JURNAL MAGISTER AKUNTANSI TRISAKTI
https://e-journal.trisakti.ac.id/index.php/jmat ISSN 2339-0859 (Online)
Vol.13 No.2 September 2026 : hal 149-176
Doi: http://doi.org/10.25105/jmat.v13i2. 27161

Ai Literacy and Complex Problem Solving in Accounting Education: The Role of Intuitive and Systematic Thinking – A Systematic Literature Review

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Abstract

The rapid development of Artificial Intelligence (AI) is reshaping accounting education and professional practice, requiring accounting students to develop not only technical competence but also AI literacy to effectively use, verify, and critically evaluate AI-generated outputs. This study systematically examines intuitive and systematic thinking as cognitive mechanisms linking AI literacy to complex problem solving, with particular emphasis on accounting students' competency development and professional readiness. A Systematic Literature Review (SLR), guided by the PRISMA protocol, was conducted using Google Scholar, Scopus, and Web of Science to identify studies published between 2016 and 2026. Of 480 articles initially identified, 40 met the predefined inclusion criteria. The synthesis revealed conceptual linkages of 90% between AI literacy and complex problem solving, 82% between AI literacy and systematic thinking, and 78% between AI literacy and intuitive thinking. However, only one of the 40 studies (2.5%) directly investigated accounting students while simultaneously examining both cognitive mechanisms, indicating a substantial research gap. The findings suggest that AI literacy can enhance analytical and critical thinking, decision-making, professional judgment, and problem-solving capabilities among accounting students. Nevertheless, these benefits depend on students' ability to critically verify, interpret, and evaluate AI-generated information rather than relying on it uncritically. Theoretically, this review extends Behavioral Accounting by positioning individual cognitive processes as mechanisms underlying AI-enabled accounting activities. Practically, accounting education should integrate AI through authentic, context-specific accounting cases, output verification, reperformance, reflective learning, and structured opportunities to strengthen professional judgment, thereby preparing students for increasingly AI-mediated and technology-intensive professional accounting work environments.

Keywords: AI Literacy; Complex Problem Solving; Intuitive Thinking; Mediating Mechanism; Systematic Thinking

JEL Classification: I23, J24, O33, D83

Submission Date: July 2, 2026 Revision Date: September 29,2026 Accepted Date: September 30,2026

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INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has emerged as a global phenomenon that is transforming how individuals, organizations, and institutions perform tasks, process information, and make decisions. The widespread adoption of generative AI across education, business, government, and other sectors has created new opportunities to enhance productivity while simultaneously raising concerns regarding human capabilities, information evaluation, and the responsible use of technology (Dwivedi et al., 2023; Microsoft, 2025). Recent evidence indicates that AI adoption has increased substantially across organizations, with businesses increasingly integrating AI into their operational functions and generative AI becoming an important component of contemporary digital transformation (McKinsey, 2024; OECD, 2026). These developments reflect a fundamental shift in human–technology interaction, particularly in activities involving data processing, knowledge generation, analytical reasoning, and complex decision-making (Dwivedi et al., 2023).

In Indonesia, AI development has increasingly become a strategic priority through national policies and initiatives aimed at strengthening digital transformation, human resource capabilities, and AI adoption across key sectors, including education, healthcare, and agriculture (Komdigi, 2025). Nevertheless, AI adoption remains uneven across countries and regions, particularly between the Global North and Global South, because of disparities in digital infrastructure, technological accessibility, and human resource capabilities (Microsoft, 2025; OECD, 2026). These disparities highlight the importance of addressing not only technological access but also individuals' capacity to understand, evaluate, and appropriately use AI-generated information.

At the individual level, AI is increasingly integrated into academic activities through AI-powered spreadsheets, automated auditing applications, data analytics tools, and generative AI platforms such as ChatGPT. In accounting education, these technologies can assist students in completing academic tasks, analyzing financial information, interpreting accounting concepts, and exploring alternative solutions to complex problems (Dwivedi et al., 2023; Wiseman & Foster, 2025). However, effective AI use requires more than the technical ability to operate AI applications. Recent studies emphasize the importance of AI literacy in enabling learners to understand the

capabilities and limitations of AI, critically evaluate AI-generated outputs, recognize potential errors and biases, and exercise appropriate human judgment when using AI-supported information (Promma et al., 2025; Tian & Zhang, 2025). Accordingly, AI literacy has become increasingly relevant in educational settings where students are expected to integrate technological competence with higher-order cognitive skills.

The importance of AI literacy is particularly evident in accounting education because contemporary accounting activities increasingly involve data analytics, automated processing, auditing technologies, financial reporting, and technology-supported decision-making. Accounting students are therefore expected to develop not only technological competence but also the cognitive capabilities required to evaluate evidence, identify problems, compare alternatives, and formulate appropriate judgments. Recent research indicates that AI literacy can strengthen analytical and diagnostic capabilities among accounting students and contribute to the development of competencies required for accounting practice in an increasingly digital environment (Promma et al., 2025; Imjai et al., 2025). Similarly, AI-supported learning activities that require students to independently reperform calculations and critically evaluate AI-generated solutions can enhance analytical skills, critical thinking, and professional judgment (Wiseman & Foster, 2025). These findings suggest that AI literacy should be regarded as an integral component of contemporary accounting education rather than merely an extension of general digital literacy.

One cognitive competency of particular importance in accounting education is complex problem solving (CPS). Accounting problems frequently involve multiple interrelated variables, incomplete or ambiguous information, conflicting evidence, and alternative courses of action that require careful evaluation. Recent research involving accounting students indicates that AI literacy is associated with complex problem-solving capabilities and that cognitive processes, particularly systematic thinking and intuitive thinking, play important roles in this relationship (Promma et al., 2025). Systematic thinking enables individuals to decompose complex problems, evaluate relevant information, examine relationships among variables, and assess alternative solutions. In contrast, intuitive thinking facilitates rapid pattern recognition and the formation of preliminary judgments based on accumulated experience and contextual cues (Promma et al., 2025). Both cognitive processes are therefore relevant to the judgment and decision-making required in accounting contexts.

From a behavioral accounting perspective, AI use should be understood not merely as a technological phenomenon but also as a behavioral process shaped by individual cognition, perceptions, experience, and information-evaluation practices. In AI-supported accounting environments, intuitive thinking may enable individuals to recognize patterns and formulate initial responses efficiently, particularly when dealing with complex or unstructured information. Nevertheless, intuitive judgments require appropriate verification because excessive reliance on automated outputs may expose users to automation bias and insufficient scrutiny of AI-generated information (Tian & Zhang, 2025). Conversely, systematic thinking encourages individuals to examine

evidence, verify calculations, compare alternatives, and critically evaluate the reasoning underlying AI-generated recommendations (Wiseman & Foster, 2025). The interaction between these cognitive processes is therefore particularly relevant to professional judgment, analytical reasoning, decision-making, critical thinking, and problem-solving in accounting.

Recent literature has begun to establish relationships between AI literacy and cognitive capabilities; however, the available evidence remains fragmented, particularly within accounting education. Promma et al. (2025), for example, found that AI literacy significantly enhanced both systematic and intuitive thinking skills, which subsequently contributed to complex problem-solving capabilities among Generation Z accounting students in Thailand. These findings provide direct empirical evidence that systematic and intuitive thinking may function as cognitive mechanisms linking AI literacy to CPS. In addition, recent research suggests that AI literacy can strengthen diagnostic and prognostic capabilities among accounting students, indicating that AI-related competence may support the development of analytical capabilities relevant to accounting decision-making (Imjai et al., 2025). However, other studies have identified potential adverse cognitive consequences associated with excessive reliance on AI. Tian and Zhang (2025) found that greater AI dependence was associated with lower critical-thinking performance, with cognitive fatigue serving as a partial mediating mechanism. Similarly, Gerlich (2025) reported a negative association between frequent AI-tool use and critical-thinking capabilities, highlighting the possibility that excessive cognitive offloading may reduce individuals' engagement in independent analytical processes.

