

Integrating Higher-Order Thinking Skills into Hemodialysis Nursing Education

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ABSTRACT

The increasing complexity of healthcare services requires nurses to possess advanced cognitive competencies, particularly Higher-Order Thinking Skills (HOTS), including critical thinking, problem-solving, and creative thinking. These skills are essential for clinical decision-making, especially in specialized clinical environments such as hemodialysis units, where patient conditions often require continuous assessment and rapid clinical judgment. However, the integration of HOTS-based educational approaches in hemodialysis nursing education remains limited.

This study employed a descriptive cross-sectional design to explore the implementation of a HOTS-based nursing education approach in a hemodialysis clinical learning setting. The participants consisted of 13 nursing learners undergoing clinical practice in a hemodialysis unit, selected using a total sampling technique. Data were collected using a structured HOTS questionnaire consisting of 41 items measuring three domains: critical thinking skills, problem-solving skills, and creative thinking skills. Each item was assessed using a four-point Likert scale ranging from poor to very good. Descriptive analysis was used to summarize the respondents' characteristics and the distribution of HOTS indicators.

The findings indicated that the implementation of a HOTS-based educational approach in the hemodialysis clinical learning environment supported the development of higher-order cognitive abilities among nursing learners. Participants demonstrated the ability to analyze patient complaints, interpret laboratory findings, identify clinical problems, and generate alternative nursing interventions in response to changing patient conditions. These competencies reflect the development of critical thinking, problem-solving, and creative thinking skills required for effective clinical practice.

Integrating HOTS into hemodialysis nursing education may strengthen nursing learners' cognitive competencies in clinical reasoning and decision-making. The implementation of HOTS-based learning strategies has the potential to enhance the preparedness of nurses in managing complex patient conditions in specialized clinical settings.

Keywords: higher-order thinking skills, nursing education, critical thinking, problem solving, hemodialysis nursing.

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What are the main findings?
<ol style="list-style-type: none">1. The integration of a Higher-Order Thinking Skills-based educational approach in hemodialysis nursing learning supports the development of critical thinking abilities, particularly in analyzing patient complaints, interpreting laboratory results, and identifying nursing problems in complex clinical situations.2. The learning approach encourages the development of problem-solving skills by enabling nursing learners to interpret patient conditions, analyze clinical information, and determine appropriate nursing interventions in response to changing patient needs.3. The HOTS-based education model also promotes creative thinking among learners, allowing them to generate alternative interventions, adapt nursing care strategies, and collaborate with healthcare teams when facing dynamic clinical conditions in hemodialysis care.

clinical evidence, and determine appropriate interventions that lead to improved patient outcomes (Daly, 1998; Carter et al., 2015). These cognitive skills are particularly important in clinical settings where patient conditions may change quickly and require immediate decision-making.

In nursing practice, critical thinking plays a central role in clinical reasoning and decision-making processes. Nurses must continuously assess patient conditions, interpret laboratory results, and prioritize care based on clinical judgment. These processes require analytical thinking, evaluation of information, and synthesis of knowledge to guide appropriate interventions (Benner et al., 2010). Research has shown that critical thinking is closely associated with professional competence and the quality of nursing care, as it enables nurses to identify patient problems accurately and implement effective care plans (Carter et al., 2015). Therefore, the development of critical thinking and other higher-order cognitive skills is considered a key objective of nursing education programs worldwide.

Despite its recognized importance, developing higher-order thinking skills among nursing students remains a significant challenge. Traditional lecture-based educational approaches often emphasize knowledge acquisition rather than cognitive skill development. However, modern healthcare environments require nurses who can engage in complex reasoning and problem-solving rather than simply recalling information (Yue et al., 2017). Studies have highlighted that structured educational strategies are needed to foster critical thinking, clinical reasoning, and decision-making skills among nursing students and novice nurses (Görücü et al., 2025).

