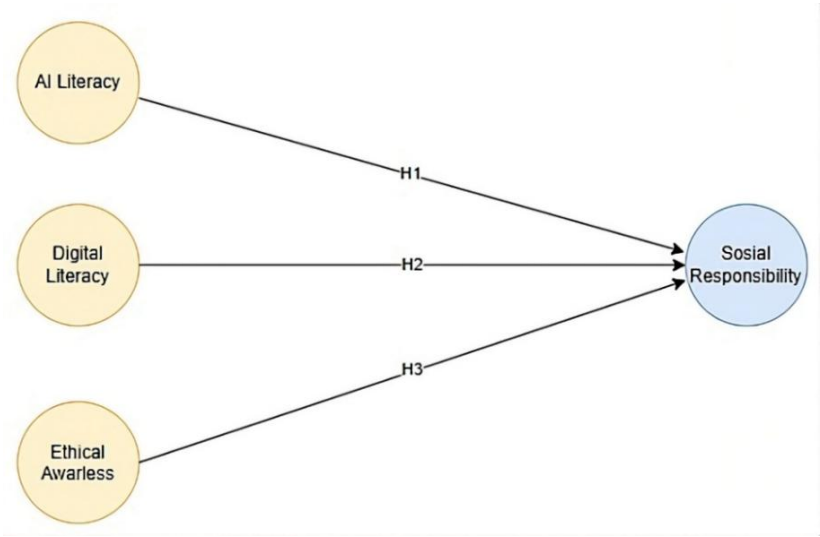

Figure 3. Model Structure

Figure 3 shows the structural relationship between the research variables that lead to the variables in accordance with the developed model, which shows the direct influence of independent variables on dependent variables, as tested in the PLS-SEM analysis, where this figure reinforces the test results that AI Literacy, Digital Literacy, Ethical Awareness, and Social Responsibility contribute significantly to the improvement of Digital Citizenship.

Table 2. Reliability and validity

Statement	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)	VIF
AIL3					2.065
AIL4	0.840	0.844	0.904	0.758	1.783
AIL5					2.274
DL1					1.580
DL4	0.779	0.780	0.872	0.695	1.554
DL5					1.821
EA1					1.564
EA3	0.823	0.815	0.889	0.728	1.951
EA4					2.117
SR3					2.291
SR4	0.780	0.795	0.871	0.693	1.690
SR5					1.912

The results of the measurement model evaluation in Table 2 show that all constructs in this study have met the reliability and validity criteria. The AI Literacy (AIL) construct shows a Cronbach's Alpha value of 0.840, a rho_A value of 0.844, and a Composite Reliability of 0.904, all of which are above the threshold value of 0.70. In addition, the AVE value of 0.758 also meets the minimum standard of 0.50, so that the AIL construct is declared reliable and has good convergent validity. All AIL indicators have VIF values between 1.783 and 2.274, which indicates that there is no multicollinearity problem.

The Digital Literacy (DL) construct also meets the eligibility criteria with a Cronbach's Alpha value of 0.779, rho_A of 0.780, and Composite Reliability of 0.872. The AVE value obtained is 0.695, so the DL construct is proven to be reliable and valid. The VIF value for the DL indicator ranged from 1.554 to 1.821, indicating no multicollinearity. The Ethical Awareness (EA) construct showed a Cronbach's Alpha value of 0.823, a rho_A of 0.815, and a Composite Reliability of 0.889, indicating strong internal consistency. The AVE of 0.728 also meets the criteria for convergent validity. The VIF value for the EA indicator ranges from 1.564 to 2.117, so all EA indicators are declared free of multicollinearity.

The Social Responsibility (SR) construct showed a good level of reliability with a Cronbach's Alpha value of 0.780, a rho_A value of 0.795, and a Composite Reliability of 0.871. The AVE value of 0.693 was above the minimum limit, so the SR construct was declared convergent valid. The VIF value for the SR indicator ranged from 1.690 to 1.912, indicating no multicollinearity issues. Overall, all constructs in this study had a Composite Reliability value above 0.70, an AVE value above 0.50, and a VIF value below 5.

Table 3. Fornell–Larcker criterion

	AI Literacy	Digital Literacy	Ethical Awarless	Social Responsibility
AI Literacy	0.870			
Digital Litercy	0.611	0.832		
Ethical Awarless	0.543	0.716	0.853	
Social Responsibility	0.425	0.745	0.818	0.860

Table 3 shows that all constructs in the model meet the discriminant validity criteria based on the Fornell–Larcker criteria. Discriminant validity is declared met if the square root of the AVE (diagonal value) is higher than the correlations between constructs in the corresponding row and column. For the AI Literacy construct, the square root of the AVE of 0.870 is significantly higher than its correlations with Digital Literacy (0.611), Ethical Awareness (0.543), and Social Responsibility (0.425). This indicates that AI Literacy has adequate discriminant validity.

