

**Article Type:** Research Paper

# Determining accounting students' design thinking skills: The role of artificial intelligence usage and digital literacy

Rahmat Darmawan\* and Harjanti Widiastuti



**AFFILIATION:**

Master of Accounting, Faculty of Economics and Business, Universitas Muhammadiyah Yogyakarta, Special Region of Yogyakarta, Indonesia

**\*CORRESPONDENCE:**

rahmatdrmwn07@gmail.com

**DOI:** [10.18196/jai.v26i3.27220](https://doi.org/10.18196/jai.v26i3.27220)

**CITATION:**

Darmawan, R., & Widiastuti, H. (2025). Determining accounting students' design thinking skills: The role of artificial intelligence usage and digital literacy. *Journal of Accounting and Investment*, 26(3), 858-881.

**ARTICLE HISTORY**

**Received:**

03 Jun 2025

**Revised:**

31 Aug 2025

**Accepted:**

30 Dec 2025



This work is licensed under a Creative Commons Attribution-Non-Commercial-No Derivatives 4.0 International License

**JAI Website:**



**Abstract**

**Research aims:** This study aims to examine the influence of Artificial Intelligence (AI) usage and digital literacy on the design thinking skills of accounting students, as well as examine the role of digital literacy as a mediating variable in the relationship between AI usage and design thinking skills.

**Design/Methodology/Approach:** A quantitative approach was used through a survey of 323 accounting students from various universities in Indonesia. Data were analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM) to test the direct and indirect influences between variables.

Research findings show that AI usage and digital literacy directly and positively influence design thinking skills. Furthermore, digital literacy mediates the positive influence of AI usage on design thinking skills. Variations in relationships were also found based on the type of institution and the student's semester level.

**Theoretical contribution/Originality:** This study expands the application of Social Cognitive Theory (SCT) by placing digital literacy as a personal factor that mediates the influence of technology on complex thinking skills. These findings also emphasize the importance of considering institutional context and learning experiences in using accounting education technology.

**Practitioner/Policy implication:** The study's results confirm the importance of a learning strategy focusing on AI integration and strengthening digital literacy to support the development of 21st-century skills.

**Research limitation/Implication:** Variations in institutional readiness and access to technology become external factors that cannot be controlled. Future research needs to include learning experiences and institutional environment as contextual variables.

**Keywords:** accounting education; ai usage; design thinking skills; digital literacy; social cognitive theory

## Introduction

The rapid development of digital technology, especially artificial intelligence (AI), has had a major impact on various sectors, including the accounting sector (Li et al., 2020; Liang & Wu, 2022). The accounting profession today faces complex challenges due to the digitization and automation of business processes that require accounting practitioners and aspiring professionals to not only master technical skills but also have creative and innovative thinking skills known as design thinking skills (Savić & Pavlović, 2023; Shamsudin, Khan, & Jusoh, 2025; Slimene & Mansour, 2024).

This skill is crucial in dealing with regulatory dynamics, information technology system integration, and solving accounting problems that are increasingly complex and multidimensional (Imjai et al., 2024). In line with these developments, AI adoption in Indonesia is also accelerating. The World Economic Forum reports that internet penetration in Indonesia will reach 79% by 2024, and AI will be one of the main drivers of digital inclusion in the financial sector (World Economic Forum, 2025). Trade.gov estimates that AI adoption in Indonesia will increase by around 30% by 2025, which is in line with the growth of the national digital economy and is worth more than US\$146 billion (U.S. Department of Commerce, 2025). World Bank data also shows the acceleration of the digitalization of financial services, with bank account ownership increasing from 20% in 2011 to 52% in 2021, and e-money users jumping from 815 thousand to 18.8 million in the 2014–2021 period (World Bank, 2023). These facts confirm that digital transformation in Indonesia reinforces the urgency of mastering design thinking skills for accounting students and practitioners.

Design thinking skills in the context of accounting include the ability to understand the needs of users (stakeholders such as clients, investors/potential investors, auditors, and management), identify complex accounting problems, and design innovative solutions that are effective and efficient (du Toit et al., 2024b; Glen et al., 2014). For example, an accountant using a design thinking approach will creatively develop a more transparent and easy-to-understand financial reporting model or design an internal control system responsive to new risks due to digitalization. These capabilities also include solution prototyping skills and continuous iteration that adapt to changing regulations and technologies (du Toit et al., 2024b, 2024a).

Accounting students as prospective accounting professionals who will enter the world of work need to be equipped with design thinking skills to be able to respond to rapid industry changes, develop innovative solutions, and increase added value to accounting work, which has tended to be routine and procedural (Imjai et al., 2024). With these skills, students can be better prepared to adapt to opportunities and challenges that arise along with technological developments and changing job market needs (Shamsudin et al., 2025). In accounting education, integrating AI technology is one of the strategic steps to enrich the learning experience and improve student competence, especially in building digital literacy, which is an important foundation in mastering technology (Imjai et al., 2024). For example, a study conducted by Marcy et al. (2024) shows that accounting students can utilize large language models such as ChatGPT to analyze company inspection reports based on Public Company Accounting Oversight Board (PCAOB) standards, compile memos, and conduct critical evaluations of the advantages and disadvantages of AI outputs. This process has been proven to develop technical skills such as prompt engineering, data analysis, and reflective writing, while strengthening design thinking skills through an iterative approach (Han et al., 2025; Marcy et al., 2024).

The use of AI in accounting education not only allows the automation of administrative tasks and data analysis but can also encourage students to develop creative and critical mindsets that are essential for the development of design thinking skills (Kaswan et al., 2024; Murdan & Halkhoree, 2024; Sulaymanova et al., 2024). However, the influence of

the use of AI on these innovative thinking skills cannot be directly understood without considering the role of digital literacy as a mediator that connects the use of technology and the development of these cognitive skills (Agaoglu et al., 2025; Imjai et al., 2024; Segbenya et al., 2023). Digital literacy enables students to operate technology and understand, evaluate, and integrate technology to solve complex accounting problems (Agaoglu et al., 2025; Imjai et al., 2024).

However, empirical research that explicitly examines the mechanism of the influence of AI usage on design thinking skills through digital literacy in the realm of accounting education is still minimal (Agaoglu et al., 2025; Imjai et al., 2024; Segbenya et al., 2023). Previous research investigated the role of digital literacy as a mediator between AI usage and creative thinking in nursing students, proving that the research results were significantly positive (Agaoglu et al., 2025). Another study investigated the influence of AI usage on employability skills, where the results showed the negative influence of the relationship (Segbenya et al., 2023). In line with this, other studies also state that AI interventions in learning do not significantly affect design thinking skills (Saritepeci & Yildiz Durak, 2024). On the other hand, other studies confirm that digital literacy significantly affects design thinking skills (Imjai et al., 2024). It is an important gap that needs to be filled to provide a deeper understanding of how technology integration can be optimized for the development of design thinking skills that are urgently required by the accounting profession in the future, through digital literacy as a mediating variable.

Previous studies have shown inconsistent results regarding the influence of AI usage on students' design thinking skills. Some studies found that AI adoption supports the development of creative and innovative thinking (Kaswan et al., 2024; Murdan & Halkhoree, 2024), while others reported negative (Segbenya et al., 2023) or non-significant effects of AI interventions on design thinking (Saritepeci & Yildiz Durak, 2024). This inconsistency suggests that the relationship cannot be fully understood without considering the role of digital literacy. Indeed, recent studies confirmed that digital literacy enhances students' ability to evaluate and integrate technology critically, strengthening design thinking skills (Agaoglu et al., 2025; Imjai et al., 2024). Few studies have specifically investigated this mediating mechanism in accounting education, particularly within the Indonesian context, where the profession increasingly demands design thinking skills. Therefore, this study aims to fill this gap by employing Social Cognitive Theory (SCT) as the primary theoretical foundation. SCT, proposed by Bandura (1986), explains how personal factors (digital literacy), behavior (AI usage), and the learning environment interact to shape learning outcomes (improving design thinking skills). As learning is viewed as a dynamic and socially influenced process, SCT provides a relevant framework for examining how AI usage and digital literacy contribute to the development of accounting students' design thinking skills, with digital literacy as a mediating variable.