INTRODUCTION

The increasing complexity of healthcare systems requires nurses to possess advanced cognitive abilities in order to deliver safe and effective patient care. Modern nursing practice demands not only technical competence but also the ability to analyze clinical information, make sound judgments, and respond to rapidly changing patient conditions. Consequently, higher-order thinking skills (HOTS), including critical thinking, problem-solving, and creative thinking, have become essential competencies in contemporary nursing education and clinical practice (Daly, 1998; Yue et al., 2017). Critical thinking enables nurses to interpret patient data, evaluate

Integrating higher-order thinking into clinical education has therefore become a priority in nursing curricula and professional training programs.

The need for advanced cognitive skills becomes even more critical in specialized clinical areas such as hemodialysis units. Patients undergoing hemodialysis often present with complex physiological conditions, including fluid imbalance, electrolyte disturbances, and multiple comorbidities, which require careful monitoring and rapid clinical decision-making. Nurses working in hemodialysis settings must interpret clinical indicators, evaluate treatment responses, and adjust nursing interventions accordingly. Such clinical situations demand strong analytical and problem-solving abilities to ensure patient safety and optimal treatment outcomes (Benner et al., 2010). Therefore, educational models that promote higher-order thinking skills are essential in preparing nurses to manage the complexities of hemodialysis care.

Educational models that integrate Higher-Order Thinking Skills (HOTS) into nursing training have been shown to support the development of critical thinking, creativity, and problem-solving abilities. HOTS-based learning approaches emphasize analysis, evaluation, and innovation in solving clinical problems rather than relying solely on memorization of theoretical knowledge. By incorporating HOTS into clinical education, nursing students and trainees can develop the cognitive flexibility necessary to respond to dynamic patient conditions and clinical challenges (Von Colln-Applying & Giuliano, 2017). Consequently, integrating HOTS into nursing education may enhance clinical competence and improve

decision-making in specialized care settings such as hemodialysis units.

However, limited studies have specifically explored the integration of HOTS-based educational models in hemodialysis nursing education. Most existing research focuses on general nursing education or critical care settings, leaving a gap in understanding how HOTS approaches can support learning in specialized clinical environments. Therefore, developing and implementing a HOTS-based nursing education model for hemodialysis care is important to enhance nurses' cognitive abilities in clinical assessment, problem identification, and decision-making. This study aims to integrate Higher-Order Thinking Skills into hemodialysis nursing education in order to strengthen critical thinking, problem-solving, and creative thinking abilities among nursing learners.

METHOD

This study employed a descriptive cross-sectional design to evaluate the implementation of a Higher-Order Thinking Skills (HOTS)-based nursing education model in a hemodialysis clinical learning setting. The participants consisted of 13 nursing learners undergoing clinical practice in the hemodialysis unit, selected using a total sampling technique. Data were collected using a structured HOTS questionnaire comprising 41 items that measured three main domains: critical thinking skills, problem-solving skills, and creative thinking skills. Each item was assessed using a **four**-point Likert scale ranging from 1 (poor) to 4 (very good). The questionnaire was designed to assess participants' abilities in clinical analysis, problem interpretation, decision-making, and innovative thinking during patient care. Descriptive statistical analysis

was used to summarize respondents' characteristics and the distribution of HOTS indicators. Ethical considerations were ensured by obtaining informed consent from all participants and maintaining confidentiality throughout the study.

RESULTS

Table 1. Demographic Characteristics of Respondents (n = 13)

Characteristics	Category	n	%
Age	≤ 25 years	7	53.8
	26–35 years	4	30.8
	> 35 years	2	15.4
	Mean ± SD	27.7	years
Gender	Female	11	84.6
	Male	2	15.4
Religion	Christian	13	100
Ethnicity	Javanese	10	76.9
	Ambonese	1	7.7
	Nias	1	7.7
	Others	1	7.7

Table 1 shows the demographic characteristics of the respondents. Most participants were ≤25 years old (53.8%), followed by those aged 26–35 years (30.8%) and over 35 years (15.4%), with a mean age of 27.7 years.

