

Content, implementation, and evaluation of artificial intelligence literacy education for nursing students : A scoping review

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Abstract

Background

Artificial intelligence (AI) is increasingly used in nursing education, but evidence on AI literacy as a nursing-specific educational competency remains fragmented.

Methods

The review was informed by Arksey and O'Malley's framework. Nine databases and Google Scholar were searched for publications from 1 January 2018 to 5 June 2026. Two reviewers independently screened the records and charted the data. Study characteristics and evaluation approaches were summarised descriptively, while educational content, pedagogical strategies, and AI-related learning tasks were synthesised using inductive thematic analysis.

Results

A total of 14 sources were included. AI literacy education primarily focuses on the responsible use of AI, the critical evaluation of AI-generated content, applications in nursing contexts, and professional judgement. In terms of teaching strategies, guided AI practice and prompt scaffolding are the most common. Assessment primarily employs standardised scales, task rubrics, and qualitative feedback; short-term assessments based on scales are more common, while performance-based assessments grounded in nursing tasks are less frequent.

Conclusions

AI literacy education for nursing students is still in its early stages, and its focus has expanded from mere technical application to responsible, critical, and context-sensitive nursing judgement. In the future, we should promote the gradual integration of AI literacy into the nursing curriculum and strengthen performance-based assessments of AI-assisted nursing judgement in real-world learning contexts.

1. Introduction

Artificial intelligence (AI) is increasingly integrated into healthcare systems. In clinical practice, it has been applied to clinical decision support, risk prediction, and nursing information management [1]. In nursing education, AI facilitates learning, clinical reasoning, and personalised instruction, offering opportunities to enhance learning experiences and prepare students for AI-enabled healthcare environments [2, 3]. However, its use also raises concerns about inaccurate information, algorithmic bias, data privacy, limited transparency, and unclear accountability [1, 4]. The World Health Organization has emphasised that health-related AI should be designed, deployed, and used in accordance with ethical principles, human rights, safety, transparency, and accountability [5]. Accordingly, nursing students require competencies extending beyond operational skills with AI, including an understanding of AI technologies, critical appraisal of AI-generated outputs, and responsible AI use [6–8]. Thus, cultivating AI literacy has become a critical priority for building the future nursing workforce [7, 8].

AI literacy is generally conceptualised as the ability to understand and use AI, critically evaluate AI systems and outputs, and address the ethical implications of AI use [9]. In nursing education, this foundational professional competency integrates clinical judgement, ethical responsibility, and patient safety [6, 7]. Consequently, students must not only understand the potential uses of AI but also assess the reliability, appropriateness, and professional boundaries of AI-generated outputs, alongside concerns such as data privacy and accountability [5, 6]. Nursing students are at a critical transition point between classroom learning and clinical practice [8]. These competencies may influence students' current learning and their future capacity to exercise sound clinical judgement, protect patient safety, and maintain professional accountability in AI-supported care settings [10, 11].

Recent nursing education initiatives have included generative AI-assisted teaching, academic writing instruction, and curriculum-embedded AI learning [10, 12, 13]. These initiatives address AI knowledge, ethical awareness, critical appraisal, and the application of AI in nursing contexts [11, 13]. Empirical studies have reported improvements in outcomes such as AI literacy, higher-order thinking, and learning performance, while curriculum frameworks have proposed progressive approaches to developing these competencies across nursing programmes [8, 10, 11]. Together, these efforts reflect a shift from tool-centred training towards competency-based education that emphasises critical, ethical, and contextually appropriate AI use [7, 8].

However, the evidence remains heterogeneous regarding what is taught, how it is delivered, and how learning is assessed [2, 3, 14]. Educational content ranges from practical AI use and academic writing to ethical awareness, critical appraisal, and clinical application [6, 8]. Implementation approaches include generative AI-assisted instruction, scaffolded learning, and integration into evidence-based practice courses [10–12].

Evaluation metrics are equally diverse, covering AI literacy, knowledge, attitudes, acceptance, higher-order thinking, and learning experiences [11, 15, 16]. Such fragmentation makes it difficult to identify core educational components, compare implementation approaches, and select appropriate evaluation strategies [3, 14].

Existing reviews have synthesised the applications, benefits, risks, and challenges of AI in nursing education [4, 14, 17]. However, these prior works have largely treated AI merely as a tool for teaching, learning, simulation, or academic support, rather than as a competency-development goal for nursing students. Therefore, this scoping review addresses three key research questions: (1) What content is included in AI literacy education for nursing students? (2) How is such education implemented, including relevant pedagogical strategies? (3) How is AI literacy education evaluated, including methods, indicators, and outcomes? The findings are intended to support the development of AI literacy curricula, training programmes, and evaluation frameworks within nursing education.