National reports indicate that digital transformation in Indonesian higher education has been accelerating, yet the adoption of AI in accounting education remains relatively limited compared to other disciplines (World Economic Forum, 2025; World Bank, 2023). This gap shows that few studies have explicitly examined the mechanism linking AI usage, digital literacy, and design thinking skills in the context of accounting education. This study

contributes to two main aspects. First, it provides a theoretical contribution by extending the application of SCT, demonstrating how personal factors (digital literacy), behavior (AI usage), and the learning environment (technology) interact to shape accounting students' design thinking skills. Second, it offers a practical contribution by proposing AI-based learning strategies that can be embedded into accounting curricula to strengthen students' digital literacy and design thinking competencies. Thus, this study not only enriches the literature on SCT in accounting education but also delivers actionable insights for innovative teaching practices that prepare students to face technological disruption and the growing complexity of the accounting profession in the Industry 4.0 era.

## **Literature Review and Hypotheses Development**

### **Social Cognitive Theory (SCT)**

SCT, developed by Bandura (1986), became this study's framework. SCT departs from the principle of reciprocal determinism, which is that personal, behavioral, and environmental factors influence each other reciprocally. In this framework, digital literacy is positioned as a personal factor reflecting students' self-efficacy and cognitive capacity to understand, evaluate, and utilize AI usage, which is positioned as a behavioral factor in the form of real student activities in operating AI-based software and applications in accounting learning. The learning environment in accounting education as an external context provides stimulus and opportunities to develop design thinking skills.

SCT also emphasizes that learning occurs through observational learning, where students observe and imitate how AI is used in solving complex accounting tasks, thus allowing them to internalize creative strategies in problem-solving, which are then applied in the practice of design thinking. Recent findings suggest that observing innovative behaviors is important in shaping students' intentions and decisions to adopt new technologies (Liu, 2025). In addition, self-efficacy determines how confident students are in exploring digital technology and integrating it into innovative accounting solutions. Previous research has found that increasing technological self-efficacy can increase the use of e-learning strategies and learning satisfaction (Mekheimer, 2025). Furthermore, Jeilani and Abubakar (2025) state that institutional support strengthens students' confidence in using AI in the learning process. Thus, digital literacy is not just a technical skill, but also reflects cognitive beliefs that strengthen the relationship between AI usage and the development of accounting students' design thinking skills.

Contemporary literature further emphasizes the relevance of SCT in the context of technology-based higher education. Digital learning integration has been shown to expand access to resources, enrich social interactions, and facilitate collaboration that stimulates student creativity (Chen & Tu, 2021). Recent studies have also shown that a digital learning environment can improve academic motivation and self-efficacy through active participation and collaborative experiences that encourage critical reflection (Khine et al., 2016; Schunk & DiBenedetto, 2020). In accounting education, AI usage not only supports the efficiency of information access but also creates space for students to test

ideas, evaluate alternatives, and iteratively build solution prototypes, a process that is in line with the principles of design thinking (Feng & Heng, 2024; Sreenivasan & Suresh, 2024).

Based on the SCT framework, this study argues that the inconsistency of previous findings regarding the influence of AI usage on design thinking skills can be understood through the role of digital literacy as a mediation mechanism. Digital literacy allows students to evaluate, select, and integrate AI technology more effectively, resulting in stronger design thinking skills. Thus, this study confirms that digital literacy is not only a technical skill, but also a cognitive factor that bridges the relationship between AI use behavior and students' innovative thinking achievements. The SCT framework provides a sharp conceptual foundation to explain how personal, behavioral, and environmental factors interact in shaping the creative competencies of accounting students in the digital era.

### **AI Usage on Design Thinking Skills**

In the framework of SCT by Bandura (1986), the AI usage is positioned as a behavioral factor that reflects how students operate and utilize technology in learning activities, rather than simply the existence of AI itself. The behavior of using AI allows students to access information, complete accounting tasks more efficiently, and develop creative solutions to complex problems (Pizarro-Romero, 2024). Through observational learning and modelling mechanisms, students can imitate best practices in AI usage for data analysis and problem-solving, which are then reinforced by academic success experiences and feedback from AI-based systems (Rios et al., 2025; Rosário, 2024).

Previous research has also shown that AI usage in learning improves students' creative self-efficacy, critical reflection, and innovative skills (Doyle, 2023; Hu et al., 2024). In addition to supporting financial data analysis and forecasting, AI allows students to build solution prototypes and test alternative strategies that align with design thinking principles (Fathonji, 2023; Feng & Heng, 2024; Zhao et al., 2023). Thus, from the perspective of SCT, students' design thinking skills are formed through the interaction between AI use behavior and digital self-confidence and a supportive learning environment (Agaoglu et al., 2025; Imjai et al., 2024; Sreenivasan & Suresh, 2024). Based on this discussion, the hypothesis proposed is:

*H<sub>1</sub>: AI usage positively influences accounting students' design thinking skills.*

### **Digital Literacy on Design Thinking Skills**

Within the framework of SCT, digital literacy is positioned as a personal factor that not only reflects technical skills but also influences self-efficacy, self-regulated learning, and students' reflective capacity in using technology to support the design thinking process (Bandura, 1986; Imjai et al., 2024). Accounting students with high digital literacy have greater self-confidence to explore digital devices, manage their learning process independently, and critically reflect on the solutions developed. It is reinforced by Cheng

et al. (2024), who found that digital literacy contributes to improved academic achievement because it helps students operate digital devices more effectively. The findings of Ding et al. (2024) also confirm that digital literacy encourages openness to new technologies, which has implications for increasing creativity and problem-solving skills.

Furthermore, digital literacy plays a role in developing social-emotional skills, critical thinking, and creative thinking relevant to applying design thinking (Audrin & Audrin, 2022; Odede & Jiyane, 2019; Phippen, 2024). In accounting, students with high digital literacy can better design digital application-based financial statement prototypes, test various alternatives to internal control systems, or evaluate extensive amounts of accounting data to produce innovative solutions. Contemporary research shows that digital learning positively affects the development of students' design skills and creativity (Agaoglu et al., 2025; Al-Hattami, 2025; Imjai et al., 2024). Therefore, digital literacy is an important foundation in strengthening the thinking skills of accounting students who are adaptive to professional dynamics. Based on this discussion, the hypothesis proposed is:

*H<sub>2</sub>: Digital literacy positively influences accounting students' design thinking skills.*

### **The Role of Digital Literacy as a Mediator**

Digital literacy is a mechanism that explains how and why AI usage can improve the design thinking skills of accounting students. Within the framework of SCT, digital literacy is not only a technical skill, but also a personal ability to understand, evaluate, and integrate technology into the learning process. With good digital literacy, AI behavior becomes more optimal because students can interpret information critically and apply it creatively to design innovative solutions in accounting (Bandura, 1986; Sriwisathiyakun, 2023; Calderon et al., 2023).

Previous research has shown inconsistent results regarding the influence of AI usage on design thinking skills. Several studies have found a positive influence (Agaoglu et al., 2025; Feng & Heng, 2024; Imjai et al., 2024; Promma et al., 2025; Sreenivasan & Suresh, 2024), while others report negative or insignificant influences (Saritepeci & Yildiz Durak, 2024; Segbenya et al., 2023). This gap can be explained through digital literacy as a mediating factor. Empirical evidence shows that digital literacy improves students' ability to integrate technology to support creativity, innovation, and problem-solving (Cheng et al., 2024; Ding et al., 2024; Zhu et al., 2023). Thus, digital literacy becomes a link that allows AI usage to have a greater impact on the development of design thinking skills of accounting students. Based on this discussion, the hypothesis proposed is:

*H<sub>3</sub>: Digital literacy mediates the positive influence of AI usage on accounting students' design thinking skills.*

A research model of the relationship between the variables of AI usage, digital literacy, and design-thinking skills is presented through Figure 1.