These divergent findings reveal an important research gap. Although recent studies have examined AI literacy, AI dependence, critical thinking, and complex problem solving, limited research has systematically integrated these streams of literature to explain how AI literacy may contribute to CPS through intuitive thinking and systematic thinking, particularly within accounting education. Existing empirical evidence is also concentrated in specific national and educational contexts, such as accounting students in Thailand, whereas evidence from developing-country contexts, including Indonesia, remains comparatively limited (Promma et al., 2025; Wijaya & Herwiyanti, 2025). Furthermore, although studies on AI-supported accounting education increasingly emphasize critical evaluation, reperformance, and professional judgment, the broader cognitive mechanisms underlying the relationship between AI literacy and complex problem solving have not yet been comprehensively synthesized (Wiseman & Foster, 2025). Accordingly, the novelty of this study lies in systematically integrating AI literacy, intuitive thinking, systematic thinking, and complex problem solving within a unified cognitive framework relevant to accounting education.

Therefore, this study conducts a Systematic Literature Review (SLR) to map and synthesize empirical evidence concerning the relationship between AI literacy and complex problem solving, with intuitive and systematic thinking considered potential cognitive mechanisms linking the two constructs. Specifically, the review examines how AI literacy is associated with complex problem solving; how intuitive and systematic

thinking relate to judgment, decision-making, analytical reasoning, critical thinking, and problem solving; and what these relationships imply for accounting education and the future readiness of accounting professionals. By systematically integrating evidence from recent studies, this review seeks to clarify the current state of knowledge and identify areas requiring further empirical investigation.

This study provides two principal contributions. First, theoretically, the SLR integrates fragmented empirical evidence concerning the potential roles of intuitive and systematic thinking as cognitive mechanisms linking AI literacy to complex problem-solving capabilities. This synthesis contributes to a more integrated understanding of how AI-related competencies interact with cognitive processes in accounting and educational contexts and extends the behavioral accounting perspective to AI-supported information processing. Second, practically, the findings provide a foundation for future primary research and offer implications for accounting education by identifying contexts and populations that remain insufficiently examined. In particular, accounting students in developing countries such as Indonesia represent a relevant context for future empirical investigation because the integration of AI into accounting education requires not only technological readiness but also the cognitive capabilities necessary to critically evaluate, verify, and responsibly apply AI-generated information.

LITERATURE REVIEW

Cognitive Load Theory

Cognitive Load Theory (CLT) explains learning and problem-solving processes by emphasizing the limited processing capacity of working memory and the potential adverse effects of excessive cognitive demands on learning and effective information processing (Sweller et al., 2019). In technology-supported learning environments, cognitive load is particularly relevant because learners must simultaneously process task-related information, navigate technological features, and evaluate information generated by digital systems (Sweller et al., 2019). Recent research suggests that generative AI may alter learners' cognitive demands by reducing the effort required for information retrieval and processing while simultaneously imposing additional demands when AI-generated information requires verification and interpretation (Scherer et al., 2025).

The relevance of CLT has become increasingly evident with the integration of generative AI into educational activities. AI can provide immediate explanations, structured information, and problem-solving assistance, potentially reducing unnecessary cognitive demands (Scherer et al., 2025). However, excessive reliance on AI may encourage cognitive offloading and reduce learners' independent engagement in problem-solving processes, particularly when AI-generated outputs are accepted without adequate critical evaluation (Tian & Zhang, 2025). Therefore, AI should not be regarded solely as a mechanism for reducing cognitive load; rather, its cognitive effects depend

on how learners interpret, evaluate, and integrate AI-generated information into their reasoning processes (Tian & Zhang, 2025).

From this perspective, AI literacy is particularly important because individuals with sufficient AI knowledge and evaluative capabilities are better equipped to determine whether AI-generated information is relevant, reliable, and appropriate for a specific task (Ng et al., 2021; Laupichler et al., 2023). AI literacy may therefore facilitate the effective allocation of cognitive resources by enabling individuals to distinguish useful AI assistance from information requiring further verification (Ng et al., 2021). In complex problem-solving contexts, this capability is particularly important because effective problem-solving requires individuals to allocate cognitive resources to identifying relationships, evaluating alternatives, and developing appropriate solutions rather than merely accepting automated outputs (Molnár et al., 2022). Accordingly, CLT provides a theoretical foundation for explaining how AI literacy may influence cognitive processing and complex problem-solving capabilities.

Dual-Process Theory

Dual-Process Theory conceptualizes human reasoning as involving distinct but interacting modes of information processing, particularly rapid intuitive processing and more deliberate analytical processing (Grayot, 2020; Nadurak, 2021). Contemporary dual-process research continues to distinguish relatively rapid and non-conscious processes from deliberate and conscious reasoning while recognizing that these processes may interact during judgment and decision-making (Grayot, 2020). Intuitive processing enables individuals to respond rapidly by drawing on patterns, prior knowledge, and contextual cues, whereas analytical processing requires greater cognitive effort, deliberate evaluation, and systematic examination of available information (Lerch et al., 2021).

The interaction between intuitive and analytical processing is particularly important in complex decision-making environments, where individuals may initially generate an intuitive response and subsequently engage in analytical reasoning to confirm, modify, or reject that response (Lerch et al., 2021). Research on strategic decision-making similarly indicates that intuition and analytical reasoning represent distinct yet complementary cognitive strategies that may be employed according to the characteristics and demands of a particular decision context (Lerch et al., 2021). Accordingly, intuitive and systematic thinking should not necessarily be regarded as mutually exclusive processes; rather, they may operate as complementary cognitive mechanisms that jointly contribute to effective information processing, judgment, and decision-making (Nadurak, 2021).

In AI-supported environments, the relevance of Dual-Process Theory becomes increasingly pronounced because AI-generated information may influence both rapid judgment formation and deliberate analytical evaluation (Tian & Zhang, 2025). Individuals with stronger AI literacy may be better equipped to interpret AI-generated

outputs and determine when intuitive responses are sufficient and when additional systematic verification is necessary (Ng et al., 2021; Laupichler et al., 2023). Thus, Dual-Process Theory provides a theoretical foundation for examining intuitive and systematic thinking as cognitive mechanisms through which AI literacy may contribute to complex problem-solving capabilities.

Accounting Education and Behavioral Accounting

Accounting education increasingly requires students to integrate technical accounting knowledge with analytical reasoning, critical thinking, professional judgment, decision-making, and problem-solving capabilities as technological transformation continues to reshape the nature of accounting work (Abdo-Salloum & Al-Mousawi, 2025). Recent evidence indicates that accounting students' technology readiness and information literacy are important factors associated with AI adoption in accounting curricula, demonstrating the increasing need to integrate technological competence with information-evaluation capabilities in accounting education (Abdo-Salloum & Al-Mousawi, 2025). Practical exposure to AI-based accounting applications may also enhance students' understanding of the usefulness of AI and strengthen their readiness to apply emerging technologies to accounting-related tasks (Abdo-Salloum & Al-Mousawi, 2025).

Nevertheless, the integration of AI into accounting education requires careful consideration of the cognitive processes underlying students' use and evaluation of technology-generated information (Wiseman & Foster, 2025). AI-supported accounting activities may enhance analytical skills, critical thinking, and professional judgment when students are required to independently evaluate, reperform, and critically review AI-generated results rather than passively accept automated recommendations (Wiseman & Foster, 2025). This approach reinforces the principle that technology should augment human reasoning and professional judgment rather than substitute for independent cognitive engagement in accounting education (Wiseman & Foster, 2025).