2. Methods

This scoping review followed Arksey and O'Malley's (2005) methodological framework [18], comprising five stages: (1) identifying the research question; (2) identifying relevant evidence; (3) selecting evidence sources; (4) charting the data; and (5) collating, summarising, and reporting the findings. It was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) [19]. The protocol was registered on the Open Science Framework (OSF; doi: 10.17605/OSF.IO/QBXZ3).

2.1. Search strategy

A systematic search was conducted across nine electronic databases: PubMed, Web of Science, CINAHL, Scopus, Embase, ERIC, PsycINFO, China National Knowledge Infrastructure (CNKI), and VIP Database. Google Scholar was also searched as a supplementary source. The search covered publications between 1 January 2018 and 5 June 2026. Preliminary searches in PubMed and CNKI informed the search strategy. Search terms and strings were refined through several rounds of consultation with experienced librarians. In addition, reference lists of all included sources were manually screened to identify potentially eligible articles not retrieved through the database searches. The PubMed search strategy was: ("Students, Nursing"[MeSH] OR "nursing student*" [Title/Abstract] OR "student nurse*" [Title/Abstract] OR "undergraduate nursing student*" [Title/Abstract] OR "nursing undergraduate*" [Title/Abstract] OR "pre-registration nursing student*" [Title/Abstract] OR "pre-registration nursing" [Title/Abstract] OR "preregistration nursing student*" [Title/Abstract] OR "postgraduate nursing student*" [Title/Abstract] OR "post-graduate nursing student*" [Title/Abstract] OR "doctoral nursing student*" [Title/Abstract] OR "doctoral nursing" [Title/Abstract] OR "PhD nursing student*" [Title/Abstract] OR "clinical nursing student*" [Title/Abstract] OR "clinical nursing intern*" [Title/Abstract] OR "nursing trainee*" [Title/Abstract]) AND ("Artificial Intelligence"[MeSH] OR "Generative Artificial Intelligence"[MeSH] OR "Large Language Models"[MeSH] OR "Machine Learning"[MeSH] OR "Natural Language Processing"[MeSH] OR "artificial intelligence" [Title/Abstract] OR "generative artificial intelligence" [Title/Abstract] OR "generative AI" [Title/Abstract] OR "GenAI" [Title/Abstract] OR "machine learning" [Title/Abstract] OR "deep learning" [Title/Abstract] OR "natural language processing" [Title/Abstract] OR "large language model*" [Title/Abstract] OR "LLM" [Title/Abstract] OR "ChatGPT" [Title/Abstract] OR "AI chatbot*" [Title/Abstract] OR "artificial intelligence chatbot*" [Title/Abstract] OR "artificial intelligence literac*" [Title/Abstract] OR "AI literac*" [Title/Abstract] OR "artificial intelligence competenc*" [Title/Abstract] OR "AI competenc*" [Title/Abstract] OR "artificial intelligence knowledge" [Title/Abstract] OR "AI knowledge" [Title/Abstract] OR "artificial intelligence skill*" [Title/Abstract] OR "AI skill*" [Title/Abstract] OR "artificial intelligence ethic*" [Title/Abstract] OR "AI ethic*" [Title/Abstract] OR "AI awareness" [Title/Abstract] OR "artificial intelligence awareness" [Title/Abstract] OR "artificial intelligence perception*" [Title/Abstract] OR "AI perception*" [Title/Abstract]) AND ("Education, Nursing"[MeSH] OR "Curriculum"[MeSH] OR "Teaching"[MeSH] OR "Program Evaluation"[MeSH] OR "nursing education" [Title/Abstract] OR "curriculum" [Title/Abstract] OR "course*" [Title/Abstract] OR "training" [Title/Abstract] OR "workshop*" [Title/Abstract] OR "educational program*" [Title/Abstract] OR "teaching" [Title/Abstract])

2.2. Eligibility criteria

Eligibility criteria were established using the PCC (Population, Concept, Context) framework [20].

Population: Nursing students, including those at the vocational, associate-degree, bachelor's, master's, and doctoral levels, as well as clinical nursing interns who still hold student status.

Concept: Structured educational activities or curriculum initiatives aimed at developing AI literacy or one or more component AI-literacy competencies. Eligible activities included courses, training programmes, instructional modules, workshops, simulations, and learning assignments. Relevant competencies included AI knowledge and understanding, AI use and interaction, critical appraisal of AI-generated outputs, ethical and responsible AI use, and context-appropriate application of AI in nursing.

Context: No restrictions were placed on educational setting or delivery platform. Eligible contexts included universities, colleges, healthcare institutions, and online learning environments.