A similar pattern is also seen for the Digital Literacy construct, with a diagonal value of 0.832, which is greater than its correlations with AI Literacy (0.611), Ethical Awareness (0.716), and Social Responsibility (0.745). Thus, Digital Literacy is declared to meet discriminant validity. Furthermore, the Ethical Awareness construct showed a root AVE value of 0.853, higher than its correlation with AI Literacy (0.543), Digital Literacy (0.716), and Social Responsibility (0.818). Although the correlation with Social Responsibility is quite high, its diagonal value remains the highest, so this construct still meets the requirements for discriminant validity.3.3. Structural Model

Table 4. Hypothesis Results

Hypotesis	Coeffisient	T Statistic	P Value	Decision
H1 : AI Literacy -> Social Responsibility	-0.151	2.017	0.022	Positive and Significant
H2 : Digital Litercy-> Social Responsibility	0.397	3.026	0.001	Positive and Significant
H3 : Ethical Awarless -> Social Responsibility	0.615	4.802	0.000	Positive and Significant

The three independent variables were shown to have a significant effect on Social Responsibility. AI Literacy had a negative but significant effect (β = –0.151; p = 0.022), while Digital Literacy (β = 0.397; p = 0.001) and Ethical Awareness (β = 0.615; p = 0.000) had a positive and significant effect. Thus, all research hypotheses were accepted.

Discussion

The findings of this study demonstrate that AI Literacy, Digital Literacy, and Ethical Awareness significantly influence Social Responsibility among university students. These results reinforce the theoretical perspective that technological literacy and ethical awareness are essential foundations for shaping responsible digital behavior in the era of artificial intelligence. The effect of AI Literacy on Social Responsibility was negative yet significant (β = –0.151; p = 0.022).

This suggests that the more students understand the risks, biases, and ethical challenges associated with AI, the more cautious and critical they become toward the social use of AI technologies. This heightened awareness may lead to an overly vigilant attitude, reducing their willingness to engage in collaborative or socially oriented digital activities. This finding aligns with [6], who argue that increased exposure to algorithmic bias and ethical controversies can produce skepticism and reduced trust in AI systems. Similar evidence shows that higher awareness of technological risks and system complexity can increase cognitive load and reduce active engagement in digital environments [17]. Therefore, AI literacy that focuses predominantly on risks without being balanced by practical ethical problem-solving skills may inadvertently lower social engagement.

In contrast, Digital Literacy exhibited a positive and significant effect on Social Responsibility (β = 0.397; p = 0.001). This indicates that the ability to access, evaluate, and produce digital information equips students to make more responsible and ethical decisions in online

environments. This finding is consistent with [1], who emphasize that digital literacy strengthens critical thinking and reduces the likelihood of harmful digital behaviors. Recent evidence also suggests that higher levels of digital literacy contribute to more accountable and prosocial online conduct, reinforcing individuals' capacity for constructive digital participation [18]. Consequently, digital literacy emerges as a crucial competence for fostering healthy and meaningful social participation in digital spaces.

The strongest predictor in this study was Ethical Awareness ($\beta = 0.615$; $p = 0.000$). This finding highlights that ethical understanding serves as the primary foundation for responsible social behavior. Prior literature also emphasizes that ethical reasoning is central to digital well-being, moral decision-making, and safe human–AI interaction, as discussed by [19]. Recent studies further support this perspective, showing that ethical awareness enhances individuals' ability to navigate moral dilemmas and engage responsibly within digital environments [20]. Students with strong ethical awareness are better able to recognize potential harm and make mindful decisions when interacting with digital technologies, ultimately strengthening their sense of social responsibility. Overall, the findings support the conceptual model which proposes that technological literacy and ethical awareness not only influence students' technical competence but also shape the quality of their social engagement in digital environments. The integration of AI Literacy, Digital Literacy, and Ethical Awareness is thus essential in cultivating responsible digital citizenship in the age of artificial intelligence.

CONCLUSIONS

This This study concludes that AI Literacy, Digital Literacy, and Ethical Awareness significantly influence students' Social Responsibility. While Digital Literacy and Ethical Awareness show positive effects, AI Literacy demonstrates a negative yet significant effect, indicating that awareness of AI's risks may intensify students' caution in digital engagement.

Theoretically, this study contributes to the growing body of literature by integrating three key literacy constructs into a single predictive model of social responsibility, highlighting the central role of ethical awareness in shaping responsible digital citizenship. Methodologically, the study offers empirical validation using the PLS-SEM approach, providing a reliable analytical framework for examining complex relationships in technology-related behavioral research. Practically, the findings emphasize the need for higher education institutions to embed digital literacy and ethical training into their curricula to prepare students for critical, informed, and responsible participation in AI-enhanced learning environments.

Future research should expand the sampling scope to broader and more diverse populations, employ longitudinal designs to capture developmental changes over time, and incorporate additional variables such as digital well-being, civic engagement, or technology trust. These extensions will deepen the understanding of how technological and ethical competencies interact to shape responsible behavior in digital contexts.

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