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Effects of Simulation-Based Education for Hypovolemic Shock on Nursing Students' Clinical Competence and Clinical Judgment

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----------ABSTRACT----------
The ultimate goal of nursing education is to prepare nursing students to make critical decisions and deliver safe, high-quality care based on sound scientific knowledge. However, due to concerns regarding patient safety, patient rights, and stringent infection control protocols, clinical practicums have increasingly become observation-oriented, limiting direct nursing care opportunities. To overcome these constraints, this study developed an emergency care simulation scenario for acute hypovolemic shock tailored to the clinical environment and evaluated its educational effectiveness on nursing students' clinical competence and clinical judgment. A methodological and quasi-experimental study using a one-group pretest-posttest design was conducted with 48 fourth-year nursing students. The program consisted of pre-briefing (10 min), simulation execution (15 min), and debriefing using the Gather-Analyze-Summarize (GAS) model (15 min). Data were collected using structured self-report instruments before the intervention and one week following completion, and analyzed using paired t-tests in IBM SPSS Statistics 25.0. Following the simulation-based education, clinical competence ($t = 10.42$, $p < .001$) and clinical judgment ($t = 2.48$, $p = .017$) significantly improved compared to baseline. In sub-domain analysis of clinical judgment, the 'Reflecting' domain showed a statistically significant increase ($t = 2.67$, $p = .010$). These findings demonstrate that realistic, scenario-based emergency simulation coupled with structured debriefing effectively fosters clinical competence and reflective clinical reasoning among prospective nurses.

KEYWORDS; *Simulation Training, Hypovolemic Shock, Clinical Competence, Clinical Judgment, Nursing Education*

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I. INTRODUCTION

The ultimate goal of nursing education is to help students develop the practice competencies needed to think critically and provide safe, high-quality care in clinical settings, grounded in solid scientific knowledge. However, amid rapid changes in the healthcare environment, along with heightened standards for patient safety, patient rights protection, and infection control, clinical practicum for nursing students has increasingly shifted from hands-on care delivery toward observation-based learning [1]. As a result, opportunities for prospective nurses to directly experience and train in complex, rapidly evolving clinical situations have become progressively more limited.

To overcome these structural limitations of clinical practicum and meet the advanced demands of clinical practice, simulation-based education has become established as an essential alternative in nursing education. Technological advances such as high-fidelity simulators (HFS) and virtual reality (VR) enable the creation of highly immersive clinical environments that closely resemble actual hospital settings [2]. The core value of simulation-based education lies in its capacity to allow learners to make autonomous decisions and expand their learning through errors, within a psychologically and physically safe environment that does not jeopardize patient safety [3]. Beyond simply repeating mechanical skills, students assess dynamic changes in patient status in real time, derive optimal interventions, and experience clinical growth through immediate debriefing feedback [4].

Prior studies have shown that simulation-based education significantly improves complex clinical judgment and critical thinking [5], and further reduces anxiety related to clinical performance while enhancing self-efficacy,

thereby serving as a key educational strategy that facilitates successful clinical adaptation and transition to practice [6-10].

However, the qualitative outcomes of simulation-based education depend critically on the realism and contextual relevance of the scenarios employed [11-13]. Many simulation scenarios currently used in Korean nursing programs have been adapted or translated from foreign protocols, and thus fail to fully capture the healthcare delivery system, interprofessional collaboration structures, and the cultural particularities of wards and intensive care units specific to Korea [6, 14]. The absence of standardized domestic development criteria contributes to variability in educational outcomes, underscoring the urgent need for tailored scenario development that reflects the realities of Korean clinical practice.

In particular, hypovolemic shock is a representative time-sensitive emergency condition that occurs frequently in clinical settings and can rapidly progress to multiple organ failure and death within a short period [15]. Managing this condition requires more than adherence to guidelines; it demands integrated competencies, including clinical judgment to promptly detect subtle changes in vital signs and clinical performance ability to rapidly and accurately execute large-bore intravenous access, transfusion, and fluid resuscitation therapy. However, for patient safety reasons, students have virtually no opportunity to directly perform these high-acuity interventions on actual patients experiencing hemorrhagic shock [16].

Accordingly, this study aims to develop a "hypovolemic shock patient care simulation scenario" that maximizes realism and immersion by reflecting the practice contexts nurses actually encounter in Korean clinical settings, and to apply this scenario to nursing students in order to examine its effects on clinical judgment and clinical performance ability—thereby establishing a standardized foundation for practice-linked emergency nursing education.