Types of evidence sources: Given the emerging and methodologically heterogeneous nature of this field, eligibility was not restricted by study design. Eligible sources included empirical quantitative, qualitative, and mixed-methods studies, along with descriptive educational reports, curriculum case studies, and curriculum or framework papers that provided sufficient information relevant to the review questions.

Sources were excluded if they: (1) included mixed populations from which data relating specifically to nursing students could not be separately extracted; (2) examined only AI literacy, attitudes, acceptance, perceptions, or intention to use AI without implementing or describing an educational activity; (3) used AI solely as a teaching or learning tool without an explicit educational focus on AI literacy or its constituent competencies; (4) described or developed AI technologies without integrating them into nursing student education; (5) were duplicate publications, lacked sufficient information to determine eligibility or extract data relevant to the review questions, or were unavailable in full text; or (6) were published in languages other than English or Chinese.

2.3. Study selection

All retrieved records were imported into EndNote X20 for deduplication. Two reviewers (WQ and LN) independently screened their titles and abstracts against the eligibility criteria. Potentially relevant publications were assessed through full-text review by the same reviewers. At each stage, the reviewers compared their screening decisions. Disagreements were resolved through discussion, and a third reviewer (SH) was consulted when consensus could not be reached.

2.4. Data charting and analysis

Prior to formal data charting, five included sources were randomly selected for pilot extraction to standardise the application of predefined variables and extraction criteria. The pilot results were compared and discussed, and the data-charting form was refined where necessary. Following this calibration process, two reviewers (WQ and LN) independently extracted data from all included sources using a predefined data-charting form. The extracted data were cross-checked. Any disagreements were resolved through discussion, consulting a third reviewer (SH) if consensus could not be reached.

The extracted information included author, year of publication, country or region, study design or report type, participant and sample characteristics, educational context, and data relevant to the review questions. Descriptive analysis was used to summarise the characteristics of the included evidence and the reported evaluation approaches and outcomes. Data relating to the content and implementation of AI literacy education were analysed inductively using thematic analysis informed by Braun and Clarke's (2006) six-phase framework [21].

3. Results

Database and supplementary searches identified 1,939 records. After 1,008 duplicates were removed, 931 records were screened by title and abstract, of which 896 were excluded. Thirty-five full-text reports were assessed for eligibility, and 22 were excluded. Citation searching identified one additional eligible report, yielding 14 sources for inclusion. All included sources were published in English. The study selection process is presented in Fig. 1.

3.1. Characteristics of the included sources

Fourteen sources published between 2024 and 2026 were included: two published in 2024, eight in 2025, and four in 2026. The sources originated from the United States ($n = 6$), China ($n = 2$), Chinese Taiwan ($n = 1$), Australia ($n = 2$), Jordan ($n = 1$), Turkey ($n = 1$), and Egypt ($n = 1$).

These sources showed substantial methodological heterogeneity. Four adopted controlled comparative designs, consisting of one randomised controlled trial and three quasi-experimental studies with control groups. Five employed single-group pretest-posttest or mixed-methods educational evaluation designs, one adopted a qualitative exploratory design, three were descriptive educational or curriculum reports, and one provided a curriculum framework. Twelve studies focused on undergraduate or pre-registration nursing education, while two addressed doctoral nursing education. Among the empirical studies reporting specific sample sizes, participant numbers ranged from 10 to 1,000. One curriculum case study described approximately 2,100 students enrolled across three course units but did not report a student-level analytic sample.

In eight studies, AI literacy education was integrated into a single existing course, while in two studies it was integrated across multiple courses. Three studies implemented stand-alone or supplementary educational programmes, whereas one proposed a programme-level curriculum framework. ChatGPT was the most frequently named platform, with other reported tools including Copilot, Doubao, and ERNIE Bot. Educational durations varied substantially, ranging from a single 3-hour session or a 3-day programme (9 hours in total) to interventions lasting four weeks, 18 weeks, one semester, or one trimester. Several studies did not report exact exposure duration. The characteristics of the included sources are presented in Table 1.

Table 1
Characteristics of the included sources (n = 14)