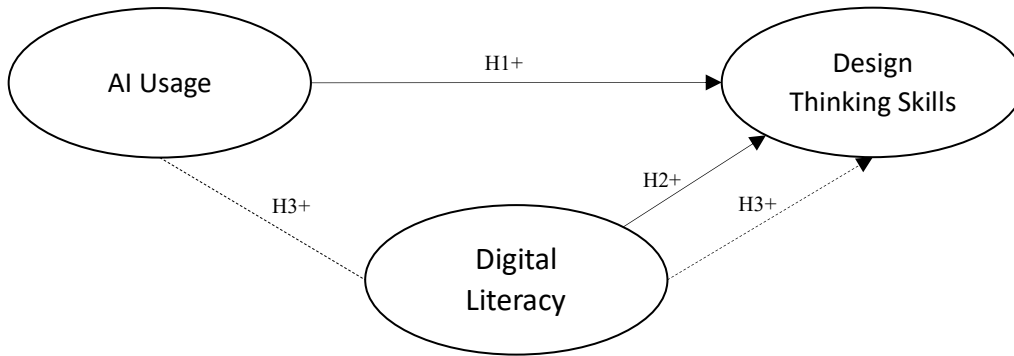


Figure 1 Research Model

## Research Method

The population in this study is accounting students in Indonesia, as they are prospective professionals who will directly face digital disruption and the application of AI in accounting practice. Accounting students are highly relevant as research subjects because the accounting curriculum is increasingly integrating digital technology. Therefore, digital literacy and design thinking skills are essential to strengthen their future job readiness..

The sampling technique used is a combination of purposive and convenience sampling. Purposive sampling was chosen so that respondents were in accordance with the research criteria, namely undergraduate or applied undergraduate students in at least semester III who have used AI software in learning. This criterion is important because third-semester students generally have adequate academic experience, such as taking exams, compiling papers, and conducting research, so that they can reflect on relevant learning experiences. Meanwhile, convenience sampling is used because of the ease of access and distribution of questionnaires online through a network of accounting students from various universities in Indonesia, thus allowing researchers to reach a wider number of respondents efficiently. With this combination, the research can ensure the representation of respondents according to the study objectives while maintaining the feasibility and effectiveness of data collection.

The exact population size is unknown. Therefore, the minimum sample size was determined using power analysis as suggested by Cohen (1992), Memon et al. (2020), and Hair et al. (2021) using G\*Power 3.1.9.7 software. The calculation was based on a linear multiple regression test: Fixed model, R<sup>2</sup> deviation from zero with 2 predictors (according to the research model). The input parameters were a medium effect ( $f^2 = 0.15$ ), a significance level of  $\alpha = 0.05$ , and a test power 0.95. The calculation results showed that the minimum sample size required was 107 respondents to achieve 95% power. Meanwhile, the study collected data from 323 respondents, exceeding the minimum

number needed. Larger sample numbers increase the generalization power of research findings and ensure stability and reliability in model estimation using PLS-SEM.

Next, data was collected using a questionnaire based on a Likert scale with five levels of answers, which is available in Google Form format. The questionnaire included three main variables: AI usage, digital literacy, and design-thinking skills. The instrument of the variable AI usage is adapted from Segbenya et al. (2023), and the variables of digital literacy and design thinking skills are adapted from Imjai et al. (2024). The operational definitions, indicators, and measurement sources of each research variable are presented in Table 1.

**Table 1** Demographics Respondents

Variabel	Operational Definition	Indicator	Source
AI Usage	Student behavior in using AI software to support accounting learning, accelerate information access, complete academic assignments, and overcome learning barriers.	1. Learning & research support 2. Quick access to information 3. Information from various sources 4. Timely completion of tasks 5. Complex task solving 6. Overcoming language barriers 7. Control & autonomy learning	Segbenya et al. (2023)
Digital Literacy	Ability to use digital technology to search, manage, evaluate, and communicate effectively.	1. Online information search 2. Effective language communication 3. Multimedia communication (voice, image, video)	Imjai et al. (2024)
Design Thinking Skills	Students' creative ability to understand user needs, think empathetically, and solve complex problems through innovative approaches.	1. New ideas/solutions 2. Empathy & listening 3. Data-driven troubleshooting 4. Systematic problem-solving	Imjai et al. (2024)

Data analysis was performed with Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4 software to test the relationships between variables. Before the model analysis, a common method variance (CMV) test was conducted using RStudio to ensure no bias in the measurement method (Tehseen et al., 2017). Descriptive analysis was used to describe respondent demographics and data distribution. Model evaluation is carried out through convergent validity tests, discriminant validity, and reliability tests. Hypothesis testing was carried out using the bootstrapping method to assess the significance of the relationship between variables. Additional analysis was carried out through Q<sup>2</sup> predict tests and PLS Predict.

Furthermore, multi-group analysis (MGA) was conducted based on the type of university (public and private) and semester level. This group separation is based on the empirical phenomenon that public universities generally have stronger digital infrastructure and institutional support than private universities, thus potentially influencing students' AI usage behavior and digital literacy (Suwendi et al., 2025; Yusuf, 2022). Similarly, the difference in semester levels reflects the variation in students' academic experiences:

early-semester students tend to be new to integrating technology in learning, while final year students have broader experience in research, accounting practices, and the use of digital devices. Therefore, the group separation was carried out to test whether the relationship between variables was consistent or if there were differences, thereby increasing the research results' external validity and generalization power.

## Result and Discussion

### Descriptive Analysis

This study analyzed 323 accounting students from various universities in Indonesia. The demographics of the respondents are presented in Table 2.

**Table 2** Results of Demographic Analysis of Respondents

Description	Total	Percentage (%)
<b>Gender</b>		
Male	100	30.96
Female	223	69.04
Total Respondents	323	100
<b>Study Program</b>		
Accounting	232	71.83
Accounting Education	86	26.63
Tax Accounting	2	0.62
Digital Business Accounting	1	0.31
Sharia Accounting	1	0.31
Public Sector Accounting	1	0.31
Total Respondents	323	100
<b>Semester</b>		
> Semester 7	141	43.65
Semester 6	82	25.39
Semester 4	100	30.96
Total Respondents	323	100
<b>GPA</b>		
3.51 – 4.00	174	53.87
3.01 – 3.50	120	37.15
2.51 – 3.00	28	8.67
Below 2.50	1	0.31
Total Respondents	323	100
<b>Province of University</b>		
D.I Yogyakarta	93	28.79
West Java	56	17.34
Jakarta	55	17.03
East Java	46	14.24
Central Java	39	12.07
West Sumatra	13	4.02
Banten	8	2.48
Bali	3	0.93
Lampung	2	0.62

**Table 2** Results of Demographic Analysis of Respondents (cont')

Description	Total	Percentage (%)
South Sulawesi	2	0.62
Riau	1	0.31
North Sumatra	1	0.31
East Nusa Tenggara	1	0.31
South Sumatra	1	0.31
South Kalimantan	1	0.31
Bengkulu	1	0.31
Total Respondents	323	100
<b>Type of University</b>		
Public	239	73.99
Private	84	26.01
Total Respondents	323	100

Table 2 shows that the total respondents of this study is 323, with the majority being female (69.04%). Most respondents came from the Accounting study program (71.83%), followed by Accounting Education (26.63%), while other study programs were only represented in small numbers. The semester distribution showed that 43.65% of respondents were above semester 7, while 25.39% were in semester 6 and 30.96% were in semester 4, so this study includes a balanced representation between undergraduate and postgraduate students. Regarding academic achievement, most respondents had a GPA above 3.00, with more than half (53.87%) in the range of 3.51–4.00. Geographically, respondents were spread across various provinces in Indonesia, with the largest concentrations in D.I. Yogyakarta (28.79%), West Java (17.34%), Jakarta (17.03%), East Java (14.24%), and Central Java (12.07%). Regarding the type of institution, most students come from public universities (73.99%) compared to private universities (26.01%). This distribution shows that the research sample has diverse representations in terms of gender, study program, academic level, and geographical and institutional context, thus strengthening the external validity of the research results. Next, the results of descriptive statistics are presented in Table 3.

**Table 3** Descriptive Statistics Results

Construct	Min	Max	Mean	Std. Deviation
AI Usage	1	5	4.19	0.74
Digital Literacy	1	5	4.02	0.74
Design Thinking Skills	1	5	4.32	0.61

Table 3 shows that the average scores of AI usage (4.19), digital literacy (4.02), and design thinking skills (4.32) of students are high on a scale of 1-5. Low standard deviations (0.61 and 0.74) indicated a relatively uniform data distribution among respondents.