Purpose of the Study

The purpose of this study is to systematically develop a hypovolemic shock patient care simulation program to strengthen nursing students' emergency nursing practice competencies, and to examine its educational effects. The specific objectives are as follows:

1. To develop a hypovolemic shock patient care simulation scenario that reflects the Korean clinical practice environment.
2. To verify the effects of the developed simulation education on nursing students' clinical performance ability, clinical judgment.

Research Hypotheses

1. Hypothesis 1: Nursing students who receive hypovolemic shock simulation education will show significantly higher clinical performance ability scores after the education compared to before.
2. Hypothesis 2: Nursing students who receive hypovolemic shock simulation education will show significantly higher clinical judgment scores after the education compared to before.

Research Methods

1. Research Design

This study is a methodological study and quasi-experimental study conducted in two stages—a scenario development phase and an evaluation phase—to develop a hypovolemic shock patient care simulation program and evaluate its effects. A one-group pre-posttest design was applied to verify the educational effects.

This study applied Jeffries' simulation framework [17] (National League for Nursing Jeffries Simulation Theory) as its theoretical framework, organically linking the scenario development process with the evaluation of educational outcomes.

- **Scenario development phase:** A hypovolemic shock nursing scenario reflecting the complexity and dynamics of actual clinical practice was constructed by incorporating the core elements of simulation design—context, facilitator (instructor), learner characteristics, and educational design—and its content validity was verified by experts.
- **Evaluation phase:** After applying the developed simulation education intervention to nursing students, pre- and post-intervention changes in the key learning outcomes—clinical performance ability, clinical judgment were compared and analyzed.

2. Study Participants

This study used convenience sampling to recruit fourth-year nursing students at C University, located in City G. The specific inclusion criteria were as follows:

1. Students who had completed a simulation-related practicum course or a theoretical course in adult nursing (emergency nursing content)
2. Students who received a full explanation of the purpose and procedures of this study and voluntarily provided written informed consent

The sample size was calculated using G*Power 3.1. Based on a paired t-test for a one-group pre-post design, and referencing a prior simulation study involving nursing students [18], a medium effect size (dz) of .50, a significance level (α) of .05, and a power (1−β) of .80 were applied, yielding a minimum required sample size of 34. Considering an anticipated attrition rate due to incomplete responses or practicum absence, a total of 48 students were recruited; there was no attrition, and data from all 48 participants were included in the final analysis.

3. Research Instruments

1) Clinical Competence

In this study, participants' clinical performance ability was measured using a self-report questionnaire developed by Lee Kyung-Wan et al. [19] and modified and supplemented by Choi Eun-Hee [20] to fit the context of simulation practice for nursing students. This instrument assesses nursing students' practical ability to integrate and directly apply nursing knowledge and skills in emergency and clinical situations, and consists of a total of 20 items across four subdomains: "nursing assessment," "nursing intervention," "nursing evaluation," and "professional attitude and communication."

To reflect the practice-specific characteristics of hypovolemic shock nursing, content validity (Content Validity Index, CVI) was assessed in this study by five experts—charge nurses with at least 5 years of emergency department experience and professors specializing in emergency nursing—and only items with an item-level content validity index (I-CVI) of .80 or higher were retained for use. Each item is rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"), with total scores ranging from 20 to 100. Higher scores indicate better clinical performance ability in hypovolemic shock situations. The reliability (Cronbach's α) of the instrument was .91 in Choi Eun-Hee's study [20], and .89 in this study.

2) Clinical Judgment

To measure participants' clinical judgment, this study used the Korean version of the Lasater Clinical Judgment Rubric (K-LCJR), a self-assessment instrument based on Tanner's [21] Clinical Judgment Model, originally developed by Lasater [22] and validated for Korean nursing students by Shim Ga-Ga and Shin Hyun-Sook [23].

The K-LCJR assesses the thinking process of identifying and resolving clinical cues across four core dimensions—"Noticing," "Interpreting," "Responding," and "Reflecting"—comprising 11 sub-items. Each item is rated on a 4-point scale: "Beginning" (1 point), "Developing" (2 points), "Accomplished" (3 points), and "Exemplary" (4 points), with total scores ranging from 11 to 44. Higher scores indicate better clinical judgment ability. The reliability (Cronbach's α) of the instrument was .88 in the study by Shim Ga-Ga and Shin Hyun-Sook [23], and .86 in this study.