Author (year)	Country/region	Study design/report type	Participants	Sample size	Educational context	AI tool(s)	Educational exposure/duration
Song et al., 2025[11]	China	Quasi-experimental controlled study	Third-year undergraduate nursing students	132; IG = 66, CG = 66	Single-course integration: Thinking and Communication	Doubao	One semester; 24 h (Sep–Dec 2024)
Tseng et al., 2025[10]	Chinese Taiwan	Quasi-experimental controlled study	Fourth-year nursing students	203; IG = 102, CG = 101	Single-course integration: Writing Case Reports and Seminars	ChatGPT and Copilot	18 weeks; 36 h
Tomlinson et al., 2025[13]	Australia	Curriculum case study	First- to third-year undergraduate nursing students	Approximately 2,100 enrolled across three units; no student-level analytic sample was reported	Multi-course integration: pilot across three units, one at each year level	GenAI/LLMs	One trimester (Trimester 1, 2024)
Reading Turchioe et al., 2024[22]	United States	Mixed-methods evaluation of a brief educational intervention	PhD nursing students	10	Single-course integration: PhD data science and visualisation course	ChatGPT 4.0	One 3-h session
Abuadas et al., 2025[23]	Jordan	Quasi-experimental controlled pretest–posttest study	Third- and fourth-year nursing students	115; IG = 57, CG = 58	Stand-alone structured AI ethics education programme	Not specified	3 days; 9 h in total
Reed et al., 2026[12]	United States	Mixed-methods single-group pretest–posttest study	Senior undergraduate nursing students	55 completed the pre-survey and 36 completed the post-survey	Single-course integration: nursing research and evidence-based practice course	ChatGPT	Implemented across two course offerings; individual exposure duration not reported
Chan, 2025[24]	United States	Descriptive pilot educational project	Second-year undergraduate nursing students	20	Single-course integration: undergraduate writing-intensive nursing course	ChatGPT	Not reported
Bumbach et al., 2024[25]	United States	Descriptive educational evaluation	Doctor of Nursing Practice students	113 assignment submissions	Single-course integration: online graduate nursing informatics and information management course	ChatGPT	Not reported
Tomlinson et al., 2026[8]	Australia	Curriculum framework design	Pre-registration nursing programme	Not applicable	Programme-level framework for a three-year progressive AI literacy curriculum	ChatGPT and AI chatbot	Not applicable
Arkan et al., 2025[26]	Turkey	Single-blind randomised controlled study	Third-year undergraduate nursing students	96; IG = 48, CG = 48	Stand-alone supplementary programme: AI-integrated nursing-process training	ChatGPT 3.5	4 weeks; 1 h/week (4 h in total)
Note: CG = control group; h = hours; IG = intervention group; PhD = Doctor of Philosophy; GenAI = generative artificial intelligence; LLM = large language model.							

Author (year)	Country/region	Study design/report type	Participants	Sample size	Educational context	AI tool(s)	Educational exposure/duration
Shen et al., 2025[27]	China	Qualitative exploratory study	Third-year undergraduate nursing students	160 completed the learning activities; 17 participated in interviews	Multi-course integration: Medical Nursing, Surgical Nursing, and Nursing Informatics	Seven Chinese-language GenAI tools (including ERNIE Bot and Doubao)	Approximately 2 months (Sep–Nov 2024)
Gouda et al., 2026[28]	Egypt	One-group pretest–posttest quasi-experimental study	Undergraduate nursing students	1,000	Stand-alone standardised blended AI education programme	No specific AI platform reported	10 sessions; post-test conducted 1 month after the programme
LaGore et al., 2025[29]	United States	One-group pretest–posttest quasi-experimental study	Undergraduate nursing students	145 in the study sample; 108 with paired pre/post data	Single-course integration: undergraduate nursing informatics course	ChatGPT	Not reported
Campbell et al., 2026[30]	United States	Pilot single-group pretest–posttest study	Senior prelicensure baccalaureate nursing students	76 invited; 32 completed the pre-survey and 20 completed the post-survey	Single-course integration: GenAI case-scenario and care-plan critique assignment in a complex care course	Generative AI platform not specified	Not reported

Note: CG = control group; h = hours; IG = intervention group; PhD = Doctor of Philosophy; GenAI = generative artificial intelligence; LLM = large language model.

3.2. Content and pedagogical implementation of AI literacy education

Across the 14 included sources, five domains of AI literacy content, five pedagogical strategies, and seven types of AI-related learning tasks were identified. Among content domains, AI use, prompting, and interaction (C2, $n = 13$), ethical, safe, and responsible AI use (C4, $n = 13$), and nursing-contextual AI application and professional judgement (C5, $n = 13$) were the most frequent. Critical appraisal of AI outputs (C3) was addressed in 12 sources, while AI concepts and foundations (C1) were included in 10.

Among pedagogical strategies, guided AI practice and prompt scaffolding (P2, $n = 13$) was the most frequent, followed by faculty facilitation and feedback (P4, $n = 9$). Case- and simulation-based learning (P1) and collaborative peer learning (P3) were each identified in eight sources, whereas reflective learning (P5) was reported in five.