Behavioral accounting complements this perspective by emphasizing the role of human cognition, information processing, judgment, and cognitive biases in accounting-related decision-making (Souza et al., 2020). Accounting judgments may be influenced by cognitive processes that shape how individuals interpret evidence, evaluate alternative information, and formulate decisions, making the examination of cognitive mechanisms particularly relevant to accounting decision behavior (Souza et al., 2020). In AI-supported accounting environments, AI literacy may therefore be regarded as a competency that enables students to use AI as a cognitive support tool while maintaining appropriate critical evaluation and professional judgment (Abdo-Salloum & Al-Mousawi, 2025; Wiseman & Foster, 2025). Within this framework, intuitive and systematic thinking may help explain how accounting students process, evaluate, and apply AI-generated information when addressing complex accounting problems.

Artificial Intelligence Literacy

AI literacy refers to an individual's capacity to understand AI, appropriately use AI applications, critically evaluate AI-generated information, and recognize the ethical considerations associated with AI use (Ng et al., 2021). More recent conceptualizations emphasize that AI literacy extends beyond operational competence, requiring individuals to understand the capabilities and limitations of AI, critically evaluate AI technologies and their outputs, and interact with AI responsibly (Laupichler et al., 2023; Kong et al., 2024). Accordingly, AI literacy represents a multidimensional competency encompassing knowledge, application, critical evaluation, and the responsible use of AI technologies (Ng et al., 2021).

In higher education, AI literacy has become increasingly important as students interact with AI systems for information retrieval, academic support, data analysis, and problem-solving (Laupichler et al., 2023). Individuals with stronger AI literacy may be better equipped to interpret AI-generated outputs and recognize circumstances in which automated information requires additional verification or critical evaluation (Kong et al., 2024). Such evaluative capabilities are particularly important because AI-generated information may contain inaccuracies, biases, or contextual limitations that users must identify before incorporating the information into academic or professional decisions (Tian & Zhang, 2025).

Within accounting education, AI literacy has become particularly relevant because accounting students are increasingly expected to interact with technologies that support data analysis, auditing, financial reporting, and decision-making (Abdo-Salloum & Al-Mousawi, 2025). Empirical evidence involving accounting students indicates that AI literacy is associated with cognitive capabilities directly relevant to complex problem solving, including systematic and intuitive thinking skills (Promma et al., 2025). Therefore, AI literacy may theoretically enhance accounting students' capacity to critically process AI-supported information and address complex problems that require analytical evaluation and professional judgment.

RESEARCH METHOD

Research Design

This study employed a Systematic Literature Review (SLR) approach to systematically map and synthesize the existing evidence concerning the relationships among AI literacy, intuitive thinking, systematic thinking, and complex problem solving (CPS). The SLR approach was selected because it enables researchers to identify, evaluate, and synthesize findings from previous studies through a structured, transparent, and replicable procedure. This methodological approach facilitates the development of a comprehensive and integrative understanding of the relationships among the constructs examined in the present study.

The literature search was conducted using three major academic databases and search platforms: Google Scholar, Scopus, and Web of Science. The final search was conducted on July 3, 2026. The search protocol was not registered with PROSPERO or OSF. The study selection process was conducted according to predetermined inclusion and exclusion criteria. Because the available documentation did not include evidence of independent duplicate screening by two reviewers, this study does not claim to have employed dual independent screening or to have calculated an inter-rater reliability coefficient.

Literature Population and Study Selection

The literature population consisted of scholarly publications addressing AI literacy or AI use, intuitive thinking, systematic thinking, and/or complex problem solving. The search strategy was designed to capture studies examining either direct or conceptually relevant relationships among these constructs. The search was limited to publications from 2016 to 2026 to ensure that the evidence synthesized reflected relatively recent developments in artificial intelligence, cognitive processes, problem-solving capabilities, and their applications in educational and professional contexts.

The literature search was performed using combinations of the following keywords: "AI literacy," "Artificial Intelligence," "complex problem solving," "problem solving," "intuitive thinking," and "systematic thinking." Boolean operators were used to combine the keywords and broaden the identification of potentially relevant studies. The resulting records were subsequently screened based on the predefined eligibility criteria.

The study selection process followed the general stages of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, consisting of identification, screening, and inclusion. At the identification stage, potentially relevant publications were retrieved from the selected databases and search platforms. At the screening stage, records were assessed against the predetermined eligibility criteria, including the removal of duplicate records and studies that did not address the constructs or relationships relevant to the review. At the inclusion stage, studies that satisfied the eligibility requirements were retained for qualitative synthesis and thematic mapping.

The inclusion criteria were as follows: (1) studies published between 2016 and 2026; (2) studies available in full-text form; (3) studies indexed or searchable through Google Scholar, Scopus, or Web of Science; (4) studies examining at least one relationship involving AI literacy or AI use, intuitive thinking, systematic thinking, or complex problem solving; and (5) for the accounting-related analysis, studies explicitly involving accounting students, accounting education, accounting practice, professional judgment, accounting decision-making, or individual behavior in the use of accounting-related technologies were specifically identified and classified.

The exclusion criteria included studies that focused exclusively on the technical development of AI without implications for cognitive processes or problem-solving;

editorials, commentaries, or opinion papers without sufficient empirical or conceptual foundations; publications without full-text access; duplicate records; and studies that did not provide information that could be meaningfully mapped onto the constructs examined in this study. Accounting relevance was therefore treated as an analytical dimension rather than as an exclusion criterion for interdisciplinary studies. This approach allowed studies from other disciplines to be retained when they provided relevant theoretical or empirical evidence concerning the cognitive relationships investigated in the present review.

Data Collection Technique

Data collection was conducted through a structured literature-search and screening procedure. For each eligible study, relevant information was identified and organized according to the research constructs and relationships examined. The extracted information included the publication year, research context, population or participants, key constructs, research approach, principal findings, and relevance to AI literacy, intuitive thinking, systematic thinking, and complex problem solving.

The selected studies were subsequently classified according to the relationships investigated among the constructs. Particular attention was given to evidence concerning the relationship between AI literacy and CPS, the relationships between AI literacy and intuitive or systematic thinking, and the contribution of intuitive and systematic thinking to complex problem solving. Studies related to accounting education and behavioral accounting were separately identified to determine the extent to which the existing evidence has been developed within the accounting context.

The final evidence was organized into structured tables to facilitate comparison across studies. This tabulation process enabled the researchers to identify recurring findings, differences in empirical evidence, research contexts, and areas that remain insufficiently explored. The structured synthesis also provided the basis for identifying the current state of knowledge and research gaps concerning the cognitive mechanisms potentially linking AI literacy with complex problem-solving capabilities.

Data Analysis and Evidence Synthesis

The analysis employed a qualitative evidence-synthesis approach rather than statistical hypothesis testing because the study was designed as a systematic literature review and did not involve the collection of primary quantitative data. The retrieved studies were analyzed comparatively by identifying similarities, differences, patterns, and relationships among the constructs under investigation.

The synthesis focused on four principal analytical dimensions: (1) the relationship between AI literacy and complex problem solving; (2) the relationship between AI literacy and intuitive thinking; (3) the relationship between AI literacy and systematic thinking; and (4) the contribution of intuitive and systematic thinking to complex problem solving. Evidence concerning the mediating roles of intuitive and

systematic thinking was also examined where the reviewed studies provided relevant empirical findings.

The findings were then integrated to develop a conceptual understanding of how AI literacy may influence complex problem-solving capabilities through cognitive processing mechanisms. Particular consideration was given to the consistency or divergence of findings across different research contexts and populations. Studies conducted within accounting education and professional accounting contexts were examined separately to determine the applicability of the broader literature to accounting-related settings.

The results of the synthesis were presented in structured tables and subsequently interpreted to identify theoretical implications, practical implications, research gaps, and opportunities for future empirical investigation. The synthesized evidence was ultimately used as a basis for formulating practical implications and recommendations for subsequent primary research, particularly research examining AI literacy, intuitive thinking, systematic thinking, and complex problem solving among accounting students and other relevant accounting populations.

