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Metacognition within vocational nursing education: A scoping review

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Abstract: Metacognition, the capacity to plan, monitor, regulate, and evaluate one's own thinking, is increasingly relevant to nursing education because safe practice requires students to recognise uncertainty, revise decisions, and learn from feedback. This scoping review mapped how metacognition has been conceptualised, assessed, associated with learning and practice outcomes, and cultivated in vocational nursing education. A structured targeted search identified evidence from higher vocational, associate-degree, diploma, practical-nursing, and comparable pre-licensure pathways, supplemented by nursing-education studies with directly transferable metacognitive mechanisms. The evidence consistently linked stronger metacognition with self-directed learning, critical thinking, problem solving, confidence in clinical decision-making, and patient-safety competence. Educational strategies with the clearest relevance were structured reflection and exam wrappers, simulation with guided debriefing, problem-based learning, virtual simulation, and scaffolded self-directed learning. However, direct vocational evidence remains geographically concentrated and dominated by cross-sectional and self-report designs. Vocational nursing programmes should therefore embed explicit planning, monitoring, regulation, and evaluation across theoretical courses, skills laboratories, simulation, and clinical placements, while assessment should capture error detection, strategy adjustment, help-seeking, and transfer to unfamiliar situations. Future studies should test whether metacognitive gains lead to observable improvements in clinical judgement, safe performance, licensure readiness, and transition to practice.

1. Introduction

Nursing competence depends on more than knowledge and procedural accuracy. Students must determine what they know, identify uncertainty, select a strategy, monitor whether it is working, and revise action when clinical information changes. These regulatory activities are central to metacognition. Flavell described metacognition as knowledge about and regulation of cognition [1], while Schraw and Dennison distinguished knowledge of cognition from processes such as planning, monitoring, debugging, and evaluation [2]. In nursing, these processes are especially important because clinical situations are incomplete, time-sensitive, and often resistant to purely routine

solutions.

Nursing-specific work has translated the construct into observable educational dimensions. The Metacognitive Inventory for Nursing Students includes self-monitoring, self-modification, self-awareness, effective learning, and problem solving [3]. A recent scoping review of undergraduate nursing education concluded that metacognition intersects strongly with reflection and self-regulated learning, but also identified inconsistent definitions, uneven measurement, limited causal evidence, and under-representation of diverse educational pathways [4].

These gaps matter in vocational nursing education, which here includes higher vocational, five-year vocational, associate-degree, diploma, and practical-nursing pathways. Although programme structures differ across countries, they share a strong emphasis on applied competence and relatively rapid transition to frontline practice. Direct studies suggest that metacognition may be particularly consequential in these settings. Among 3,047 five-year higher vocational nursing students in China, metacognitive ability was positively associated with self-directed learning and critical thinking [5]. Other vocational studies linked metacognition with confidence in clinical decision-making [6], problem-solving ability [7], and patient-safety competence [8].

Despite these signals, vocational evidence remains fragmented across learner-characteristic studies and educational interventions. Metacognition may appear as an explicit outcome, a mechanism within reflection or self-directed learning, or a process activated by simulation and debriefing. This review therefore aimed to map the construct within vocational nursing education by asking: (1) how metacognition is conceptualised and assessed; (2) which learning and practice outcomes are associated with it; (3) which educational strategies can cultivate it; and (4) what curriculum and research gaps remain.

2. Methods

2.1 Review design and scope

A scoping-review approach was selected because the literature includes cross-sectional studies, mixed-methods work, quasi-experiments, randomised trials, educational evaluations, and reviews with heterogeneous outcomes. The Population-Concept-Context framework guided eligibility. The population comprised students in higher vocational, associate-degree, diploma, practical-nursing, five-year vocational, or comparable pre-licensure programmes. The concept was metacognition, including metacognitive knowledge and regulation and closely related processes of structured self-monitoring, reflection, and strategy evaluation. Contexts included classroom learning, skills laboratories, simulation, online learning, and clinical practicum.

2.2 Search, eligibility, and synthesis

A structured targeted search was undertaken for literature available through 8 August 2026. Searches prioritised PubMed/MEDLINE and accessible English and Chinese scholarly sources, with citation tracking of key studies and reviews. Search terms combined variants of metacognit, metacognitive awareness, self-monitoring, reflection, self-directed learning, and self-regulation with nursing student, vocational nursing, higher vocational nursing, associate degree nursing, practical nursing, diploma nursing, simulation, debriefing, clinical decision-making, problem solving, and patient safety. Seminal theory and nursing-specific instrument-development sources were retained for conceptual interpretation.

Sources were considered directly vocational when the programme was explicitly identified as higher vocational, five-year vocational, associate-degree, diploma, or practical nursing. Complementary nursing-education sources were retained when they tested an explicitly

metacognitive construct or intervention with clear relevance to vocational curriculum design, such as exam wrappers, simulation debriefing, virtual simulation, comprehensive skills training, or problem-based learning. Information was charted on educational pathway, design, metacognitive construct, measurement, intervention, and learning or practice outcomes. Heterogeneity precluded meta-analysis, so findings were synthesised narratively. Because this is a literature-grounded manuscript draft rather than a completed multi-database systematic export, formal submission should be preceded by database replication, duplicate independent screening, and a PRISMA-ScR flow diagram.