AI-related learning tasks were most commonly focused on the active examination of AI-generated outputs. AI-output verification and refinement (T4, $n = 11$) was the most frequently identified task, followed by AI-assisted nursing decision-making and care planning (T3, $n = 6$) and AI ethics case analysis and appropriate-use decisions (T7, $n = 5$). AI-assisted writing and content generation (T1) appeared in four sources, AI-supported virtual-patient communication and role-based interaction (T6) in three, and AI-supported evidence-based inquiry and synthesis (T2) alongside AI-supported patient education and practice-resource development (T5) in two sources each. Detailed coding is presented in Table 2, and the thematic distribution is shown in Fig. 2.

Table 2
Content and pedagogical implementation of AI literacy education (n = 14)

Author (year)	AI literacy content	Pedagogical strategies	AI-related learning tasks
Song et al., 2025[11]	C1–C5	P1–P5	T3, T4, T6
Tseng et al., 2025[10]	C1–C5	P2, P3, P4	T1, T2, T3, T4
Tomlinson et al., 2025[13]	C1–C5	P1, P2	T4, T5, T6
Reading Turchioe et al., 2024[22]	C1–C5	P2, P4, P5	T1, T4, T7
Abuadas et al., 2025[23]	C1, C4, C5	P1, P3	T7
Reed et al., 2026[12]	C2, C3, C4, C5	P2, P3, P4	T2, T4
Chan, 2025[24]	C2, C3, C4	P2, P4	T1, T4
Bumbach et al., 2024[25]	C2, C3, C4, C5	P2	T4, T5
Tomlinson et al., 2026[8]	C1–C5	P1, P2, P5	T3, T4, T6, T7
Arkan et al., 2025[26]	C1, C2, C4, C5	P1, P2, P3, P4	T3, T7
Shen et al., 2025[27]	C1–C5	P1, P2, P3, P4	T3, T4
Gouda et al., 2026[28]	C1–C5	P1–P5	T7
LaGore et al., 2025[29]	C1–C5	P2, P5	T1, T4
Campbell et al., 2026[30]	C2, C3, C5	P1, P2, P3, P4	T3, T4
Note: C1 = AI concepts and foundations; C2 = AI use, prompting, and interaction; C3 = Critical appraisal of AI outputs; C4 = Ethical, safe, and responsible AI use; C5 = Nursing-contextual AI application and professional judgement			
P1 = Case- and simulation-based learning; P2 = Guided AI practice and prompt scaffolding; P3 = Collaborative peer learning; P4 = Faculty facilitation and feedback; P5 = Reflective learning;			
T1 = AI-assisted writing and content generation; T2 = AI-supported evidence-based inquiry and synthesis; T3 = AI-assisted nursing decision-making and care planning; T4 = AI-output verification and refinement; T5 = AI-supported patient education and practice-resource development; T6 = AI-supported virtual-patient communication and role-based interaction; T7 = AI ethics case analysis and appropriate-use decisions			

3.3. Evaluation approaches, indicators, and key findings of AI literacy education

There were significant differences in the evaluation methods used in the included sources. Standardised instruments included measures of AI literacy, AI knowledge, AI acceptance, AI attitudes, AI-related anxiety, ethical awareness, higher-order thinking, problem-solving, and nursing-process competency, including AILS, MAILS, GAAIS, TAIEA, AIAS, AIKS-16, AIA-34, HOTS, PSI, and NPCF. Other sources used assignment rubrics, case-report assessments, educator or student feedback, written reflections, and semi-structured interviews to evaluate performance, learning experiences, feasibility, and the critical appraisal of AI-generated content.

Reported findings were generally favourable but not uniform across outcomes. Quantitative studies most commonly reported improvements in AI literacy or knowledge, ethical awareness, acceptance, problem-solving, higher-order thinking, nursing-process competency, or reduced AI anxiety. However, changes in attitudes were less consistent in some studies. Performance- and experience-based evaluations provided additional insights: student participants demonstrated greater scrutiny of AI-generated outputs, while difficulties remained in individualising nursing plans, applying AI in complex clinical situations, and determining appropriate use. Qualitative findings further indicated that the educational value of GenAI depended on prompt quality, content verification, and professional judgement. Curriculum-level reports supported the feasibility of progressive integration, although the curriculum framework study did not include empirical outcome data. Overall, the evaluation evidence was characterised by substantial heterogeneity in both measurement approaches and outcome domains, with standardised self-report tools, performance-based assessments, and qualitative evaluation methods adopted concurrently (Table 3).