Furthermore, a CMV test is performed before testing the hypothesis using PLS. The CMV test determines whether the data used does not contain bias or potential errors, such as self-reporting bias, complexity, ambiguity, and questionnaire scale. Based on the results of the CMV test in this study, it is known that the value of the proportion of variance described as 36% is less than 50% based on the threshold set by MacKenzie & Podsakoff (2012), Podsakoff & Organ (1986), and Tehseen et al. (2017). It indicates that the data does not have significant bias or potential errors, so that it can proceed to the convergent validity test stage.

**Table 4** Convergent Validity Testing Results

Indicators	Code	Outer Loading	AVE
<b>AI Usage</b>			
AI software provides learning and research support for me	AIU1	0.827	0.631
AI software helps me access the right information	AIU2	0.788	
AI software provides information from multiple sources in the shortest possible time	AIU3	0.790	
AI software helps me complete tasks faster or on time	AIU4	0.842	
AI software helps me complete tasks without any hassle	AIU5	0.847	
AI software helps overcome barriers such as language	AIU6	0.730	
AI software provides more control and autonomy (independence) for me in learning	AIU7	0.726	
<b>Digital Literacy</b>			
I use online research tools (Google Scholar, Publish & Perish, etc.) to get the best information	DL1	0.858	0.698
I can use appropriate language (both spoken and written) effectively when communicating online	DL2	0.764	
During online meetings, I can enhance digital communication effectively with multimedia (e.g., sound, images, and video)	DL3	0.896	
<b>Design Thinking Skills</b>			
I spend my free time discovering new things to improve efficiency at work	DTS1	0.804	0.707
I listen to the other person's reasons or views before taking action	DTS2	0.858	
I solve problems based on data	DTS3	0.831	
I can solve problems with a systematic process	DTS4	0.847	

The convergent validity test was evaluated based on the outer loading and AVE values. The acceptance criteria in this study stated that a variable is considered valid if the outer loading value is more than 0.708 and the AVE value is more than 0.5 (Hair et al., 2021). This research model fulfills a convergent validity that ensures that each indicator consistently measures the construct. The results of the convergent validity test are presented in Table 4.

**Table 5** Discriminant Validity (Fornell and Lacker) Testing Results

	AI Usage	Design Thinking Skills	Digital Literacy
AI Usage	<b>0.794</b>		
Design Thinking Skills	0.742	<b>0.835</b>	
Digital Literacy	0.325	0.368	<b>0.841</b>

After the convergent validity test was carried out, this study conducted a discriminant validity test. Discriminant validity testing ensures that each variable in the study is theoretically and empirically different, which confirms the uniqueness of the constructs in the research model. The test was performed using the Fornell and Larcker criteria, where validity is achieved if the root of the AVE is greater than the correlation between variables, and the Heterotrait-Monotrait Ratio (HTMT) value must be below 0.85 (Hair et al., 2021). The discriminatory validity of this research model has been met. The results of

the tests with the Fornell and Larcker criteria are presented in Table 5, and the HTMT results are presented in Table 6.

**Table 6** Discriminant Validity (HTMT) Testing Results

	Heterotrait-monotrait ratio (HTMT)
Design Thinking Skills <-> AI Usage	0.842
Digital Literacy <-> AI Usage	0.357
Digital Literacy <-> Design Thinking Skills	0.430

Next, the reliability estimates in this study were analyzed using Composite Reliability (CR) and Cronbach's Alpha to measure the internal consistency of the instruments. A variable is considered reliable if the CR value is  $\geq 0.60$ , which indicates that the instrument can measure the variable consistently (Hair et al., 2021). In addition, reliability was also tested using Cronbach's Alpha, with acceptance criteria ranging from 0.60 to 0.95, following non-exploratory research standards (Hair et al., 2021). The values in this range indicate that the research instrument is reliable in measuring each variable. This research is reliable and measures variables consistently. The results of the reliability estimate are presented in Table 7.

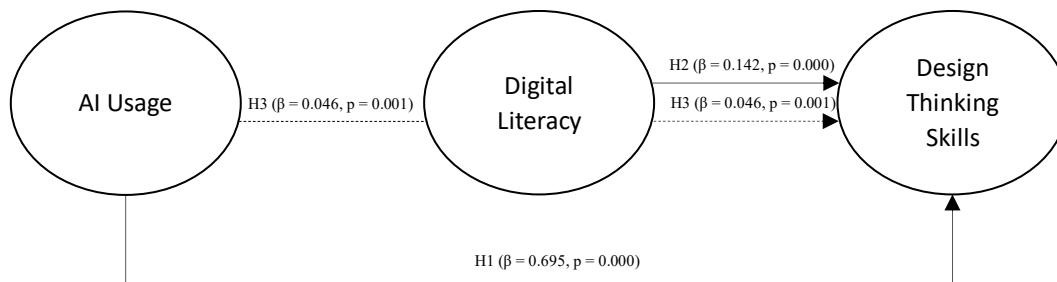
**Table 7** Reliability Estimation Results

Variable	Cronbach's alpha	CR (rho_a)	CR (rho_c)
AI Usage	0.902	0.906	0.923
Design Thinking Skills	0.855	0.856	0.902
Digital Literacy	0.798	0.858	0.878

After the data is declared valid and reliable through the assessment of the measurement model, a structural model assessment is carried out. Structural models are evaluated to test the research hypothesis and assess the relationships between the variables in the model. This process includes several stages of analysis, starting with checking the linearity between variables using VIF, where a VIF value below 5 indicates no high linearity, while a VIF value below 3 is more recommended (Hair et al., 2021). Furthermore, the significance of the path coefficient was tested through the bootstrapping method, with the criterion of  $p < 0.05$  as an indicator of the significant relationship between variables (Hair et al., 2021). The 95% Confidence Interval for the Path Coefficient is also used to see the minimum and maximum limits of influence between variables at the 95% confidence level (Sarstedt et al., 2021). Then, this study also used the  $R^2$  value to measure predictive strength with the categories of substantial ( $\geq 0.75$ ), medium ( $\geq 0.50$ ), and weak ( $\geq 0.25$ ) (Hair et al., 2021). Table 8 shows the results of the structural model assessment, and Figure 2 shows the hypothesis test results.

**Table 8** Structural Model Assessment Results

Association	Samples $\beta$ (p-value)					
	All Samples	Public HEIs	Private HEIs	4th-Semester Student	6th-Semester Student	7+ Semester Student
<b>Direct Effect</b>						
AI Usage → Design Thinking Skills	0.695 (0.000)*	0.710 (0.000)*	0.706 (0.000)*	0.976 (0.000)*	0.964 (0.000)*	0.292 (0.000)*
AI Usage → Digital Literacy	0.325 (0.000)*	0.405 (0.000)*	0.328 (0.000)*	0.448 (0.000)*	0.303 (0.002)*	0.371 (0.000)*
Digital Literacy → Design Thinking Skills	0.142 (0.000)*	0.168 (0.048)*	0.114 (0.008)*	-0.004 (0.399)*	-0.010 (0.353)	0.407 (0.000)*
<b>Indirect Effect</b>						
AI Usage → Digital Literacy → Design Thinking Skills	0.046 (0.001)*	0.068 (0.059)	0.037 (0.016)*	-0.002 (0.404)	-0.003 (0.375)	0.151 (0.001)*
<b>VIF</b>				1.572–2.655		
<i>Note: *Supported at the significance level of 0.05</i>						



**Figure 2** Hypothesis Testing Results

Based on Table 8 and Figure 2, the results of the structural model assessment on all samples and hypothesis tests show that the direct influence of AI usage on design thinking skills (H1) is significantly positive with a path coefficient ( $\beta$ ) of 0.695 ( $p < 0.001$ ), so this hypothesis is supported. The influence of AI usage on digital literacy was also significantly positive, with a  $\beta$  value of 0.325 ( $p < 0.001$ ), although it was not the central hypothesis. Furthermore, the effect of digital literacy on design thinking skills (H2) was also significantly positive with a  $\beta$  of 0.142 ( $p < 0.001$ ), which means that the second hypothesis is supported. In addition, the indirect influence of AI usage on design thinking skills through digital literacy (H3) is also positively significant with a  $\beta$  value of 0.046 ( $p = 0.001$ ), so the third hypothesis is also supported. The VIF value of 1,572 to 2,655 indicates the absence of multicollinearity problems in the research model. Overall, these results reinforce that AI usage and digital literacy contribute significantly to the development of design thinking skills of accounting students, both directly and through digital literacy mediation.