3. Findings

3.1 Conceptualisation and outcome associations

Across the evidence, metacognition was most consistently represented by four regulatory actions: planning before learning or clinical action, monitoring understanding and performance, modifying strategies in response to feedback, and evaluating the quality of the final decision or outcome. This pattern is compatible with nursing-specific dimensions of self-awareness, self-monitoring, self-modification, effective learning, and problem solving [3]. Metacognition also overlaps with self-directed learning, but the constructs are not identical: self-directed learning concerns responsibility for organising learning, whereas metacognition specifies the monitoring and control processes that make such responsibility effective.

The strongest direct vocational pattern was the association between metacognition and adaptive learning or reasoning. Jin and Ji found positive relationships among metacognition, self-directed learning, and critical thinking in a large higher vocational sample [5]. Higher vocational students with stronger metacognition also reported greater confidence in clinical nursing decision-making [6], while a two-college study found a positive association between metacognition and problem-solving ability [7]. Most importantly, a 2025 mixed-methods study identified metacognition as a factor influencing patient-safety competence, both directly and indirectly through self-efficacy and self-directed learning [8]. These convergent findings suggest that metacognition is relevant not merely to academic study but to recognition of uncertainty, checking one's limits, and modifying action when routine responses are insufficient. Representative evidence directly relevant to vocational nursing metacognition is summarised in Table 1.

Table 1. Representative evidence directly relevant to vocational nursing metacognition

Study	Vocational context	Design	Main implication
Jin & Ji, 2021 [5]	China; 3,047 five-year higher vocational students	Cross-sectional	Metacognition was positively associated with self-directed learning and critical thinking.
Zhou et al., 2018 [6]	China; 219 higher vocational students	Cross-sectional	Higher metacognition was associated with greater confidence in clinical decision-making.
Chen et al., 2025 [7]	China; 577 students from two vocational colleges	Cross-sectional	Metacognition was positively related to problem-solving ability.

Zhou et al., 2025 [8]	China; 523 vocational students + interviews	Mixed methods	Metacognition contributed to patient-safety competence directly and through self-efficacy/self-directed learning.
Sethares et al., 2021 [9]	USA; associate-degree and BSN students	Descriptive	Exam wrappers made error analysis and future study-strategy adjustment explicit.
Yun & Kang, 2024 [10]	Practical-nursing simulation	Randomised trial	Collaborative reflective debriefing improved problem solving, decision confidence, and reflective thinking.
Hudson & Penkalski, 2022 [11]	USA; practical nursing students	Comparative study	Simulation and interactive case study both improved critical thinking, highlighting reasoning design over technology alone.

3.2 Educational approaches

Structured reflection is the most direct way to make metacognitive regulation visible. Exam wrappers ask students to review preparation, identify why answers were wrong, and commit to a different strategy. In associate-degree nursing students, this approach supported explicit reflection on study behaviour and errors [9]; a later scoping review likewise concluded that exam wrappers can strengthen reflective and self-regulated learning processes in nursing education [12]. In vocational programmes, the same logic can be applied to medication calculations, skills check-offs, OSCEs, and clinical documentation by asking students to identify the source of error, evidence for that diagnosis, and one concrete adjustment before the next attempt.

Simulation is also well suited to metacognitive teaching because it exposes decision processes before patient harm occurs. A practical-nursing study found that both high-fidelity simulation and interactive case study improved critical thinking, with no clear advantage for technological fidelity [11]. The implication is that reasoning prompts and feedback matter more than simulation hardware alone. Debriefing provides the regulatory phase: a collaborative reflection-based strategy in practical-nursing simulation improved problem solving, confidence in clinical decision-making, and reflective thinking [10]. Evidence-based debriefing more broadly emphasises reconstruction of actions, recognition of reasoning patterns, and testing of alternatives [13].

Complementary intervention evidence supports repeated cycles of action and review. A comprehensive nursing skills course improved metacognitive awareness, including knowledge and regulation of cognition [14], and multi-user virtual simulation improved both metacognition and nursing competency across multiple sites [15]. Problem-based learning can serve a similar function when students must identify what is known, define learning needs, compare hypotheses, justify sources, and evaluate whether the solution fits the evidence; a quasi-experimental nursing study reported improved metacognitive thinking after a problem-based learning programme [16]. These approaches are transferable to vocational education when they are deliberately structured around planning, monitoring, feedback, and revision rather than task completion alone.

Self-directed learning also requires scaffolding. Higher vocational students learning online showed only moderate self-directed learning and substantial influence from learner and environmental factors [17]. In vocational clinical practice, stronger self-directed learning readiness was associated with better competency achievement [18]. Therefore, educators should teach how to set specific learning goals, select appropriate resources, check understanding, seek help, and adapt ineffective strategies instead of assuming that practice-oriented students will regulate learning

automatically.