Table 3
Evaluation approaches, indicators, and key findings of AI literacy education (n = 14)

Author (year)	Assessment tools	Main evaluation indicators	Key findings
Song et al., 2025[11]	AILS; HOTS questionnaire	Higher-order thinking; AI literacy	GenAI-supported instruction improved AI literacy and higher-order skills, particularly problem-solving and decision-making.
Tseng et al., 2025[10]	MAILS; case-report assessment	AI literacy; case-report performance	Scaffolded GenAI use improved AI literacy and case-report performance, although nursing-plan coherence and individualisation remained limited.
Tomlinson et al., 2025[13]	12-item educator survey; reflective meetings; student feedback	Feasibility; acceptability; implementation experience	Progressive curriculum integration was feasible and acceptable, but clearer guidance and faculty development were needed.
Reading Turchioe et al., 2024[22]	5-point competency rating; written reflections	GenAI competency; safety and usability appraisal	Brief hands-on training increased perceived GenAI competency and strengthened judgement of appropriate use and limitations.
Abuadas et al., 2025[23]	TAIEA; Ethical Sensitivity Scale; GAAIS; TAM-based intention scale	AI ethical awareness; moral sensitivity; AI attitudes; adoption intention	Ethics-focused education improved ethical awareness, moral sensitivity, positive attitudes, and adoption intention.
Reed et al., 2026[12]	GAAIS; open-ended reflections	AI attitudes; perceptions and learning experience	Standardised attitude changes were limited, while reflections indicated more cautious and verification-oriented AI use.
Chan, 2025[24]	Assignment rubric	Critical appraisal of AI-generated content; evidence-supported writing	Students demonstrated evidence-based appraisal of omissions, inaccuracies, and unsupported AI-generated content.
Bumbach et al., 2024[25]	25-point assignment rubric; faculty debrief	AI-assisted resource development; output accuracy and applicability	AI supported practice-resource development but was less applicable in complex clinical situations.
Tomlinson et al., 2026[8]	Not applicable	Not applicable	The framework proposed progressive AI-literacy development from foundational understanding to professionally judged clinical use; no empirical outcomes were evaluated.
Arkan et al., 2025[26]	PSI; GAAIS; NPCF	Problem-solving; AI attitudes; nursing-process competency	ChatGPT-integrated training improved problem-solving, AI attitudes, and nursing-process competency.
Shen et al., 2025[27]	Semi-structured interviews	GenAI learning experience; prompt effectiveness	GenAI learning benefits depended on prompt quality and professional judgement, with persistent limitations in accuracy, privacy, and humanistic understanding.
Gouda et al., 2026[28]	AIKS-16; AIA-34	AI knowledge; AI acceptance	Structured blended education improved AI knowledge and acceptance across multiple technology-acceptance dimensions.
LaGore et al., 2025[29]	AILS; AIAS	AI literacy; AI anxiety	The module was associated with higher AI literacy and lower AI anxiety.
Campbell et al., 2026[30]	Author-developed pre/post survey	AI-use knowledge/confidence; appraisal of accuracy, bias, and holistic nursing concepts	Students reported stronger appraisal of accuracy, bias, and holistic nursing content in AI-generated material.
Note: GenAI = generative artificial intelligence; AIA-34 = Artificial Intelligence Acceptance Scale (34-item); AILS = Artificial Intelligence Literacy Scale; AIAS = Artificial Intelligence Anxiety Scale; AIKS-16 = Artificial Intelligence Knowledge Scale (16-item); GAAIS = General Attitudes towards Artificial Intelligence Scale; HOTS = higher-order thinking skills; MAILS = Meta AI Literacy Scale; NPCF = Nursing Process Competency Form; PSI = Problem-Solving Inventory; TAIEA = Test for Artificial Intelligence Ethics Awareness; TAM = Technology Acceptance Model.			

4. Discussion

4.1. AI literacy as a foundation for accountable judgement

AI literacy education in nursing has shifted from operational tool-use towards critical appraisal and responsible application. This aligns with higher education literature that conceptualises AI literacy as a multidimensional competency involving understanding, use, evaluation, and ethical engagement [31, 32]. Several included studies also reported improvements in higher-order thinking, problem-solving, or nursing-process

competency [11, 10, 26]. However, these findings were derived mainly from course-based or short-term evaluations and do not establish students' sustained judgement in complex nursing contexts.

Appraisal of AI-generated outputs in nursing contexts should not focus solely on factual accuracy. Bumbach et al. reported that students encountered few difficulties when using ChatGPT to develop simpler patient-related resources but faced greater challenges in tasks involving highly complex clinical scenarios [25]. Likewise, Shen et al. found that although prompt optimisation improved the accuracy and contextual relevance of AI-generated care plans, students remained concerned about incomplete outputs, privacy risks, and limited sensitivity to patients' emotional and individual needs [27]. Thus, these findings indicate that critical appraisal within nursing AI literacy requires not only the identification of inaccurate information but also professional judgement regarding whether AI-generated outputs align with patients' specific circumstances, available evidence, and person-centred care needs.