RESULTS AND DISCUSSION

Results

The article selection process was conducted systematically in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework. A total of 480 articles were initially identified through Google Scholar, Scopus, and Web of Science. After the removal of 200 duplicate records, 280 articles remained for title and abstract screening.

During the screening stage, the 280 records were assessed for their relevance to the primary constructs examined in this review: AI literacy, complex problem solving, intuitive thinking, and systematic thinking. A total of 127 articles were excluded because their titles or abstracts did not sufficiently align with the scope of the review. Consequently, 153 articles proceeded to the full-text retrieval stage.

Of the 153 articles sought for full-text retrieval, 80 could not be retrieved because of repository access restrictions or the unavailability of full-text documents online. Therefore, 73 articles proceeded to the eligibility assessment stage, during which each article was evaluated against the predefined inclusion and exclusion criteria.

A further 33 articles were excluded during the eligibility assessment for two primary reasons. First, 15 studies did not examine a direct or sufficiently relevant relationship involving AI literacy, complex problem solving, intuitive thinking, or systematic thinking. Second, 18 studies did not provide an adequate empirical or conceptual basis for inclusion, including editorials, commentaries, opinion pieces, and studies lacking sufficiently verifiable primary or secondary evidence.

The final selection comprised 40 articles that met all eligibility criteria. These studies were subsequently included in the qualitative evidence synthesis to examine the relationships among AI literacy, intuitive thinking, systematic thinking, and complex problem solving. Particular attention was given to their relevance to educational and professional contexts and, where evidence was available, to accounting education.

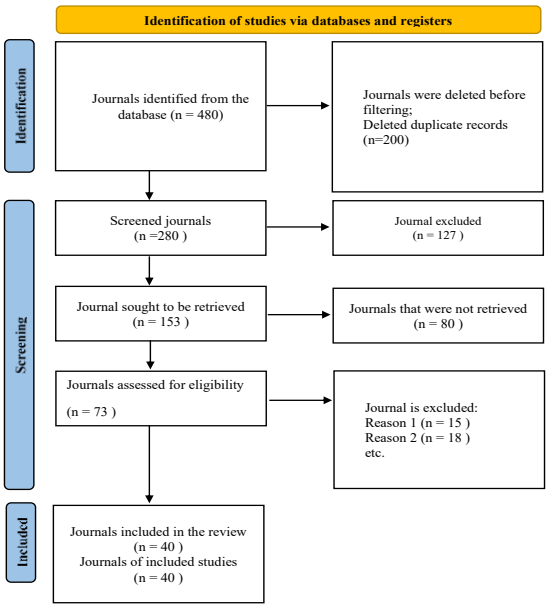


Figure 1
PRISMA Flow Diagram

The synthesis table presents the findings from the 40 studies identified as relevant to AI literacy, complex problem solving, and the potential roles of intuitive thinking and systematic thinking as cognitive mechanisms. The selected literature was published between 2016 and 2026 and covered diverse educational and professional settings, ranging from K–12 education and higher education to workplace and industrial environments.

Each study was examined across six principal dimensions: research focus, conceptualization of AI literacy, treatment of complex problem solving, role of intuitive thinking, role of systematic thinking, and practical implications. This structured approach enabled the identification of recurring patterns and differences across the literature while maintaining the interdisciplinary scope of the review.

The synthesis indicates that most studies examined AI literacy and complex problem solving or other forms of higher-order thinking as related but separate areas of inquiry. In contrast, studies explicitly positioning intuitive thinking and systematic thinking as mediating cognitive mechanisms remain relatively limited. Among the reviewed literature, Promma et al. (2025) represents the study most closely aligned with the conceptual framework of the present review because it empirically examined AI literacy, systematic thinking, intuitive thinking, and complex problem solving simultaneously among accounting students using Structural Equation Modeling.

Table 1
Relevant Studies

No.	Journal Title	Research Focus
1	A Competency Framework for AI Literacy: Variations by Different Learner Groups and an Implied Learning Pathway	Development of a comprehensive AI literacy competency framework for diverse learner groups, based on educational level and academic discipline.
2	A Five-Step AI-Information Problem Solving (AI-IPS) Model for Critical, Ethical, and Responsible Usage	Designing an ethical and responsible AI-based information problem-solving model for academic and professional contexts.
3	AI Competency Assessment and Ranking: A Framework for Higher Education	Uncovering AI usage patterns among university students and translating them into practical guidelines for teaching and higher education policy.
4	Aligning the Operationalization of Digital Competences with Perceived AI Literacy: The Case of HE Students in IT Engineering and Teacher Education	Enhancing the alignment between digital competence and AI literacy among students in Informatics Engineering and Teacher Education programs in Serbia.
5	Artificial Intelligence in Higher Education: Exploring Faculty Use, Self-Efficacy, Distinct Profiles, and Professional Development Needs	Exploring lecturers' perceptions, self-efficacy, latent profiles, and professional development needs regarding the use of AI in higher education.
6	Artificial Intelligence in Service	Development of the theory regarding job displacement by AI in the service sector, focusing on the four types of intelligence required to perform service tasks.
7	Artificial Intelligence Literacy for Technology Education	A critical analysis of various components of AI literacy in the literature and its development in the context of technological literacy as multiliteracy.
8	Artificial Intelligence Literacy in Sustainable Development: A Learning Experiment in Higher Education	Mapping students' capabilities and perceptions regarding AI, as well as its potential to address questions concerning the sustainable transition in society.
9	Automation, Artificial Intelligence and Future Skills Needs: An Irish Perspective	Exploring stakeholder perspectives on the skills required for the future of work in the era of AI and technology in Ireland.
10	Constructing AI Literacy: A Hands-On Approach for School Children	A literature review on the constructionist approach to AI literacy education for school-age children.
11	Cultivating Critical Thinking in Future Professionals through Advanced Information Literacy and Learning Technologies	Designing a new conceptual framework that integrates advanced information literacy with learning technologies to foster critical thinking

No.	Journal Title	Research Focus
		among university students preparing for professional careers.
12	Current Status and Perspectives Regarding the Skills and Meta-Competencies Needed by Employees in the Era 4.0	An investigation into the perspective of small and medium-sized enterprises (SMEs) in Romania regarding AI system adoption and the employee competencies required in the Industry 4.0 era.
13	Design and Validation of the AI Literacy Questionnaire: The Affective, Behavioural, Cognitive and Ethical Approach	Development and validation of a four-dimensional AI literacy measurement instrument—affective, behavioral, cognitive, and ethical—for secondary school students.
14	Design, System, Value: The Role of Problem-Solving and Critical Thinking Capabilities in Technology Education, as Perceived by Teachers	Investigating the views of primary and secondary school technology teachers in Sweden on problem-solving and critical thinking as curriculum components and teaching skills.
15	Developing an Artificial Intelligence Literacy Framework: Evaluation of a Literacy Course for Senior Secondary Students Using a Project-Based Learning Approach	Development of an AI literacy framework and evaluation of a project-based AI literacy course for high school students.
16	Developing Problem-Solving Skills to Support Sustainability in STEM Education Using Generative AI Tools	Designing a multi-stage modeling approach to integrate generative AI tools into design-based STEM education that supports sustainability.
17	Do Students Need to Think Hard? The Interplay of AI and Cognitive Abilities in Solving Problems	Investigating the role of AI usage in economic problem-solving by non-AI expert students, considering the factors of cognitive reflection, need for cognition, and creativity.
18	Effects of Generative Artificial Intelligence on Higher-Order Thinking Skills and Artificial Intelligence Literacy in Nursing Undergraduates: A Quasi-Experimental Study	Exploring the impact of generative AI-based interactive teaching strategies on the higher-order thinking skills and AI literacy of nursing students.
19	Evaluating Educational Robotics Kits through the Lens of Technological Literacy: Product Design Gaps and Opportunities	An investigation into the extent to which Educational Robotics Kits (ERK) are intentionally designed to support the development of students' technological literacy.
20	Examining the Relationships between University Students' 21st Century Skills, Artificial Intelligence Literacy and Artificial Intelligence Attitudes	An examination of the relationship between 21st-century skills, AI literacy, and attitudes towards AI among fine arts students in Türkiye.