Next, to see the consistency of the relationship between variables, an additional analysis was carried out in the form of MGA, which was reviewed based on the type of university (public vs private) and the semester level. The analysis results showed a variation in the strength of the relationship between AI usage, digital literacy, and design thinking skills in each group. In public universities, the relationship between AI usage and design thinking skills was stronger ( $\beta = 0.710$ ,  $p < 0.001$ ) compared to private universities ( $\beta = 0.706$ ,  $p < 0.001$ ), although this difference was not significant. Digital literacy also has a more substantial effect on design thinking skills in public universities ( $\beta = 0.168$ ,  $p = 0.048$ ) compared to private universities ( $\beta = 0.114$ ,  $p = 0.008$ ), which shows that in public universities, digital literacy has a greater role in improving students' design thinking skills. The indirect effect of AI usage on design thinking skills through digital literacy was also seen significantly in private universities ( $\beta = 0.037$ ,  $p = 0.016$ ), but not significantly in public universities ( $p > 0.05$ ), which indicates that the mediation pathway through digital literacy is more dominant in private universities.

In addition, when looking at semester levels, more striking differences emerge. In 4th and 6th-semester students, the effect of digital literacy on design thinking skills was insignificant ( $p > 0.05$ ), suggesting that in students with less academic experience, digital literacy did not significantly impact design thinking skills. On the other hand, in students in the 7th semester and above, the relationship between digital literacy and design thinking skills was significantly positive ( $\beta = 0.407$ ,  $p < 0.001$ ), indicating that students with more academic experience have better design thinking skills driven by digital literacy. The indirect effect on 7th-semester students and above was also positive ( $\beta = 0.151$ ,  $p = 0.001$ ), showing that digital literacy plays an important role in mediating the influence of AI usage on design thinking skills in this group. However, in 4th and 6th semester students, the effect of digital literacy mediation was insignificant ( $p > 0.05$ ), indicating that the relationship between AI usage and design thinking skills is more direct without involving digital literacy as a mediator.

Next, to measure the predictive power of this research model, the value of the determination coefficient ( $R^2$ ) of each dependent variable is presented in Table 9.

**Table 9** Results of the Coefficient of Determination of the Research Model

Variables	$R^2$	$R^2$ adjusted
Design Thinking Skills	0.568	0.565
Digital Literacy	0.105	0.103

Based on Table 9, the determination coefficient ( $R^2$ ) value for the variable design thinking skills is 0.568 with an adjusted  $R^2$  of 0.565, indicating that approximately 56.8% of the variation in design thinking skills can be explained by exogenous variables in this study model. This value suggests predictive power, according to the general standards in social research (Hair et al., 2021). Meanwhile, the value of  $R^2$  for the variable digital literacy is 0.105 with an adjusted  $R^2$  of 0.103, suggesting that about 10.5% of the variation in digital literacy can be explained by the exogenous variables present in the model. This value shows that the influence of exogenous variables on digital literacy is still relatively weak, so other factors outside the model may contribute to the variability of students' digital

literacy. However, this value is still acceptable in social research (Falk & Miller, 1992; Hair et al., 2021). Overall, this model has adequate predictive power, especially in explaining the variables of design thinking skills.

Additional analysis was carried out by looking at the Q<sup>2</sup> predict and PLS predict values. Q<sup>2</sup> predicts measures the model's predictive ability, with > values of 0 indicating predictive relevance, while values of 0.25 and 0.50 indicate medium and large predictive levels (Hair et al., 2021). PLS Predict compares the predictive power of the PLS model with linear regression using RMSE and MAE, where the PLS model is considered stronger if it has lower RMSE and MAE values than linear regression (Hair et al., 2021). This evaluation determines whether the model is valid and has good predictive power. The results of the Q<sup>2</sup> and PLS predict assessments are presented in Table 10.

**Table 10** Q<sup>2</sup> and PLS Predict Results

	Q <sup>2</sup> predict	PLS-SEM_RMSE	PLS- SEM_MAE	LM_RMSE	LM_MAE
DTS1	0.353	0.471	0.328	0.474	0.332
DTS2	0.351	0.491	0.303	0.511	0.331
DTS3	0.383	0.501*	0.314*	0.494	0.296
DTS4	0.417	0.468*	0.302*	0.467	0.279
DL1	0.066	0.575*	0.493*	0.562	0.463
DL2	0.012	0.748	0.593	0.749	0.595
DL3	0.113	0.613	0.468	0.628	0.474

*Note: \*PLS-SEM>LM*

Based on Table 10, the Q<sup>2</sup> prediction value for most indicators is above 0.25, indicating that the model has good predictive capabilities, especially in the design thinking skills indicator (DTS1 to DTS4). However, some digital literacy indicators (DL1 to DL3) have a Q<sup>2</sup> predict value below 0.25, which indicates lower predictability of the variable. Regarding prediction accuracy measured with RMSE and MAE, most PLS-SEM values are smaller than linear regression (LM) model values, indicating that PLS-SEM models generally provide better predictions than linear regressions. However, in the DTS3, DTS4, and DL1 indicators, the RMSE and MAE values of the PLS-SEM model were slightly greater than those of LM, which indicates a less-than-optimal prediction of these variables. These results suggest that the model matches the PLS model and has adequate predictive capabilities.

**AI Usage on Design Thinking Skills**

The findings that show a positive and significant influence between AI usage and design thinking skills of accounting students strengthen the theoretical studies presented previously, especially in the framework of SCT. SCT explained that a person's behavior results from the interaction between personal, behavioral, and environmental factors (Bandura, 1986). AI as a learning tool provides access to information and creates learning conditions that allow students to develop self-efficacy, reflective thinking, and form

adaptive cognitive strategies in solving complex problems (Doyle, 2023; Pizarro-Romero, 2024).

These findings are also supported by Rios et al. (2025), who found that AI usage provides personalized feedback and supports students in developing critical thinking skills through analyzing arguments and validating information. This skill is relevant to the design thinking approach, which requires students to identify and define problems precisely before designing solutions. It is reinforced by Rosario (2024), revealing that using AI directly increases students' analytical capacity, especially in processing complex data often found in accounting, such as financial statements, big data, or risk predictions.

AI usage also enriches students' creative thinking processes through simulation-based learning experiences, automation, and dynamic modeling (Bala & Harnal, 2024; Zhao et al., 2023). AI-based simulations allow students to iteratively test various solution scenarios, which is the core of the prototyping and testing stages in design thinking (Doyle, 2023). In addition, research from Hu et al. (2024) and Saritepeci and Yildiz Durak (2024) shows that AI usage can stimulate students' critical reflection on decisions made during the learning process, thereby not only improving the outcome but also reinforcing structured and repetitive thought processes.

Furthermore, these results are also in line with the findings of Agaoglu et al. (2025) and Sreenivasan and Suresh (2024), who emphasize that the integration of technologies such as AI in education not only aims to improve students' technical skills, but also encourages the expansion of creative, collaborative, and solutive skills needed in the modern world of work. Therefore, the significant impact of AI usage on design thinking skills can be seen as part of the transformation of accounting learning towards a more adaptive, innovative, and contextual direction to meet the profession's demands.

Interestingly, these findings are consistent in various categories of respondents in public and private universities and across different semesters. Despite variations in the power of influence, a significant positive relationship between AI usage and design thinking skills remains common. It indicates that the benefits of using AI in supporting the development of design thinking skills are cross-contextual, but not consistently uniform in intensity. In students with more limited academic experience, the influence of AI tends to be more direct and practical. In contrast, in advanced students/higher semesters, the contribution of AI to design thinking skills is more in-depth and integrated into the process of analysis and evaluation of solutions.