4. Research Procedure

1) Instructor Preparation

To ensure the quality and operational validity of simulation-based practicum education, the researcher completed multiple accredited faculty development programs, including Nursing Simulation Operating Training, strategies for activating simulator use, S-PBL education, the Simulation Specialist Training Course, e-PBL-based course operation and strategies, and an advanced simulation educator course. At the time of the study, the researcher was solely responsible for teaching fundamentals of nursing and simulation-based practicum courses at the university.

2) Simulation Environment and Preparation

The simulation laboratory was designed to closely resemble an actual university hospital emergency department. Clinical equipment and supplies—including a high-fidelity patient simulator, patient monitor, emergency cart, intravenous infusion pump, and transfusion/fluid infusion sets—were standardized and arranged accordingly. A one-way mirror and audio communication system were installed between the practicum room and the control room, allowing the instructor to control the flow of the scenario and vital sign parameters from outside the room, and to observe and video-record the students' entire performance in real time.

Prior to the simulation, participants were assigned to small-group teams of 4 members each. During orientation, teams engaged in a pre-simulation discussion (approximately 60 minutes) in which they identified core nursing problems and developed a nursing intervention plan based on an overview of the patient case. Team members were instructed to autonomously assign roles among themselves, consisting of 1 charge nurse, 2 assessment nurses, and 1 medication nurse.

3) Simulation Implementation and Scenario Content

The scenario was developed and its content validity verified between April 15 and May 20, 2025, through four in-depth panel meetings involving an expert panel composed of one adult health nursing professor, one fundamentals of nursing professor, and one head nurse from a university hospital emergency department.

The simulation run time was set at 15 minutes per team <Table 1>. Participants were organized into a total of 12 teams (4 members per team, 48 participants in total), with each team member autonomously assigning roles during the pre-briefing session—1 charge nurse, 2 assessment nurses, and 1 medication nurse—to carry out the nursing interventions specified in the scenario.

Process	Monitor Setting (Instructor)	Patient/Manikin (Action)	Student Intervention	Cue/Prompt
Problem Recognition *(3 min)*	RR: 28/min HR: 128/min BP: 78/44 mmHg SpO2: 90% Temp: 35.8℃ EKG: Sinus tachycardia	*"I feel so weak… and really thirsty…"* Patient is drowsy, restless, and slow to respond to verbal stimuli. Skin is pale, cool, and diaphoretic.	• Perform hand hygiene and don appropriate PPE • Introduce self and verify patient identity (name, ID band, birth date) • Obtain focused history from caregiver (onset, amount/frequency of hematemesis, prior GI history, NSAID/alcohol use) • Perform rapid primary survey (general appearance, airway, breathing, circulation) • Activate emergency response / call for assistance	Role member providing cue – Patient's wife: *"He suddenly vomited a lot of fresh blood twice at home and then became too weak to stand – that's why we called 911!"*

Process	Monitor Setting (Instructor)	Patient/Manikin (Action)	Student Intervention	Cue/Prompt
Focused Assessment *(4 min)*	(Vital signs deteriorate further if the student delays intervention) RR: 30/min HR: 132/min BP: 72/42 mmHg SpO2: 88%	Pulse: weak, thready, and rapid Capillary refill > 3 seconds *"The room is spinning… I think I'm going to pass out."*	• Perform systematic ABCDE assessment • Assess level of consciousness using the AVPU scale • Inspect skin color, temperature, and moisture; assess for active bleeding • Apply continuous cardiac monitor and pulse oximetry • Administer O2 via non-rebreather mask at 10–15 L/min to maintain SpO2 ≥ 94% • Position patient supine with legs elevated (modified Trendelenburg) unless contraindicated • Insert indwelling urinary catheter to monitor hourly urine output	Role member providing cue – Patient: *"I'm so thirsty and my heart is racing…"* *"I can't catch my breath."*
Intervention *(5 min)*	RR → 24/min HR → 118/min BP → 82/54 mmHg SpO2 → 95% Temp → 36.0℃	*"Am I going to be okay? Please don't leave me…"*	• Notify physician promptly using SBAR communication • Insert two large-bore (14–16G) peripheral IV catheters • Initiate rapid crystalloid resuscitation (0.9% normal saline bolus per protocol) via pressure bag/rapid infuser • Obtain blood samples for type & crossmatch, CBC, coagulation panel, electrolytes, and lactate • Prepare and anticipate need for blood product transfusion • Apply warming blanket / warmed fluids to prevent hypothermia • Continuously reassess vital signs, LOC, and urine output; titrate O2 as needed • Provide clear, calm explanation of procedures to reduce anxiety	*(If the student delays IV access)* Role member providing cue – Physician (Instructor): *"Have you secured the large-bore IV lines yet? We need to start fluid resuscitation now, and send blood for crossmatch immediately."*
Evaluation *(3 min)*	RR ← 18/min HR ← 92/min BP ↑ 110/70 mmHg SpO2 ↑ 97% Temp ↑ 36.7℃	*"I feel a lot better now – less dizzy, and breathing is easier."*	• Verify blood product against order using independent two-nurse identification • Reassess vital signs, LOC, skin perfusion, and bleeding status • Monitor closely for signs of transfusion reaction during infusion • Accurately document assessment findings,	Role member providing cue – Patient: If the student does not communicate the evaluation findings, the patient asks, "Has the bleeding stopped? Am I going to need