No.	Journal Title	Research Focus
21	Exploring the Conceptual Model and Instructional Design Principles of Intelligent Problem-Solving Learning	Development of a competency-based instructional design framework to foster adaptability, creativity, and meta-learning in AI-powered learning environments.
22	Exploring the Relationship between AI Literacy, AI Trust, AI Dependency, and 21st Century Skills in Preservice Mathematics Teachers	Determining the structural relationships among AI literacy, AI trust, AI dependence, and 21st-century skills among prospective mathematics teachers using Structural Equation Modeling (SEM)
23	Fostering Students' AI Literacy Development through Educational Games: AI Knowledge, Affective and Cognitive Engagement	An investigation into the effectiveness of the Treasure Island gamification platform in enhancing AI literacy, motivation, and cognitive engagement among secondary school students.
24	Human versus Artificial Intelligence	A discussion of the similarities and differences between human intelligence and artificial intelligence to provide a foundation for the research and development of human-AI systems.
25	Influence of AI Literacy and 21st-Century Skills on the Acceptance of Generative Artificial Intelligence among College Students	Investigating the influence of AI literacy and 21st-century skills on the acceptance of generative AI among university students.
26	Integration of Artificial Intelligence Competencies into a Holistic Digital Literacy Framework for Middle School Education	Designing an AI-Enriched Digital Educational Framework (AIEDF) to prepare junior high school students for an AI-driven world.
27	Latent Profile Analysis of AI Literacy and Trust in Mathematics Teachers and Their Relations with AI Dependency and 21st-Century Skills	Identification of latent profiles of AI literacy and AI trust among mathematics teachers, and examination of their correlations with AI dependency and 21st-century skills.
28	Predictive Capability of Foundational Concepts Tests for Problem-Solving Using Machine Learning Concepts: Evaluating Project-Based Learning Courses in Artificial Intelligence Literacy Education	Design and evaluation of an AI literacy program to enhance understanding of machine learning concepts and problem-solving skills through a project-based course.
29	Rebooting Employees: Upskilling for Artificial Intelligence in Multinational Corporations	Identifying critical skills required for employee upskilling in multinational companies within the context of AI adoption.
30	Shaping Tomorrow: Anticipating Skills Requirements Based on the	Examination of the impact of AI on workforce skills needs using foresight analysis and scenario methods in a business context

No.	Journal Title	Research Focus
	Integration of Artificial Intelligence in Business Organizations	
31	The Effects of Artificial Intelligence Supported Flipped Classroom Applications on Learning Experience, Perception, and Artificial Intelligence Literacy in Higher Education	Determining the impact of AI-assisted flipped classroom implementation on AI literacy, perceptions, and learning experiences of university students in higher education.
32	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	An investigation into the impact of AI literacy on complex problem-solving skills among Generation Z accounting students in Thailand, mediated by systematic and intuitive thinking.
33	The Role of Critical Thinking on Undergraduates' Reliance Behaviours on Generative AI in Problem-Solving	An empirical investigation into the relationship between critical thinking and generative AI dependency behavior in problem-solving among university students.
34	Uncovering Structural Relationships between AI Literacy, AI Ethics, AI Problem-Solving, and Self-Regulated Learning	Exploring the structural relationships between dimensions of AI literacy and their influence on AI ethics, AI-based problem-solving, and self-regulated learning among university students.
35	What are Artificial Intelligence Literacy and Competency? A Comprehensive Framework to Support Them	Defining AI literacy and competencies and developing a comprehensive framework for K-12 AI education based on the perspectives of experienced teachers.
36	Artificial Intelligence Literacy Moderating the Effects of Artificial Intelligence Use on Cognitive Outcomes Including Memory Retention, Decision Making, and Cognitive Laziness	Exploring the impact of AI usage on three key cognitive outcomes memory retention, decision-making, and cognitive laziness with AI literacy as a moderator.
37	The Effects of Artificial Intelligence Ethics Awareness, Digital Literacy, and Metacognition on Nursing Students' Attitudes toward Artificial Intelligence	Examination of the influence of AI ethical awareness, digital literacy, and metacognition on nursing students' attitudes toward AI
38	Effects of a Educational Approach on Students' Technological Literacy	Exploration of the influence of a technologically conceptualized transdisciplinary educational approach on the development of technological literacy of junior high school students

No.	Journal Title	Research Focus
39	Artificial Intelligence Tools on the Digital Literacy and 21st Century Skills	An investigation into the effects of using AI tools and STEM-themed story writing training on the digital literacy levels and 21st-century skills of prospective Turkish language teachers.
40	Evaluation in Artificial Intelligence: From Task-Oriented to Ability-Oriented Measurement	A description and critical assessment of various methods for evaluating AI systems, ranging from task-oriented evaluation to cognitive-capability-oriented evaluation.

Table 2 presents a thematic synthesis of the 40 selected studies. To avoid the impression that the SLR results represent statistical effect estimates, the synthesis is organized thematically based on the constructs examined, patterns of findings, and their relevance to accounting education. Details of the 40 studies have been moved to supplementary material to keep the main body of the article concise and focused.

Table 2
Thematic Synthesis

Synthesis theme	Key findings pattern	Relevance to accounting education
AI literacy as a competency	AI literacy is not limited to the use of tools but encompasses understanding, evaluation, verification, ethics, and human-AI collaboration.	Students need to be able to evaluate the accuracy, bias, sources, and limitations of AI outputs.
AI literacy and problem solving	Several studies link AI literacy to problem-solving, analytical thinking, critical thinking, or higher-order thinking, though study designs and constructs vary.	AI can serve as a tool to generate alternative solutions without replacing students' reasoning processes.
Systematic and intuitive thinking	Systematic thinking is evident in structured analysis, evidence verification, and the evaluation of alternatives; intuitive thinking involves pattern recognition, rapid response, and contextual judgment.	The two should be viewed as complementary: intuition generates an initial response, while analysis examines and validates it.

Synthesis theme	Key findings pattern	Relevance to accounting education
Research gap accounting education	Most of the evidence comes from across disciplines. Only Promma et al. (2025) directly examined the four constructs among accounting students.	Primary studies involving accounting students—particularly within the Indonesian context—are needed to examine the cognitive mechanisms and their implications for professional judgment.

Based on the synthesis, most studies address AI literacy in relation to problem-solving or higher-order thinking, whereas research explicitly positioning intuitive thinking and systematic thinking as mediating mechanisms remains limited. The study by Promma et al. (2025) aligns most closely with the conceptual model of the present study, as it empirically examines AI literacy, systematic thinking, intuitive thinking, and complex problem-solving among accounting students. Consequently, the research gap lies not in the magnitude of statistical relationships derived from this systematic literature review (SLR), but rather in the limited empirical evidence examining these specific cognitive mechanisms simultaneously within the context of accounting education.

Table 3
Matrix of Conceptual Linkage Strength Between Variables

	AI Literacy	Systematic Thinking	Intuitive Thinking	Complex Problem Solving
AI Literacy		82%	78%	90%
Systematic Thinking	82%		60%	75%
Intuitive Thinking	78%	60%		70%
Complex Problem Solving	90%	75%	70%	

This matrix presents estimated strengths of conceptual linkages between core variables, based on the extent to which each pair was discussed concurrently across the 40 synthesized studies. The strongest linkage was found between AI Literacy and Complex Problem Solving (90%), confirming that nearly all studies view AI literacy as a direct prerequisite for complex problem-solving capabilities—whether in academic, clinical, or industrial contexts. AI Literacy was also consistently linked to Systematic Thinking (82%) and Intuitive Thinking (78%), indicating that these two thinking styles are commonly positioned as derivatives, outcomes, or prerequisites of an individual's AI literacy. Linkages between Complex Problem Solving and both Systematic Thinking (75%) and Intuitive Thinking (70%) were also strong, suggesting that these thinking styles are frequently discussed as direct predictors of problem-solving ability, even if not always within a formal mediation framework. Most notably—and of particular relevance to this study—the linkage between Systematic Thinking and Intuitive Thinking as a dual mechanism stood at only 60%; this indicates that relatively few studies have simultaneously modeled both as parallel mediation pathways between AI literacy and complex problem solving, thereby highlighting a research gap that supports the contribution of this review.