AI literacy may therefore be regarded as a foundation for accountable nursing judgement; however, further empirical investigation is needed to determine whether it contributes to sustained professional judgement in real-world clinical settings.

4.2. From guided AI practice to longitudinal curriculum integration

The findings indicate that AI literacy education for nursing students is primarily embedded within existing curricula rather than offered as a stand-alone course. Guided AI practice and prompt-based scaffolding were the most common teaching strategies, supplemented by instructor feedback, case-based or simulated learning, peer collaboration, and reflective activities to varying degrees. The most frequent learning task was verifying and correcting AI-generated output. Current teaching practices focus not only on students' ability to design effective prompts and obtain answers, but also on situating AI use within a structured "generate–verify–revise" learning process. Previous reviews have similarly emphasised that AI instruction requires clear design, faculty guidance, and appropriate usage guidelines [3, 4]. For example, Reed et al. embedded structured AI activities into a nursing research and evidence-based practice course, whereby students compared and reflected on AI-generated outputs[12].

However, evidence on vertical curriculum integration remains limited. Most educational activities were confined to a single course or a short teaching cycle, and only a few involved multiple courses. Although Tomlinson et al. proposed a progressive curriculum framework for a three-year pre-registration nursing programme, empirical evaluation of student learning outcomes has not yet been conducted [8]. Consequently, the existing evidence mainly addresses how AI literacy is taught within a single course or learning activity, whereas direct evidence is lacking on how different learning stages are connected and whether competencies accumulate as course complexity increases.

Given the identified instructional content and task types, a feasible curriculum design would align AI literacy development with the complexity of nursing learning tasks. Early courses may focus on a basic understanding of AI, responsible use, and prompt design; subsequent courses can reinforce critical use through verification of AI outputs and evaluation of evidence; and later, in more complex tasks such as nursing care planning and case analysis, students are required to assess and interpret AI-generated recommendations. This progressive arrangement not only aligns with the task logic of existing teaching practices but also provides a testable foundation for future longitudinal curriculum integration.

4.3. Assessment heterogeneity and limited evidence of competency transfer

Assessment methods for AI literacy education were diverse, including standardised scales, researcher-developed instruments, task rubrics, written reflections, student feedback, and qualitative interviews. These differences reflect heterogeneity in the design objectives and assessment purposes of the included studies. However, the learning constructs measured by various assessment tools and the nature of the evidence they provide differ. Knowledge, attitudes, acceptance, self-perceived competence, and task performance each reflect different aspects of educational outcomes and thus cannot be treated as interchangeable evidence for AI literacy. Similar concerns about variation in AI literacy constructs and measurement approaches have been raised in previous research, especially regarding construct definition, scale development, and the interpretation of educational outcomes [17, 32]. Given that critical evaluation, application in nursing contexts, and professional judgement have been identified as core components of AI literacy education, improvements in scale scores or self-reported outcomes alone do not demonstrate that students can appropriately handle AI-generated information within authentic nursing tasks.

For example, while Tseng et al. reported improvements in AI literacy and overall case-report performance, they still identified gaps between nursing problems and nursing plans, as well as limited individualisation of nursing interventions[10]. Reed et al. reported relatively modest changes in standardised attitude measures, whereas student reflections more strongly reflected an awareness that AI outputs require verification and cautious application[12]. This suggests that improvements in scale scores or overall course performance may coexist with persistent difficulties in specific nursing tasks. Task-based performance evaluations can directly reflect students' practical application in nursing tasks, while reflections and qualitative data can supplement their understanding of AI-output reliability, boundaries for AI use, and personal responsibility for verification.

Therefore, future evaluations should strengthen the alignment between educational objectives, measured constructs, and evidence types. Knowledge, attitudes, and acceptance can continue to serve as foundational learning outcomes, while objectives related to critical AI use and nursing judgement require direct observation of how students verify, refine, and interpret AI outputs through contextualised tasks such as nursing plans, case analyses, and evidence-based practice. Longitudinal follow-ups and evaluations in clinical learning environments are needed to determine whether these competencies transfer across different tasks and contexts, thereby addressing the current evidence gap regarding the transferability of AI literacy competencies.

5. Limitations

This scoping review has several limitations. First, the evidence base was small and very recent, comprising studies published between 2024 and 2026. The findings therefore reflect an emerging field rather than a mature, well-established body of evidence. Second, eligibility was restricted to publications in English or Chinese, although all included sources were ultimately published in English. The studies also represented a limited range of national and institutional settings, which may restrict transferability to nursing programmes with different curricula, regulatory expectations, or digital resources. Third, most included studies adopted short-term, course-based evaluations and relied heavily on self-reported outcomes. Consequently, evidence concerning the long-term retention and clinical transfer of AI-related competencies remains limited. Finally, no formal methodological quality appraisal was undertaken, consistent with the mapping purpose of this scoping review.