Process	Monitor Setting (Instructor)	Patient/Manikin (Action)	Student Intervention	Cue/Prompt
			interventions, intake/output, and patient response • Communicate evaluation findings to the patient and care team; plan for ongoing monitoring	surgery?"

Table 1. Hypovolemic Shock Simulation Scenario Flowchart

- **Scenario case overview:** Mr. Kim (male, 55 years old), with a history of peptic ulcer disease 3 years prior, had a history of excessive alcohol consumption and recent self-administered use of NSAIDs to relieve epigastric discomfort. Two hours before arrival, he collapsed at home after a massive episode of hematemesis (approximately 500 mL, twice) and was transported to the emergency department via 119 emergency medical services. On arrival, the patient's level of consciousness had declined from alert to drowsy, and he presented with severe thirst, cold sweating, peripheral coldness, pallor, and extreme anxiety—an acute hypovolemic shock situation.
- **Core performance tasks:** Students were required to promptly notice and interpret real-time deteriorating vital signs (hypotension, tachycardia, tachypnea), and collaboratively perform priority-based emergency interventions (responding), including immediate oxygen administration, securing a large-bore IV line, initiating massive fluid resuscitation, preparing for emergency transfusion, and monitoring blood loss.
- **Debriefing:** Immediately after the scenario, students moved to a separate debriefing room, completed a self-reflection journal, and participated in a debriefing session applying the GAS (Gather-Analyze-Summarize) model of Phrampus and O'Donnell [26].
    - **Gather:** Emotions were ventilated immediately after the practicum, and students shared factual observations of what they had first noticed in the patient's urgent clinical situation.
    - **Analyze:** Teams reflected on the appropriateness of their nursing assessments, the prioritization of interventions, and the causes of errors or delays, engaging in in-depth analysis of their critical thinking process.
    - **Summarize:** Students consolidated the core principles of hypovolemic shock patient care and reviewed strategies for practical application.

5. Data Collection and Ethical Considerations

Data were collected from July 1 to July 15, 2025.Prior to data collection, protective measures for vulnerable subjects were implemented in consideration of the fact that participants were currently enrolled students. Both orally and in writing, it was explicitly disclosed that participation or withdrawal from the study would result in no disadvantage whatsoever to academic performance or course evaluation. An online questionnaire (Google Forms) URL link was distributed via mobile messenger to those who voluntarily agreed to participate. The first page of the survey provided information on the study's purpose, procedures, guarantee of anonymity, confidentiality, and the right to withdraw; the system was designed so that participants could proceed to the main survey (approximately 15–20 minutes) only after completing online electronic informed consent. All collected data were converted into anonymous identification codes and stored as encrypted files; participants were informed that the data would not be used for any purpose other than statistical analysis and would be permanently destroyed after the legally required retention period (3 years).

The pretest was conducted immediately before the start of the simulation intervention, and the posttest was conducted one week after the completion of the education, using the same instruments, in order to confirm the maintenance of educational effects and reflective effects.