However, it should be noted that the coefficient of influence in 7+ semester students was lower ( $\beta = 0.292$ ) than in 4th and 6th semester students ( $\beta > 0.96$ ). This phenomenon can be explained from several sides. First, final year students rely more on practical experience from internships or research, so that the dependence on AI is relatively reduced. Second, the possibility of digital fatigue after being exposed to technology for a long time can reduce the effectiveness of AI in supporting creative thinking skills (Maloney et al., 2023). Third, research shows that over-reliance on AI can lead to cognitive atrophy or decreased ability to think independently, and recent surveys reveal that senior

students sometimes experience an emotional conflict between the need for efficiency and the fear of losing analytical skills, which prevents them from making optimal use of AI (Business Insider, 2025; Khan, 2025).

Thus, the decrease in the effect on the senior group does not indicate that AI has lost relevance, but it does indicate a shift in the role of AI from a direct enabler in early students to a complementary tool in advanced students. Therefore, the success of using AI in universities is highly dependent on integration strategies tailored to the students' academic development stage so that its benefits to design thinking skills can be optimally achieved. These findings confirm that the use of AI in accounting education is theoretically relevant through the lens of SCT and is empirically proven in strengthening students' design thinking skills. Universities need to strategically integrate AI technology into the curriculum and learning activities to equip accounting students as prospective professional accountants.

### **Digital Literacy on Design Thinking Skills**

The study results show that digital literacy has a positive and significant effect on the design thinking skills of accounting students and strengthens the SCT-based thinking framework. In this theory, digital literacy is a personal factor shaping how individuals interact with the learning environment and technology (Bandura, 1986; Imjai et al., 2024). Students with high digital literacy demonstrate proficiency in strategically accessing, evaluating, and using information and technology, which is an important foundation in developing an adaptive and creative design mindset. It is in line with the findings of Ding et al. (2024), which shows that digital literacy encourages students' openness to exploring new technologies to improve problem-solving skills and creativity, which is the core of design thinking.

Furthermore, digital literacy allows students to manage and synthesize complex data, use visualization tools, and utilize collaborative platforms in designing solutions, thereby strengthening all stages of design thinking, from empathize to test. Research by Cheng et al. (2024) emphasizes that students accustomed to using digital devices effectively show better academic and cognitive performance, including in project-based tasks that demand creativity and innovation, as in contemporary accounting practices. These findings are also reinforced by Audrin and Audrin (2022) and Phippen (2024), which emphasizes that digital literacy supports the development of critical, collaborative, and reflective thinking, all of which are important components of design thinking skills.

In addition, these results also reflect the importance of digital literacy in today's increasingly digitized accounting profession. Highly digitally literate accounting students are better equipped to design innovative solutions using the latest technology, such as cloud-based accounting software, big data analytics, and financial report automation (Agaoglu et al., 2025; Al-Hattami, 2025). Therefore, it can be concluded that digital literacy not only supports academic achievement but also strengthens students' creative thinking and problem-solving capacity in facing real challenges in the world of work. These findings affirm the need to systematically enhance digital literacy in the accounting curriculum to

form graduates who can design thinking, innovate, and adapt to technological developments effectively.

Further findings suggest that the strength of the relationship between digital literacy and design thinking skills is not uniform across groups of students. This influence is more substantial in final year students with academic experience and broader exposure to technology, so they can strategically integrate digital literacy in the design thinking process. On the other hand, the influence of digital literacy on first- and second-year students has not been significant. It can be explained by the fact that early students are still at the stage of mastering basic accounting concepts and operational digital skills, so they are not used to using digital literacy to support creative, reflective, and complex problem-solving thinking. In other words, their digital literacy has not developed into a strategic capacity that can be transformed into innovative design thinking skills.

In addition, the results also show differences by type of institution, where students from public universities have a greater digital literacy impact on *design thinking* skills than students from private universities. It reflects that institutional contexts, digital infrastructure, and learning experiences also influence the effectiveness of digital literacy in shaping design thinking capacity. Thus, the integration of digital literacy in accounting education needs to be adjusted to the academic level and institutional support to optimize the benefits. It opens up space for further exploration of these factors in future research.

### **AI Usage of Design Thinking Skills through Digital Literacy**

The results of this study empirically support the hypothesis that digital literacy mediates positively and significantly the influence of AI usage on the design thinking skills of accounting students. These findings confirm that using AI alone does not necessarily guarantee improving design thinking skills. Still, it will be more effective if students have adequate digital literacy. It is in line with the SCT framework by Bandura (1986), where personal, behavioral, and environmental factors interact to affect a person's skills and cognition. Digital literacy is a personal factor that strengthens the relationship between AI use behavior and complex cognitive behaviors such as design thinking. As stated by Sriwisathiyakun (2023), digital literacy allows students to become passive users of technology and understand, assess, and integrate technology creatively to produce innovative solutions in accounting practice. In other words, digital literacy is a catalyst that bridges the potential of AI with cognitive needs in design thinking.

This mediation role also answers the inconsistencies of previous research results, where some studies found a positive influence of AI on design thinking (Agaoglu et al., 2025; Imjai et al., 2024), while other studies show no significant influence, and even tend to be negative (Saritepeci & Yildiz Durak, 2024; Segbenya et al., 2023). This inconsistency can be explained by differences in students' digital literacy levels in each research context. When digital literacy is low, AI is not utilized optimally, so it does not increase design thinking skills. However, when digital literacy is high, students can explore the potential of AI as an analytical and creative thinking tool, especially in identifying user needs,

formulating problems, and designing and testing solutions that are appropriate to the dynamic accounting context (Cheng et al., 2024; Ding et al., 2024; Zhu et al., 2023).

Further, the findings of the intergroup comparative analysis reinforce this understanding by showing that the mediated role of digital literacy in the relationship between AI use and design thinking skills is more dominant in groups of students with higher semesters and specific university contexts. It shows that the effectiveness of digital literacy as a bridge of AI's influence on design thinking skills is greatly influenced by the level of academic maturity, learning experience, and institutional support. First- or second-year students generally do not have sufficient digital literacy capacity to integrate AI in the design thinking process, so the impact is insignificant. In contrast, final year students with more complex academic experiences can use digital literacy strategically to optimize the role of AI in high-level problem-solving.

From a practical perspective, the results of this study have important implications for faculties and institutions of higher education. The accounting curriculum must be designed to gradually strengthen students' digital literacy, from introducing fundamental skills in the early years to integrating digital literacy in design-based projects and problem-solving at an advanced level. AI-based training and workshops can also be held to improve students' ability to apply technology to analyze, evaluate, and design accounting solutions. In addition, institutional support in the form of digital infrastructure, access to AI-based software, and innovative learning policies needs to be prepared so that digital literacy and AI can be integrated sustainably. Thus, colleges can ensure that AI is not only adopted as a technical aid but also as a catalyst for developing accounting students' design thinking skills.

## **Conclusion**

This study concludes that the use of AI has a positive and significant influence on the design thinking skills of accounting students, both directly and through the role of digital literacy mediation. These findings confirm that integrating AI-based technology in learning can strengthen students' creative, reflective, and solutive thinking capacity if supported by adequate digital competencies. In addition, the results of the comparative analysis between groups showed that the strength of this relationship varied depending on the academic level of the student and the type of educational institution, which indicates the influence of context on the effectiveness of technological interventions in education.

In the literature, the implications of this research enrich the study of technology in higher education by adding the mediation dimension of digital literacy and differences in academic and institutional contexts. From the theoretical side, this study strengthens the relevance of SCT by placing digital literacy as a personal factor that interacts not only with AI usage but also is influenced by academic maturity, learning experience, and institutional support in shaping design thinking skills. The practical implication is the need for universities, especially accounting study programs, to design curricula and learning

strategies that gradually strengthen digital literacy, from basic skills in the early years to strategic implementation in design-based projects at the advanced level. In addition, AI-based training and workshops, as well as the provision of adequate digital infrastructure, need to be prepared so that students can optimally integrate technology in developing design thinking skills that are contextual, creative, and relevant to the needs of the accounting profession in the digital era.

This research faces limitations related to the variation in institutional conditions and heterogeneity of technology implementation in each university that is the object of study. Although data was collected from several universities, the level of exposure and utilization of AI in the learning process is not uniform, which can affect students' perception of the use of AI and its relevance to design thinking skills. In addition, students' understanding of AI and digital literacy concepts is likely influenced by the differences in socialization and training provided by their respective institutions. While beyond the researcher's control, these factors can cause response variations and affect the consistency of results between groups.