6. Conclusions

This review indicates that AI literacy education for nursing students remains in its early stages. Current educational initiatives have moved beyond basic AI tool-use and are gradually encompassing responsible use, critical evaluation of AI-generated outputs, context-specific applications in nursing, and professional judgement. However, these initiatives remain largely confined to individual courses or short-term instructional activities, and assessment still relies heavily on short-term, scale-based measurements. Future practice should prioritise the progressive, longitudinal integration of AI literacy into nursing curricula, and strengthen performance-based assessments grounded in authentic nursing tasks and real-world learning contexts. Priority should be given to evaluating students' ability to verify, contextually assess, and revise AI-generated content, and to justify its use in nursing decision-making.

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CRediT authorship contribution statement

Conceptualization and data curation, WQ and LN; Formal analysis, LQP and QJM; Writing-original draft preparation and editing, WQ and HXL; Supervision, SH and ZHL. All authors have read and agreed to the published version of the manuscript.

Declaration of Competing Interest

The authors have nothing to declare.

Author Contribution

Conceptualization and data curation, WQ and LN; Formal analysis, LQP and QJM; Writing-original draft preparation and editing, WQ and HXL; Supervision, SH and ZHL. All authors have read and agreed to the published version of the manuscript.

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Figures

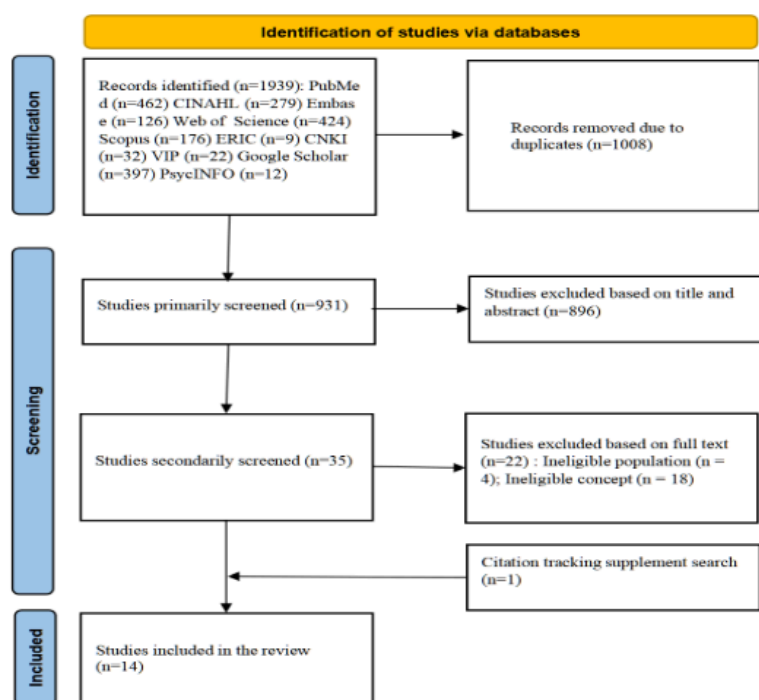


Figure 1

The flow chart of literature screening

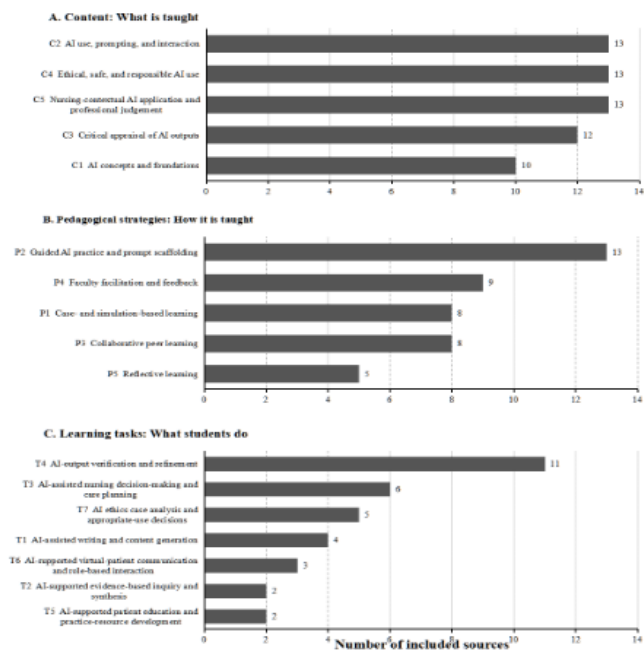


Figure 2

Thematic distribution of AI literacy education content, pedagogical strategies, and learning tasks across the included sources