6. Data Analysis

The collected data were analyzed using IBM SPSS Statistics 25.0. The specific analytic methods were as follows:

1. Descriptive statistics (frequencies and percentages, means and standard deviations) were calculated for participants' general characteristics.
2. Pre- and post-intervention scores for clinical performance ability and clinical judgment were presented as means and standard deviations.
3. Normality of the key dependent variables was tested using the Shapiro-Wilk test, confirming that all variables satisfied the assumption of normal distribution ($p > .05$).
4. Paired t-tests were conducted to examine differences in clinical performance ability and clinical judgment before and after the hypovolemic shock simulation education.
5. The reliability of the measurement instruments was evaluated by calculating Cronbach's α, a coefficient of internal consistency.
6. The statistical significance level (α) was set at .05 for all analyses.

II. GRAPH DATABASES

Results

1. General Characteristics of Participants

Participants were a total of 48 fourth-year nursing students, comprising 14 male students (29.2%) and 34 female students (70.8%). The mean age of participants was 23.15±1.42 years. Regarding major satisfaction, "very satisfied" was the most common response (29 students, 60.4%), followed by "satisfied" (12 students, 25.0%), "neutral" (5 students, 10.4%), and "dissatisfied" and "very dissatisfied" (1 student each, 2.1%).

In addition, satisfaction with prior simulation coursework showed "very satisfied" as the highest proportion (31 students, 64.6%), followed by "satisfied" (11 students, 22.9%), "neutral" (4 students, 8.3%), and "dissatisfied" and "very dissatisfied" (1 student each, 2.1%) <Table 2>.

(N = 48)

Characteristics	Category	n (%) or M ± SD
Gender	Male	14 (29.2)
	Female	34 (70.8)
Age (years)		23.15 ± 1.42
Major satisfaction	Very satisfied	29 (60.4)
	Satisfied	12 (25.0)
	Average	5 (10.4)
	Dissatisfied	1 (2.1)
	Very dissatisfied	1 (2.1)
Simulation class satisfaction	Very satisfied	31 (64.6)
	Satisfied	11 (22.9)
	Average	4 (8.3)
	Dissatisfied	1 (2.1)
	Very dissatisfied	1 (2.1)

Table 2. General Characteristics of the Participants

2. Hypothesis Testing

The results of hypothesis testing analyzing changes in participants' clinical performance ability and clinical judgment before and after the hypovolemic shock simulation education are as follows <Table 3>.

- **Testing of Hypothesis 1:** To verify that "nursing students who receive hypovolemic shock simulation education will show significantly higher clinical performance ability scores after the education compared to before," results showed that participants' clinical performance ability improved

significantly from 2.95±0.41 before the education to 3.84±0.43 after the education (t = 10.42, p < .001). Therefore, Hypothesis 1 was supported.

- **Testing of Hypothesis 2:** To verify that "nursing students who receive hypovolemic shock simulation education will show significantly higher clinical judgment scores after the education compared to before," results showed that the overall clinical judgment score improved significantly from 2.71±0.47 before the education to 2.94±0.53 after the education (t = 2.48, p = .017). Therefore, Hypothesis 2 was supported. Among the sub-domains, only the "Reflecting" domain showed a statistically significant increase in score (t = 2.67, p = .010), while the "Noticing," "Interpreting," and "Responding" domains showed an upward trend in scores but no statistically significant difference.

(N = 48)

Variables	**Pre-test**	**Post-test**	*t*	*p*
	M ± *SD*	*M* ± *SD*		
Clinical Competence	2.95 ± 0.41	3.84 ± 0.43	10.42	<.001
Clinical Judgment	2.71 ± 0.47	2.94 ± 0.53	2.48	.017
Noticing	2.68 ± 0.52	2.79 ± 0.55	1.15	.256
Interpreting	2.65 ± 0.49	2.76 ± 0.51	1.28	.207
Responding	2.74 ± 0.50	2.85 ± 0.52	1.21	.232
Reflecting	2.77 ± 0.48	3.36 ± 0.54	2.67	.010

Table 3. Comparison of Clinical Competence and Clinical Judgment between Pre- and Post-test

III. RESULT VIEW

This study attempted to develop a hypovolemic shock patient care simulation program that reflects the domestic clinical practice environment, apply it to nursing students, and examine its educational effects on clinical performance ability and clinical judgment in emergency nursing situations.