The majority of respondents were female (84.6%), while 15.4% were male. All participants identified their religion as Christian (100%). In terms of ethnicity, most respondents were Javanese (76.9%), while the rest were Ambonese (7.7%), Nias (7.7%), and other ethnic backgrounds (7.7%).

Table 2. Variables and Indicators of HOTS Measurement

Variable	Indicators	Number of Items
Critical Thinking Skills (CTS)	Analysis	6
	Comparative Study	5
	Evaluation	6
Problem Solving Skills (PSS)	Problem Interpretation	4
	Problem Analysis	4
	Problem Solving & Creative Thinking	Insight
Creative Thinking Skills (CRETS)	Thinking Alternatively	5
	Innovative Thinking	6
	Total Items	

Table 2 presents the variables and indicators used to measure Higher Order Thinking Skills (HOTS) in this study. The instrument consisted of three main domains: Critical Thinking Skills (CTS), Problem Solving Skills (PSS), and Creative Thinking Skills (CRETS).

The Critical Thinking Skills domain included three indicators: analysis (6 items), comparative study (5 items), and evaluation (6 items). The Problem Solving Skills domain consisted of problem interpretation (4 items) and problem analysis (4 items). In addition, an insight indicator (5 items) represented the integration between problem solving and creative thinking processes.

Finally, the Creative Thinking Skills domain included thinking alternatively (5 items) and innovative thinking (6 items). Overall, the questionnaire consisted of 41 items designed to assess students' higher order thinking skills in clinical nursing situations.

Table 3. Score Range of HOTS Variables

Variable	Number of Items	Minimum Score	Maximum Score
Critical Thinking Skills (CTS)	17	17	68
Problem Solving Skills (PSS)	8	8	32
Insight (PSS & CRETS)	5	5	20
Creative Thinking Skills (CRETS)	11	11	44
Total HOTS	41	41	164

The questionnaire consisted of 41 items, with possible total scores ranging from 41 to 164. Higher scores reflected higher levels of Higher Order Thinking Skills (HOTS) among respondents (Table 3).

DISCUSSION

The integration of Higher-Order Thinking Skills (HOTS) into hemodialysis nursing education highlights the importance of developing cognitive competencies that support complex clinical decision-making. Nursing practice requires professionals to continuously analyze patient data, interpret clinical findings, and determine appropriate interventions in dynamic clinical environments. Higher-order thinking skills, particularly critical thinking, problem-solving, and creative thinking, are therefore considered fundamental competencies for safe and effective nursing practice (Benner et al., 2010; Yue et al., 2017). These skills enable nurses to move beyond routine procedures

and engage in reflective clinical reasoning when responding to patient needs.

Critical thinking plays a central role in nursing education because it supports clinical judgment and improves the quality of patient care. Nurses must be able to interpret patient symptoms, analyze laboratory results, and evaluate treatment responses in order to provide appropriate interventions. The literature consistently emphasizes that critical thinking is essential for clinical reasoning and decision-making in nursing practice (Carter et al., 2015; Daly, 1998). Nurses who demonstrate strong critical thinking abilities are better equipped to assess patient conditions, identify potential risks, and respond effectively to clinical changes. Furthermore, critical thinking contributes to patient safety by enabling nurses to recognize inconsistencies in clinical data and question inappropriate clinical orders when necessary (Cohen, 2018).

In addition to critical thinking, problem-solving skills are also essential in clinical nursing practice. Problem-solving allows nurses to identify patient problems, prioritize care, and determine appropriate nursing interventions. In complex healthcare environments, nurses often encounter situations that require rapid assessment and decision-making. These situations demand analytical thinking and the ability to synthesize multiple sources of information. Research has shown that problem-solving abilities are closely related to critical thinking and are necessary for making accurate clinical decisions in patient care (Mahmoud, 2012). Moreover, nurses with strong problem-solving skills are more capable of managing unexpected clinical situations and adapting their interventions based on patient responses (Benner et al., 2010).