As a follow-up to these limitations, future research is recommended to map the condition of institutions in more detail, including the level of integration of AI in the curriculum, the availability of digital infrastructure, and internal policies that support the development of students' digital literacy. In addition, it is important to include the variables of learning experience and the institutional environment as contextual factors that have the potential to moderate the relationship between AI usage, digital literacy, and design thinking skills. The comparative case study approach can be used to explore the differences between institutions with diverse levels of technological readiness and academic culture. Advanced research models can also be developed using the multi-level structural equation modeling (MSEM) approach or the moderated mediation model to more comprehensively analyze how the interaction between individual and institutional factors affects the effectiveness of technology-based learning in the context of higher education.

## References

- Agaoglu, F. O., Bas, M., Tarsuslu, S., Ekinci, L. O., & Agaoglu, N. B. (2025). The mediating digital literacy and the moderating role of academic support in the relationship between artificial intelligence usage and creative thinking in nursing students. *BMC Nursing*, 24(1), 484. <https://doi.org/10.1186/s12912-025-03128-3>
- Al-Hattami, H. M. (2025). Understanding how digital accounting education fosters innovation: The moderating roles of technological self-efficacy and digital literacy. *International Journal of Management Education*, 23(2). <https://doi.org/10.1016/j.ijme.2025.101131>
- Audrin, C., & Audrin, B. (2022). Key factors in digital literacy in learning and education: a systematic literature review using text mining. *Education and Information Technologies*, 27(6), 7395 – 7419. <https://doi.org/10.1007/s10639-021-10832-5>
- Bala, R., & Harnal, S. (2024). Transforming business education in India: Harnessing the power of AI tools for future success. In *Integrating Cutting-Edge Technology Into the Classroom* (pp. 337–346). <https://doi.org/10.4018/979-8-3693-3124-8.ch016>

- Bandura, A. (1986). Social Foundations of Thought and Action. In *The Health Psychology Reader*. SAGE Publications Ltd. <https://doi.org/10.4135/9781446221129.n6>
- Chen, C.-C., & Tu, H.-Y. (2021). The Effect of Digital Game-Based Learning on Learning Motivation and Performance Under Social Cognitive Theory and Entrepreneurial Thinking. *Frontiers in Psychology, Volume 12*. <https://doi.org/10.3389/fpsyg.2021.750711>
- Cheng, S., Kim, Y., & Choi, J.-H. (2024). The Effect of Digital Literacy on International Students' Adjustment to University Life: Focusing on the Mediating Effect of ICT Self-efficacy. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 14596 LNCS, 358 – 374. [https://doi.org/10.1007/978-3-031-57850-2\\_27](https://doi.org/10.1007/978-3-031-57850-2_27)
- Cohen, J. (1992). A Power Primer. *Psychological Bulletin*, 112(1), 155–159. <https://doi.org/10.1037/0033-2909.112.1.155>
- Ding, S., Zhang, Y., Huang, H., Chen, D., & Gao, Z. (2024). The relationship between digital literacy and K-12 students' academic performance: Mediation effects of problem-solving ability. *Proceedings - 2024 International Symposium on Educational Technology, ISET 2024*, 132 – 136. <https://doi.org/10.1109/ISET61814.2024.00034>
- Doyle, S. (2023). Augmenting intelligence with generative AI: A guide for teaching talented students. In *Practices That Promote Innovation for Talented Students* (pp. 125–144). <https://doi.org/10.4018/978-1-6684-5806-8.ch006>
- du Toit, E., Marx, B., & Smith, R. (2024a). A Model to Develop Integrated Thinking Skills of Prospective Professional Accountants. In *Advances in Accounting Education: Teaching and Curriculum Innovations* (Vol. 28, pp. 161–185). <https://doi.org/10.1108/S1085-462220240000028010>
- du Toit, E., Marx, B., & Smith, R. J. (2024b). Delineating the parameters of integrated thinking: A synthetic literature review. *Journal of Economic and Financial Sciences*, 17(1). <https://doi.org/10.4102/jef.v17i1.891>
- Falk, R., & Miller, N. (1992). A Primer for Soft Modeling. *The University of Akron Press: Akron, OH*.
- Fathoni, A. F. C. A. (2023). Leveraging Generative AI Solutions in Art and Design Education: Bridging Sustainable Creativity and Fostering Academic Integrity for Innovative Society. *E3S Web of Conferences*, 426. <https://doi.org/10.1051/e3sconf/202342601102>
- Feng, L., & Heng, H. (2024). Research on the application of artificial intelligence technology in teaching the cultural inheritance and innovation of urban public space. *Applied Mathematics and Nonlinear Sciences*, 9(1). <https://doi.org/10.2478/amns-2024-1498>
- Glen, R., Suci, C., & Baughn, C. (2014). The need for design thinking in business schools. *Academy of Management Learning and Education*, 13(4), 653 – 667. <https://doi.org/10.5465/amle.2012.0308>
- Hair, J. F., Hult, G. T. M., Ringle, S. M., Sarstedt, M., Danks, N., & Ray, S. (2021). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*. Springer.
- Han, M., Mustafa, H., & Kharuddin, S. (2025). AI adoption in accounting education: A UTAUT-based analysis of mediating and moderating mechanisms. *Journal of Pedagogical Research*, 9(2), 191–205. <https://doi.org/10.33902/JPR.202532831>
- Hu, Y.-H., Hsieh, C.-L., & Salac, E. S. N. (2024). Advancing freshman skills in information literacy and self-regulation: The role of AI learning companions and Mandala Chart in academic libraries. *Journal of Academic Librarianship*, 50(3). <https://doi.org/10.1016/j.acalib.2024.102885>
- Imjai, N., Promma, W., Usman, B., & Aujirapongpan, S. (2024). The intertwined effects of digital literacy, agile mindset on design thinking skill and management control

- competency: Insights from Thai young accountants. *International Journal of Information Management Data Insights*, 4(2), 100244. <https://doi.org/10.1016/j.jjime.2024.100244>
- Jeilani, A., & Abubakar, S. (2025). Perceived institutional support and its effects on student perceptions of AI learning in higher education: the role of mediating perceived learning outcomes and moderating technology self-efficacy. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1548900>
- Kaswan, K. S., Dhatteerwal, J. S., & Ojha, R. P. (2024). AI in personalized learning. In *Advances in Technological Innovations in Higher Education* (pp. 103–117). CRC Press. <https://doi.org/10.1201/9781003376699-9>
- Khine, M. S., Areepattamannil, S., & Cunningham, D. (2016). Non-cognitive Skills and Factors in Educational Attainment. In M. S. Khine & S. Areepattamannil (Eds.), *Sense Publishers, Dordrecht, The Netherlands*. SensePublishers. <https://doi.org/10.1007/978-94-6300-591-3>
- Li, C., Hao hao, S., & Ming, F. (2020). Research on the Impact of Artificial Intelligence Technology on Accounting. *Journal of Physics: Conference Series*, 1486(3). <https://doi.org/10.1088/1742-6596/1486/3/032042>
- Liang, P., & Wu, L. (2022). The Application of Artificial Intelligence in Accounting. *Proceedings - 2022 International Conference on Computer Network, Electronic and Automation, ICCNEA 2022*, 55 – 59. <https://doi.org/10.1109/ICCNEA57056.2022.00023>
- Liu, J. (2025). Psychological pathways in enterprise participation in university-industry collaboration: how does social cognitive theory explain participation willingness? *Frontiers in Psychology*, 16. <https://doi.org/10.3389/fpsyg.2025.1578950>
- MacKenzie, S. B., & Podsakoff, P. M. (2012). Common method bias in marketing: Causes, mechanisms, and procedural remedies. *Journal of Retailing*, 88(4), 542–555.
- Marcy, A. S., Boyle, D. M., Gomaa, A., & Li, Y. (2024). Leveraging Ai in Auditing: A Case Study Using Chatgpt to Analyze PCAOB Firm Inspection Reports. *SRRN*. <https://doi.org/10.2139/ssrn.5077266>
- Mekheimer, M. (2025). Technological self-efficacy, motivation, and contextual factors in advanced EFL e-learning: a mixed-methods study of strategy use and satisfaction. *Humanities and Social Sciences Communications*, 12(1), 677. <https://doi.org/10.1057/s41599-025-04947-0>
- Memon, M., Ting, H., Cheah, J., Ramayah, T., Chuah, F., & Cham, T. (2020). Sample size for survey research: review and recommendations. *Journal of Applied Structural Equation Modelling*, 4(2), 1–20.
- Murdan, A. P., & Halkhoree, R. (2024). Integration of Artificial Intelligence for educational excellence and innovation in higher education institutions. *1st International Conference on Smart Energy Systems and Artificial Intelligence, SESAI 2024*. <https://doi.org/10.1109/SESAI61023.2024.10599402>
- Odede, I., & Jiyane, G. (2019). Exploring dimensional constructs of digital literacy skills for higher education. *Library Philosophy and Practice*, 2019. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85072936967&partnerID=40&md5=f325ac2898f5cffe991bd070ed10>
- Phippen, A. (2024). Digital Literacy. In *Encyclopedia of Libraries, Librarianship, and Information Science, First Edition, Four Volume Set* (Vol. 4). <https://doi.org/10.1016/B978-0-323-95689-5.00097-3>
- Pizarro-Romero, J. (2024). AI Performance in Specialized Source Search and Academic Writing; [Desempenho da IA na busca de fontes especializadas e escrita de textos acadêmicos]; [Desempeño de la IA en la búsqueda de fuentes especializadas y escritura de textos académicos]. *Lengua y Sociedad*, 23(2), 911 – 944. <https://doi.org/10.15381/lengsoc.v23i2.27856>