3.3 Assessment of metacognition

Assessment remains a weakness. Self-report inventories are useful for mapping perceived awareness, but high-stakes nursing education requires behavioural evidence. A vocationally relevant assessment system should combine self-report with structured reflection, think-aloud or verbal justification during simulation, observation of cue recognition and strategy switching, OSCE stations containing unexpected changes, and clinical supervisor ratings. Assessment should distinguish final task success from the regulatory process. A student who detects an initial error, stops, seeks assistance, and revises the plan may demonstrate safer metacognition than a student who completes a familiar procedure correctly but cannot recognise when the context makes it inappropriate.

4. Curriculum implications

Metacognition should be embedded as a curriculum thread rather than taught as a separate learning-skills lecture. In foundational courses, students can learn the language of planning, monitoring, regulation, and evaluation and use brief learning logs to identify what they know and where confidence exceeds evidence. In skills laboratories, each procedure can begin with questions such as 'What is the goal?', 'What information do I need?', and 'What risk would make me stop?', and end with 'What changed?', 'What cue did I miss?', and 'What will I do differently next time?'.

In the intermediate stage, the same cycle should be applied to integrated cases and simulation. Prebriefing can require prediction of cues and decision points; scenarios can introduce uncertainty or deterioration; debriefing can trace the reasoning pathway rather than simply review technical steps. During clinical placements, students can complete short structured reflections linked to supervisor feedback and progressively take responsibility for identifying learning needs and evidence sources. The final curricular expectation should be transfer: students should demonstrate that a regulatory strategy learned in one context can be used appropriately with a new patient, ward, or community situation.

Assessment should likewise extend beyond whether a procedure is completed correctly. Skills checklists and OSCEs can award credit for reviewing relevant data, naming anticipated risks, stating escalation criteria, checking the effect of an intervention, and revising the plan when evidence changes. Deliberately incomplete or changing scenarios are especially useful. For example, a medication station can introduce a new allergy history or abnormal vital sign after the student has begun; safe performance is demonstrated by detecting the conflict, stopping, verifying, and escalating rather than by mechanically completing the task. This approach aligns metacognitive regulation with patient safety [8].

Faculty development is essential because metacognitive teaching changes feedback. Instead of providing the correct answer immediately, teachers can first ask students to reconstruct their reasoning, identify when a cue was missed, and propose an alternative strategy. Reflective assignments should also be judged by evidence of a specific decision, the information used, uncertainty appraisal, strategy choice, feedback or outcome information, and a justified adjustment for future action—not by length or emotional disclosure alone.

5. Evidence gaps and future research

Four gaps are clear. First, direct vocational research is limited and geographically concentrated, particularly in China and parts of Asia. Cross-national work should describe programme structures

precisely rather than treating all non-baccalaureate pathways as equivalent. Second, most direct studies are cross-sectional, so associations with critical thinking, problem solving, decision confidence, and patient-safety competence [5-8] cannot establish causality. Longitudinal and experimental studies are needed across classroom, simulation, and clinical phases.

Third, self-report measures dominate. Future assessment should examine calibration accuracy, error detection, strategy switching, help-seeking, and escalation behaviour and should test whether metacognitive scores predict objective clinical performance. Fourth, intervention research should determine dosage, durability, and transfer. Trials of reflective assessment, comprehensive skills training, virtual simulation, problem-based learning, and structured debriefing [10,12,14-16] should include outcomes such as clinical judgement, medication safety, prioritisation, documentation quality, licensure performance, and supervisor-rated readiness.

This review also has methodological limitations. Vocational terminology varies across countries, and the present manuscript was developed from a targeted structured evidence search rather than a completed multi-database systematic export with duplicate independent screening. Complementary non-vocational nursing studies were included when vocational intervention evidence was sparse; their applicability should therefore be tested rather than assumed. Before journal submission, the search should be replicated in CINAHL, MEDLINE, Scopus, Web of Science, ERIC, CNKI, Wanfang, and SinoMed, followed by deduplication, independent screening, and full PRISMA-ScR reporting.

6. Conclusion

Metacognition is a plausible core capability for vocational nursing education because it links learning regulation with the realities of clinical work: recognising uncertainty, checking understanding, revising a plan, learning from error, and knowing when to seek help. Direct vocational evidence associates stronger metacognition with self-directed learning, critical thinking, problem solving, confidence in clinical decision-making, and patient-safety competence. Structured reflection, exam wrappers, simulation with guided debriefing, problem-based learning, virtual simulation, and scaffolded self-directed learning can make these processes visible and teachable. The curricular priority is not to create a separate metacognition course, but to embed planning, monitoring, regulation, evaluation, and transfer throughout skills training, simulation, assessment, and clinical supervision. Future research should test whether these changes produce observable improvements in safe performance and readiness for practice.

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