Table 4
Accounting Context Subanalysis

Category	Number	Percentage	Notes
Direct study on accounting	1	2,5%	Promma et al. (2025), Gen Z accounting students; examined both mechanisms simultaneously

A sub-analysis of the accounting context reveals that only one out of 40 articles (2.5%)—specifically Promma et al. (2025)—directly examined accounting students and simultaneously tested the relationships between AI literacy, systematic thinking, intuitive thinking, and complex problem-solving. That study, which focused on Generation Z accounting students in Thailand, provides the empirical evidence most closely aligned with the conceptual model of the present study. The remaining 39 articles offered cross-disciplinary evidence that was theoretically or pedagogically relevant but did not directly examine an accounting population. These findings highlight a clear research gap: while the relationships between these variables have been extensively discussed in general education, the specific evidence base within accounting education remains very limited.

Table 5
Distribution of Studies by Research Context/Level of Application

Research Context Cluster	Number	Percentage	Representative Study Examples
Higher Education and Students	17	42,50%	; ;
Primary and Secondary Education (K-12)	9	22,50%	; ;
Conceptual Framework & Instruments/Models	8	20,00%	; ;
The World of Work and Industry	6	15,00%	; ;

Table 5 shows that the higher education context dominates the references with 17 studies (42.5%), reflecting that university students are the most frequently studied population regarding AI literacy and complex problem-solving; this includes a directly relevant study by Promma et al. (2025c) on Generation Z accounting students in Thailand, as well as other studies focusing on pre-service teachers, nursing students, and fine arts students. The K-12 context accounts for 9 studies (22.5%), generally focusing on building foundational AI competencies from an early age through project-based learning, educational games, and constructionist approaches that emphasize hands-on experimentation. Meanwhile, 8 studies (20%) are conceptual-methodological in nature, providing frameworks, taxonomies, and standardized measurement instruments that serve as key references for empirically operationalizing AI literacy variables and competencies. Although the workforce and industry sector represents the smallest share (15%), it makes a significant contribution by justifying the topic's practical relevance beyond purely academic realms—specifically by highlighting the need for complex cognitive upskilling in the workforce amidst automation and the adoption of generative AI in business organizations. Overall, the distribution across these four clusters confirms

that while the research focuses on university students, it is grounded in a literature landscape spanning all educational levels and professional contexts, thereby strengthening the basis for interpreting the findings across different contexts and populations.

For accounting students, these findings have direct implications. AI literacy can facilitate the resolution of accounting cases by enabling students to use AI to generate analytical alternatives; however, they must still verify assumptions, data sources, calculations, and consistency with accounting standards (Wiseman & Foster, 2025). Systematic thinking supports analytical reasoning by breaking down cases into components, tracing relationships between accounts or variables, examining evidence, and comparing decision alternatives. Intuitive thinking plays a role in professional judgment and decision-making when students recognize patterns, assess the relevance of information, or respond to situations that lack a fully structured format. However, intuition should not replace analysis; it requires confirmation through analytical procedures and sufficient evidence. The curricular implication is the need for AI-based cases that require students to formulate problems, evaluate AI outputs, perform re-performance or recalculations, identify errors and biases, compare alternatives, and justify decisions through professional judgment (Wiseman & Foster, 2025).

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

Conclusions

This study concludes that intuitive thinking and systematic thinking represent important cognitive mechanisms linking AI literacy to complex problem solving, based on a synthesis of 40 articles selected from 480 records identified through Google Scholar, Scopus, and Web of Science using a PRISMA-based systematic review process. The conceptual association between AI literacy and complex problem solving was the most frequently identified relationship (90%), followed by the associations between AI literacy and systematic thinking (82%) and between AI literacy and intuitive thinking (78%). The associations of systematic thinking and intuitive thinking with complex problem solving were identified in 75% and 70% of the reviewed literature, respectively. However, only 60% of the reviewed literature addressed systematic thinking and intuitive thinking as interconnected cognitive mechanisms, suggesting that relatively few studies have explicitly examined both processes as parallel pathways linking AI literacy to complex problem solving. The review also reveals a substantial research gap in the accounting context, as only one study directly examined accounting students while simultaneously investigating AI literacy, systematic thinking, intuitive thinking, and complex problem solving. Overall, although the potential importance of these cognitive mechanisms is increasingly recognized, their simultaneous empirical examination remains limited, particularly within accounting education. This gap provides a clear foundation for further primary research.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the percentages representing conceptual associations among the core

constructs were derived from qualitative coding based on how explicitly pairs of variables were addressed across the 40 reviewed articles, rather than from statistical aggregation or meta-analytic effect-size estimation. Accordingly, these percentages should be interpreted as indicators of literature coverage rather than measures of empirical effect strength and may be influenced by researcher judgment. Second, only one reviewed study directly investigated accounting students while simultaneously examining the complete set of constructs addressed in this review, thereby limiting the extent to which the synthesized evidence can be generalized to accounting education. Third, the final sample of 40 articles, drawn from 480 initially identified records, was relatively limited for a research area integrating four interconnected constructs—AI literacy, intuitive thinking, systematic thinking, and complex problem solving. Moreover, many of the included studies examined only a subset of these constructs rather than investigating them simultaneously. Fourth, the literature search was restricted to Google Scholar, Scopus, and Web of Science and primarily employed English-language keywords, which may have resulted in the omission of relevant local studies, particularly those published in Indonesian or using alternative terminology for the constructs examined. Finally, much of the available evidence originated from general educational contexts; therefore, the relationships among AI literacy, cognitive processing, and professional judgment in accounting-specific environments remain insufficiently established.

Recommendations

Future research should develop a more explicit empirical agenda within accounting education by testing the proposed AI literacy → intuitive thinking/systematic thinking → complex problem solving framework among accounting students in Indonesia and other developing-country contexts. Primary studies should also investigate how intuitive and systematic thinking contribute to professional judgment, analytical reasoning, critical thinking, and decision-making across accounting-related domains, including financial accounting, auditing, taxation, and accounting information systems. Experimental and Structural Equation Modeling (SEM) approaches could be employed to examine AI-supported tasks under varying conditions of verification, reperformance, critical review, and reflective evaluation. Future behavioral accounting research could further investigate cognitive reflection, automation bias, trust in AI, AI dependence, self-regulated learning, and prior accounting experience as potential factors influencing the quality and effectiveness of AI use. At the curriculum level, future studies could evaluate the effectiveness of AI-based case learning, problem-based learning, and experiential learning in simultaneously developing AI literacy, complex problem-solving capabilities, professional judgment, and readiness for accounting careers.