- Podsakoff, P. M., & Organ, D. W. (1986). Self-Reports in Organizational Research: Problems and Prospects. *Journal of Management*, 12(4), 531–544. <https://doi.org/10.1177/014920638601200408>
- Promma, W., Imjai, N., Usman, B., & Aujirapongpan, S. (2025). The influence of AI literacy on complex problem-solving skills through systematic thinking skills and intuition thinking skills: An empirical study in Thai gen Z accounting students. *Computers and Education: Artificial Intelligence*, 8. <https://doi.org/10.1016/j.caeai.2025.100382>
- Rios, T. C.-D. Lo, Solis-Trujillo, B., Perez-Ruiz, J., & Aquije-Mansilla, M. (2025). Systematic review of critical thinking using artificial intelligence. *Edelweiss Applied Science and Technology*, 9(3), 990 – 1001. <https://doi.org/10.55214/25768484.v9i3.5405>
- Rosário, A. T. (2024). How artificial intelligence can help accounting in information management. In *Artificial Intelligence Approaches to Sustainable Accounting*. <https://doi.org/10.4018/979-8-3693-0847-9.ch005>
- Saritepeci, M., & Yildiz Durak, H. (2024). Effectiveness of artificial intelligence integration in design-based learning on design thinking mindset, creative and reflective thinking skills: An experimental study. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-024-12829-2>
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial Least Squares Structural Equation Modeling. In *Handbook of Market Research* (pp. 1–47). Springer International Publishing. [https://doi.org/10.1007/978-3-319-05542-8\\_15-2](https://doi.org/10.1007/978-3-319-05542-8_15-2)
- Savić, B., & Pavlović, V. (2023). Impact of Digitalization on the Accounting Profession. *Contributions to Finance and Accounting, Part F233*, 19 – 34. [https://doi.org/10.1007/978-3-031-23269-5\\_2](https://doi.org/10.1007/978-3-031-23269-5_2)
- Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology*, 60, 101832. <https://doi.org/10.1016/j.cedpsych.2019.101832>
- Segbenya, M., Bervell, B., Frimpong-Manso, E., Otoo, I. C., Andzie, T. A., & Achina, S. (2023). Artificial intelligence in higher education: Modelling the antecedents of artificial intelligence usage and effects on 21st century employability skills among postgraduate students in Ghana. *Computers and Education: Artificial Intelligence*, 5, 100188. <https://doi.org/10.1016/j.caeai.2023.100188>
- Shamsudin, A., Khan, M. N. A. A., & Jusoh, A. (2025). Unveiling Challenges and Opportunities in the Integration of Emerging Technologies in the Accounting Profession: A Preliminary Investigation; [(Menyingkap Cabaran dan Peluang Pengintegrasian Teknologi Terkini dalam Profesion Perakaunan: Satu Penyelidikan . *Jurnal Pengurusan*, 73, 1 – 4. <https://doi.org/10.17576/pengurusan-2025-73-1>
- Slimene, I. Ben, & Mansour, N. (2024). Digital Transformation and Artificial Intelligence of the Accountancy Profession. *Lecture Notes in Networks and Systems*, 1083 LNNS, 76 – 91. [https://doi.org/10.1007/978-3-031-67431-0\\_8](https://doi.org/10.1007/978-3-031-67431-0_8)
- Sreenivasan, A., & Suresh, M. (2024). Design thinking and artificial intelligence: A systematic literature review exploring synergies. *International Journal of Innovation Studies*, 8(3), 297 – 312. <https://doi.org/10.1016/j.ijis.2024.05.001>
- Sriwisathiyakun, K. (2023). Utilizing Design Thinking to Create Digital Self-Directed Learning Environment for Enhancing Digital Literacy in Thai Higher Education. *Journal of Information Technology Education: Innovations in Practice*, 22, 201 – 214. <https://doi.org/10.28945/5184>
- Sulaymanova, S., Boboyeva, Z., & Soliyev, O. (2024). The Integration of Artificial Intelligence towards Interactive Based Higher Education System Design. *2024 4th International Conference on Advance Computing and Innovative Technologies in Engineering, ICACITE 2024*, 514–518. <https://doi.org/10.1109/ICACITE60783.2024.10617254>

## Darmawan & Widiastuti

Determining accounting students' design thinking skills: The role of artificial intelligence ...

- Tehseen, S., Ramayah, T., & Sajilan, S. (2017). Testing and Controlling for Common Method Variance: A Review of Available Methods. *Journal of Management Sciences*, 4(2), 142–168. <https://doi.org/10.20547/jms.2014.1704202>
- U.S. Department of Commerce. (2025). *Indonesia - Digital Transformation*.
- World Bank. (2023). *Inclusion through Innovation in Financial Services: Winning over Businesspeople and Consumers in Indonesia*.
- World Economic Forum. (2025). *The Rise of AI in Indonesia*.
- Zhao, L., Peng, J., Dong, L. D., Compton, B. J., Zhong, Z., Li, Y., Mao, H., Ye, J., Heyman, G. D., & Lee, K. (2023). Academic cheating interferes with learning among middle school children. *Journal of Experimental Child Psychology*, 226, 105566. <https://doi.org/10.1016/j.jecp.2022.105566>
- Zhu, Z., Zhang, Y., & Zhao, S. (2023). A Study of Problem-solving Ability in Science and Technology Innovation Courses under the IPO Framework: Digital Literacy as A Mediator. *Proceedings - 2023 International Symposium on Educational Technology, ISET 2023*, 84 – 88. <https://doi.org/10.1109/ISET58841.2023.00025>
- 

### About the Authors

**Rahmat Darmawan (R.D.)** – is a students from Master of Accounting, Faculty of Economics and Business, Universitas Muhammadiyah Yogyakarta. Email: [rahmatdrmwn07@gmail.com](mailto:rahmatdrmwn07@gmail.com)

**Harjanti Widiastuti (H.W.)** – is a lecturer from Master of Accounting, Faculty of Economics and Business, Universitas Muhammadiyah Yogyakarta. Email: [widyas@umy.ac.id](mailto:widyas@umy.ac.id)

### Author Contributions

Conceptualisation, R.D. and H.W.; Methodology, R.D. and H.W.; Investigation, R.D.; Analysis, R.D.; Original draft preparation, R.D.; Review and editing, R.D. and H.W.; Visualization, R.D.; Supervision, H.W.

### Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.



© 2024 by the authors. Submitted for possible open-access publication under the terms and conditions of the Creative Commons Attribution (CC-BY-NC-ND 4.0) license (<http://creativecommons.org/licenses/by/4.0/>).