The significant improvement in participants' clinical performance ability following the hypovolemic shock simulation education is consistent with prior studies reporting that simulation-based education helps learners integrate and demonstrate nursing knowledge, skills, and attitudes in high-risk, clinically realistic situations [25, 27]. Hypovolemic shock, in particular, is an area requiring the simultaneous execution of complex interventions—securing large-bore IV access, emergency transfusion, intravenous fluid administration, and real-time vital sign assessment. It is interpreted that the experience of directly performing these high-acuity emergency interventions—difficult to practice hands-on during clinical practicum for patient safety reasons—within a safe environment substantially drove students' improvement in practical performance competency. Prior studies have similarly reported that repeated intervention practice using simulation significantly enhances nursing students' clinical performance ability and practice confidence [28], and it is considered that the realism and clinical tension provided by this study's scenario immersed students in their respective roles (charge nurse, assessment nurse, medication nurse), leading to integrated, team-based nursing performance.

In this study, participants' overall clinical judgment score improved significantly after the education, which aligns with prior research indicating that simulation education helps learners make sound decisions within complex clinical contexts, beyond mere fragmentary skill acquisition [29]. In the sub-domain analysis, a statistically significant improvement was observed only in the "Reflecting" domain, while the "Noticing," "Interpreting," and "Responding" domains showed an upward trend in scores but did not reach statistical significance. This is consistent with research findings that debriefing—a core stage of simulation education—selectively facilitates learners' reflective thinking [30]. In Lasater's [22] Clinical Judgment Rubric, reflecting is a higher-order cognitive stage in which learners critically re-evaluate their own judgment and intervention process after performing nursing care and explore alternatives. It is judged that the structured debriefing based on the GAS (Gather-Analyze-Summarize) model and the self-reflection journal applied in this study enabled students

to objectively look back on their judgment errors and strengths, thereby driving marked growth in "reflecting" competency.

On the other hand, the lack of significant differences in the "Noticing" and "Interpreting" domains suggests a structural limitation of a single-session simulation education. The ability to intuitively capture clinical cues (noticing) and rapidly link them to disease pathophysiology (interpreting) is difficult to form through a single, short-term simulation experience alone, and requires repeated exposure to diverse clinical cases along with accumulated experiential knowledge. This suggests that, in order to solidify students' noticing and interpreting competencies, repeated provision of simulation modules with progressively advancing levels of difficulty is needed, beyond a single educational session.

The methodological limitations and significance of this study are as follows. First, due to ethical considerations regarding equitable access to educational opportunities and practical sampling constraints, this study applied a one-group pretest-posttest design without a control group. Therefore, the possibility that testing effects or historical factors partially contributed to the observed educational effects cannot be ruled out. Second, although this study conducted the posttest one week after the completion of education—thereby partially excluding immediate post-education transient effects—it did not track the long-term retention level of the educational effects. Third, because convenience sampling was used with nursing students from a single university, caution is needed in generalizing the findings to nursing students as a whole.

Nonetheless, this study holds significant value for nursing education in that it developed a hypovolemic shock scenario faithfully reflecting the domestic clinical practice context based on Jeffries' [17] theoretical framework, and—through rigorous expert content validation linked with standardized GAS debriefing—empirically demonstrated improvement in fourth-year nursing students' clinical performance ability and clinical judgment (reflecting domain).

IV. CONCLUSION

This study is a one-group pretest-posttest quasi-experimental study conducted to systematically develop a hypovolemic shock patient care simulation program to strengthen nursing students' emergency nursing practice competencies and to examine its effects.

The findings confirmed that hypovolemic shock simulation education is an effective educational intervention that significantly improves nursing students' clinical performance ability and clinical judgment (particularly the reflecting domain). In particular, the realistic emergency intervention experience using a high-fidelity simulator and the in-depth debriefing based on the GAS model made decisive contributions to enabling students to acquire clinical skills within a safe environment and to reflectively restructure their own decision-making process.

Based on these findings, the following recommendations are proposed:

1. **Expansion of research design:** As this study employed a single-group design, future research should apply a randomized controlled trial (RCT) or nonequivalent control group design to more rigorously verify the internal validity of the intervention's effects.
2. **Repeated education and longitudinal evaluation:** To cultivate intuitive noticing and interpreting competencies and to assess the temporal retention of educational effects, longitudinal research is recommended that combines staged, multi-session simulation modules with follow-up assessments at set intervals (e.g., 1, 3, and 6 months).
3. **Diversification of the target population:** It is recommended that the hypovolemic shock simulation program developed in this study be expanded beyond soon-to-graduate nursing students to clinical transition education programs for newly graduated nurses and practicing nurses in emergency departments and intensive care units.

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