REFERENCES

Abdo-Salloum, A., & El-Mousawi, H. (2025). Accounting Students' Technology Readiness, Perceptions, and Digital Competence Toward AI adoption in Accounting Curricula. *Journal of Accounting Education*, *70*, 1–12. https://doi.org/10.1016/j.jaccedu.2025.100951

Alamäki, A., Nyberg, C., Kimberley, A., & Salonen, A. O. (2024). Artificial intelligence literacy in sustainable development: A learning experiment in higher education. *Frontiers in Education*, *9*(March), 1–10. https://doi.org/10.3389/feduc.2024.1343406

Aleksić, V., Mandić, M., & Ivanović, M. (2025). Aligning the Operationalization of Digital Competences with Perceived AI Literacy: The Case of HE Students in IT Engineering and Teacher Education. *Education Sciences*, *15*(12). https://doi.org/10.3390/educsci15121582

Altamimi, R., & Al-Haija'a, A. A. (2026). Integration of artificial intelligence competencies into a holistic digital literacy framework for middle school education. *Scientific Reports*, *16*(1), 0–38. https://doi.org/10.1038/s41598-026-47133-1

Angay Kutluk, F. (2017). Behavioral Accounting and its Interactions. In S. Gokten (Ed.), *Accounting and Corporate Reporting - Today and Tomorrow*. IntechOpen. https://doi.org/10.5772/intechopen.68972

Antonov, O., Gordiichuk, S., Dubaseniuk, O., Sydorchuk, N., Koliadenko, S., & Poplavska, S. (2026). Cultivating Critical Thinking in Future Professionals through Advanced Information Literacy and Learning Technologies. *Indian Journal of Information Sources and Services*, *16*(1), 663–674. https://doi.org/10.51983/ijiss-2026.16.1.69

Bang, C., & Hur, Y. (2026). The effects of artificial intelligence ethics awareness, digital literacy, and metacognition on nursing students' attitudes toward artificial intelligence. *BMC Medical Ethics*, *27*(1), 0–7. https://doi.org/10.1186/s12910-026-01445-z

Bećirović, S., Augustín, M., Mattoš, B., & Dančo, J. (2026). Uncovering structural relationships between AI literacy, AI ethics, AI problem-solving, and self-regulated learning. *Discover Computing*, *29*(1), 1–32. https://doi.org/10.1007/s10791-026-10042-y

Bircan, M. A., Şeref, İ., & Nacaroğlu, O. (2025). The effect of STEM themed story writing training with artificial intelligence tools on the digital literacy and 21 st century skills of preservice teachers. *Education and Information Technologies*, 21479–21498.

Bobitan, N., Dumitrescu, D., Popa, A. F., Sahlian, D. N., & Turlea, I. C. (2024). Shaping Tomorrow: Anticipating Skills Requirements Based on the Integration of Artificial Intelligence in Business Organizations—A Foresight Analysis Using the Scenario Method. *Electronics (Switzerland)*, *13*(11). https://doi.org/10.3390/electronics13112198

BPPT. (2020). *Strategi Nasional Kecerdasan Artifisial 2020–2045*. https://korika.id/wp-content/uploads/2024/07/stranas-ka-2045.pdf

Bukartaite, R., & Hooper, D. (2023). Automation, artificial intelligence and future skills needs: an Irish perspective. *European Journal of Training and Development*, *47*(10), 163–185. https://doi.org/10.1108/EJTD-03-2023-0045

Busuttil, L. (2025). Constructing AI Literacy: A Hands-On Approach for School Children. *Informatics in Education*, *24*(4), 761–779. https://doi.org/10.15388/infedu.2025.26

Butler, M. G., Church, K. S., & Spencer, A. W. (2019). Do, reflect, think, apply: Experiential education in accounting. *Journal of Accounting Education*, *48*, 12–21. https://doi.org/10.1016/J.JACCEDU.2019.05.001

Chee, H., Ahn, S., & Lee, J. (2025). A Competency Framework for AI Literacy: Variations by Different Learner Groups and an Implied Learning Pathway. *British Journal of Educational Technology*, *56*(5), 2146–2182. https://doi.org/10.1111/bjet.13556

Chiu, T. K. F., Ahmad, Z., Ismailov, M., & Sanusi, I. T. (2024). What are artificial intelligence literacy and competency? A comprehensive framework to support them. *Computers and Education Open*, *6*(January), 100171. https://doi.org/10.1016/j.caeo.2024.100171

Dane, E., & Pratt, M. (2007). Exploring Intuition and its Role in Managerial Decision Making. *Academy of Management Review*, *32*. https://doi.org/10.5465/AMR.2007.23463682

Dörner, D., & Funke, J. (2017). Complex Problem Solving: What It Is and What It Is Not. *Frontiers in Psychology*, *8*, 1–11. https://doi.org/10.3389/fpsyg.2017.01153

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., … Wright, R. (2023). Opinion Paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, *71*, 102642. https://doi.org/10.1016/J.IJINFOMGT.2023.102642

Evans, J. (2008). Dual-Processing Accounts of Reasoning, Judgment, and Social Cognition. *Annual Review of Psychology*, *59*, 255–278. https://doi.org/10.1146/annurev.psych.59.103006.093629

Evans, J., & Stanovich, K. (2013). Dual-Process Theories of Higher Cognition. *Perspectives on Psychological Science*, *8*, 223–241. https://doi.org/10.1177/1745691612460685

Funke, J. (2010). Complex problem solving: A case for complex cognition? In *Cognitive Processing* (Vol. 11, Number 2, pp. 133–142). https://doi.org/10.1007/s10339-009-0345-0

Gerlich, M. (2025). AI Tools in Society: Impacts on Cognitive Offloading and the Future of Critical Thinking. *Societies*, *15*(1). https://doi.org/10.3390/soc15010006

Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology*, *62*, 451–482. https://doi.org/10.1146/annurev-psych-120709-145346

Goddard, K., Roudsari, A., & Wyatt, J. (2011). Automation bias: A systematic review of frequency, effect mediators, and mitigators. *Journal of the American Medical Informatics Association : JAMIA*, *19*, 121–127. https://doi.org/10.1136/amiajnl-2011-000089

Hernández-Orallo, J. (2017). Evaluation in artificial intelligence: from task-oriented to ability-oriented measurement. In *Artificial Intelligence Review* (Vol. 48, Number 3). https://doi.org/10.1007/s10462-016-9505-7

Hou, C., Zhu, G., & Sudarshan, V. (2025). The role of critical thinking on undergraduates' reliance behaviours on generative AI in problem-solving. *British Journal of Educational Technology*, *56*(5), 1919–1941. https://doi.org/10.1111/bjet.13613

Huang, M. H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, *21*(2), 155–172. https://doi.org/10.1177/1094670517752459

Jaiswal, A., Arun, C. J., & Varma, A. (2022). Rebooting employees: upskilling for artificial intelligence in multinational corporations. *International Journal of Human Resource Management*, *33*(6), 1179–1208. https://doi.org/10.1080/09585192.2021.1891114

Kahneman, Daniel. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.

Komdigi. (2025). *Roadmap Kecerdasan Artifisial Nasional 2025–2045*. https://goodstats.id/article/indonesia-luncurkan-roadmap-ai-nasional-2025-2045-fokus-pada-inovasi-etika-dan-investasi-5ztqU

Kong, S. C., Cheung, M. Y. W., & Tsang, O. (2024). Developing an artificial intelligence literacy framework: Evaluation of a literacy course for senior secondary students using a project-based learning approach. *Computers and Education: Artificial Intelligence*, *6*(November 2023), 100214. https://doi.org/10.1016/j.caeai.2024.100214

Kong, S. C., & Hou, C. (2025). Predictive capability of foundational concepts tests for problem-solving using machine learning concepts: Evaluating project-based learning courses in artificial intelligence literacy education. *Computers and Education: Artificial Intelligence*, *9*(November), 100503. https://doi.org/10.1016/j.caeai.2025.100503

Korteling, J. E. (Hans), van de Boer-Visschedijk, G. C., Blankendaal, R. A. M., Boonekamp, R. C., & Eikelboom, A. R. (2021). Human- versus Artificial Intelligence. *Frontiers in Artificial Intelligence*, *4*(March), 1–13. https://doi.org/10.3389/frai.2021.622364

Lee, Y., & Lee, S. S. (2025). Exploring the Conceptual Model and Instructional Design Principles of Intelligent Problem-Solving Learning. *Sustainability (Switzerland)*, *17*(17), 1–33. https://doi.org/10.3390/su17177682

Liu, J., Zhou, D., & Zhang, Y. (2026). Evaluating educational robotics kits through the lens of technological literacy: product design gaps and opportunities. *International Journal of Technology and Design Education*. https://doi.org/10.1007/s10798-026-10099-2

Long, D., & Magerko, B. (2020). What is AI Literacy? Competencies and Design Considerations. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, CHI '20*, 1–16. https://doi.org/10.1145/3313831.3376727

Mah, D. K., & Groß, N. (2024). Artificial intelligence in higher education: exploring faculty use, self-efficacy, distinct profiles, and professional development needs. *International Journal of Educational Technology in Higher Education*, *21*(1), 1–17. https://doi.org/10.1186/s41239-024-00490-1

McKinsey. (2024). *The state of AI in early 2024: Gen AI adoption spikes and starts to generate value*.