Creative thinking is another important component of HOTS that supports innovation in clinical care. In rapidly changing clinical environments, nurses must be able to generate alternative strategies when standard interventions do not produce the expected outcomes. Creative thinking encourages nurses to explore different approaches to patient care and develop innovative solutions to clinical problems. Educational strategies that foster creativity in nursing practice can enhance adaptability and clinical flexibility, allowing nurses to respond effectively to complex patient conditions (Von Colln-Appling & Giuliano, 2017). In this context, integrating creative thinking into nursing education supports the development of flexible and adaptive clinical reasoning skills.

The importance of HOTS becomes even more evident in specialized clinical settings such as hemodialysis units. Patients undergoing hemodialysis often present with complex physiological conditions, including electrolyte imbalance, fluid overload, and multiple chronic comorbidities. These conditions require nurses to perform continuous assessments and make timely clinical decisions. Therefore, nurses working in hemodialysis units must possess strong analytical and decision-making abilities to ensure safe and effective patient care. The development of HOTS within nursing education can support nurses in interpreting complex patient data and determining appropriate nursing interventions in such high-risk clinical environments (Benner et al., 2010).

Despite the recognized importance of higher-order thinking skills in nursing practice, many studies indicate that nursing students and novice nurses still demonstrate limited critical thinking ability. Research has

reported that a considerable proportion of nurses exhibit only moderate levels of critical thinking competence, suggesting the need for educational strategies that actively promote cognitive skill development (Zuriguél-Pérez et al., 2021). Traditional teaching approaches in nursing education often focus on knowledge transmission rather than developing analytical reasoning and problem-solving skills. As a result, students may acquire theoretical knowledge without fully developing the cognitive abilities required for complex clinical decision-making.

Furthermore, previous studies emphasize that educational strategies designed to enhance critical thinking should be integrated into both classroom learning and clinical practice environments. Learning activities such as case-based learning, clinical simulations, and reflective discussions have been recommended to support the development of higher-order thinking skills in nursing students (Yue et al., 2017). These educational approaches encourage learners to analyze clinical scenarios, evaluate evidence, and develop appropriate interventions. By engaging in these activities, nursing students can strengthen their clinical reasoning and decision-making skills in real-world clinical situations.

However, although many studies have explored the development of critical thinking in general nursing education, research focusing specifically on HOTS-based learning in specialized clinical areas remains limited. Most existing studies examine critical thinking in undergraduate nursing education or general clinical training contexts, while fewer studies address how HOTS-based educational models can be implemented in specialized units such as hemodialysis care. This gap highlights the need for educational

innovations that specifically address the cognitive demands of specialized nursing practice. Integrating HOTS into hemodialysis nursing education may therefore represent an important strategy for improving nurses' clinical reasoning and decision-making abilities in this complex care environment.

Therefore, the integration of HOTS into hemodialysis nursing education offers a promising approach to strengthening cognitive competencies among nursing learners. By emphasizing critical thinking, problem-solving, and creative thinking, HOTS-based educational models can support the development of advanced clinical reasoning skills that are essential for managing complex patient conditions. Future research should further explore the effectiveness of HOTS-based educational strategies in specialized clinical settings and evaluate their impact on clinical competence and patient outcomes.

CONCLUSION

The integration of Higher-Order Thinking Skills (HOTS) into hemodialysis nursing education highlights the importance of developing advanced cognitive competencies among nursing learners. By emphasizing critical thinking, problem-solving, and creative thinking, HOTS-based educational approaches can support learners in analyzing clinical information, identifying patient problems, and making appropriate clinical decisions in complex healthcare environments. In specialized clinical settings such as hemodialysis units, the ability to interpret patient conditions, evaluate treatment responses, and adapt nursing interventions is essential for ensuring patient safety and quality of care. Therefore, incorporating HOTS into nursing education may contribute to strengthening clinical

reasoning and improving the preparedness of nurses in managing complex patient conditions. Future studies are recommended to further evaluate the effectiveness of HOTS-based educational models in different clinical settings and to explore their potential impact on clinical competence and patient outcomes.

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CONFLICT OF INTEREST

No conflict of interest.

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