Microsoft. (2025). *Global AI Adoption in 2025 - A Widening Digital Divide*. https://www.microsoft.com/en-us/research/wp-content/uploads/2026/01/Microsoft-AI-Diffusion-Report-2025-H2.pdf

Moșoi, A. A., Maican, C. I., Cazan, A. M., & Sumedrea, S. (2025). Do students need to think hard? The interplay of AI and cognitive abilities in solving problems. *Education and Information Technologies*, *30*(17), 24337–24364. https://doi.org/10.1007/s10639-025-13738-8

Neamţu, D. M., Bejinaru, R., Anichiti, A., Butnaru, G. I., & Hapenciuc, C. V. (2025). Current status and perspectives regarding the skills and meta-competencies needed by employees in the era 4.0. *Kybernetes*. https://doi.org/10.1108/K-10-2024-2918

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, *2*, 100041. https://doi.org/10.1016/J.CAEAI.2021.100041

Ng, D. T. K., Wu, W., Leung, J. K. L., Chiu, T. K. F., & Chu, S. K. W. (2024). Design and validation of the AI literacy questionnaire: The affective, behavioural, cognitive and ethical approach. *British Journal of Educational Technology*, *55*(3), 1082–1104. https://doi.org/10.1111/bjet.13411

Ng, D. T. K., Xinyu, C., Leung, J. K. L., & Chu, S. K. W. (2024). Fostering students' AI literacy development through educational games: AI knowledge, affective and cognitive engagement. *Journal of Computer Assisted Learning*, *40*(5), 2049–2064. https://doi.org/10.1111/jcal.13009

OECD. (2026). *AI use by individuals surges across the OECD as adoption by firms continues to expand*. https://www.oecd.org/en/about/news/announcements/2026/01/ai-use-by-individuals-surges-across-the-oecd-as-adoption-by-firms-continues-to-expand.html

O'Neil, Cathy. (2016). *Weapons of math destruction : how big data increases inequality and threatens democracy*. Crown.

Ozkan, Z. C. (2026). Examining the Relationships between University Students' 21st Century Skills, Artificial Intelligence Literacy and Artificial Intelligence Attitudes. *International Journal of Technology in Education and Science*, *10*(3), 693–710. https://doi.org/10.46328/ijtes.8184

Paas, F., & Van Merrienboer, J. J. G. (1994). Variability of Worked Examples and Transfer of Geometrical Problem-Solving Skills: A Cognitive-Load Approach. *Journal of Educational Psychology*, *86*, 122–133. https://doi.org/10.1037/0022-0663.86.1.122

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*, 100382. https://doi.org/https://doi.org/10.1016/j.caeai.2025.100382

Rupnik, D. (2020). Effects of a Educational Approach on Students ' Technological Literacy. *Journal of Baltic Science Education*, *19*(1), 121–141.

Salhab, R., & Aboushi, M. M. (2025). Influence of AI literacy and 21st-century skills on the acceptance of generative artificial intelligence among college students. *Frontiers in Education*, *10*(September), 1–12. https://doi.org/10.3389/feduc.2025.1640212

Sánchez-Ruiz, L. M., Llobregat-Gómez, N., Vega-Fleitas, E., & Moll-López, S. (2025). AI Competency Assessment and Ranking: A Framework for Higher Education. *Applied Sciences (Switzerland)*, *15*(22), 1–27. https://doi.org/10.3390/app152212248

Schooner, P., Nordlöf, C., Klasander, C., & Hallström, J. (2017). Design, system, value: The role of problem-solving and critical thinking capabilities in technology education, as perceived by teachers. *Design and Technologyu Education: An International Journal* , *22*(3), 60–75.

Song, D., Zhang, P., Zhu, Y., Qi, S., Yang, Y., Gong, L., & Zhou, L. (2025). Effects of generative artificial intelligence on higher-order thinking skills and artificial intelligence literacy in nursing undergraduates: A quasi-experimental study. *Nurse Education in Practice*, *88*(81), 104549. https://doi.org/10.1016/j.nepr.2025.104549

Stanovich, K. E. . (2011). *Rationality and the reflective mind*. Oxford University Press.

Stolpe, K., & Hallström, J. (2024). Artificial intelligence literacy for technology education. *Computers and Education Open*, *6*(November 2023), 0–7. https://doi.org/10.1016/j.caeo.2024.100159

Štuikys, V., Burbaitė, R., Binkis, M., & Ziberkas, G. (2025). Developing Problem-Solving Skills to Support Sustainability in STEM Education Using Generative AI Tools. *Sustainability (Switzerland)*, *17*(15). https://doi.org/10.3390/su17156935

Sweller, J. (1988). Cognitive Load During Problem Solving: Effects on Learning. *Cognitive Science*, *12*(2), 257–285. https://doi.org/https://doi.org/10.1207/s15516709cog1202_4

Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive Load Theory*. Springer New York. https://doi.org/10.1007/978-1-4419-8126-4

Tanveer, M. (2026). Discover Psychology Article in Press Artificial intelligence literacy moderating the effects of artificial intelligence use on cognitive outcomes including memory retention decision making and cognitive laziness IN AR IN. *Discover Psychology*.

Tian, J., & Zhang, R. (2025). Learners' AI dependence and critical thinking: The psychological mechanism of fatigue and the social buffering role of AI literacy. *Acta Psychologica*, *260*, 105725. https://doi.org/10.1016/J.ACTPSY.2025.105725

Unesco & Kominfo. (2024). *Indonesia AI Readiness Assessment Report*. https://www.unesco.org/en/articles/unesco-and-kominfo-completed-ai-readiness-assessment-indonesia-ready-ai

Wijaya, T. T., Yu, Q., Cao, Y., He, Y., & Leung, F. K. S. (2024). Latent Profile Analysis of AI Literacy and Trust in Mathematics Teachers and Their Relations with AI Dependency and 21st-Century Skills. *Behavioral Sciences*, *14*(11). https://doi.org/10.3390/bs14111008

Wiseman, D., & Foster, D. (2025). Bridging AI with cost accounting education: A pedagogical framework using reperformance and critical error review. *Journal of Accounting Education*, *72*, 100988. https://doi.org/10.1016/J.JACCEDU.2025.100988

Yavuz, M., Balat, Ş., & Kayali, B. (2025). The Effects of Artificial Intelligence Supported Flipped Classroom Applications on Learning Experience, Perception, and Artificial Intelligence Literacy in Higher Education. *Open Praxis*, *17*(2), 286–304. https://doi.org/10.55982/openpraxis.17.2.811

Zhang, D., Wijaya, T. T., Wang, Y., Su, M., Li, X., & Damayanti, N. W. (2025). Exploring the relationship between AI literacy, AI trust, AI dependency, and 21st century skills in preservice mathematics teachers. *Scientific Reports*, *15*(1), 1–15. https://doi.org/10.1038/s41598-025-99127-0

Zhou, X., Liu, G., & Chiu, T. K. F. (2026). A five-Step AI-Information problem solving (AI-IPS) model for critical, ethical, and responsible usage. *Interactive Learning Environments*, *4820*, 1–20. https://doi.org/10.1080/10494820.2026.2614080