

Development of Teaching Methods in Basic Nursing Education Using Process Flow Diagram - Effective Pre / Post Exercises for Integrated Practices -

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Abstract

New nurses must be able to take on multiple patients at the same time once employed, observe patient conditions and respond to patient complaints while determining priorities and resolving multiple issues as the same as experienced nurses. In the Japanese basic nursing education, however, the only practical training in which multiple patients are assigned is the integration practice in the highest grade. In many cases, the pre-training exercises (pre-supervision) and post-training review (post-supervision) for effective integrated practice are left to the discretion of each educational institution and each nursing faculty member in charge. To solve this problem, we developed, implemented, and evaluated a simulation method for pre- and post-instruction using the Process Flow Diagram. This paper presents the specifics of these activities and explain how Process Flow Diagram was useful in this case study.

Keywords : Basic Nursing Education, Integrated Practice, Multiple Tasks, New Nurses, Pre-post Instruction, Priorities, Simulation, Process Flow Diagram

1 Introduction

In 2011, to bridge the gap between basic nursing education and the practical demands of clinical settings, the Ministry of Health, Labour and Welfare expressed the need both to enhance basic nursing education and to devise specific strategies for training new nurses to increase their practical clinical skills. Following extensive discussions, the "Training Guidelines for New Nursing Staff" were developed. Furthermore, upon taking into account various factors such as the changing dynamics of medical environments, the revisions made to basic nursing education, and the results of the training, the "Revised Training Guidelines for New Nursing Staff" were introduced in 2014[1]. The 2022 Hospital Nursing Survey revealed a 10.3% increase in the turnover rate of newly graduated nursing staff, the highest rate since 2005[2][3].

In terms of clinical settings, it has been recognized that a significant factor contributing to the maladjustment and early resignation of new nurses is the discrepancy between the competencies acquired during basic nursing education and those required in the field[4].

From the outset, new nurses are expected to handle multiple responsibilities, including prioritizing and managing care for several patients as the same as experienced nurses. The

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"Integrated Practical Training" component of basic nursing education, positioned as a unifying field, is designed to address these scenarios. In its 2019 "Basic Nursing Education Review Committee Report", the Ministry of Health, Labour and Welfare emphasized the necessity of bolstering clinical judgment skills to make science-based nursing decisions in light of increasing diversity and complexity among care recipients. The report recommended enhancing lectures and practical exercises to build these foundational skills[5]. However, detailed guidelines on the lectures and practical exercises for addressing the issues of multitasking and caring for multiple patients in integrated practical training were not specified, leaving it to individual nursing colleges to determine their approach. Furthermore, hospital internships typically involve students being assigned to a single patient to hone the requisite nursing skills. For this reason, education with regard to multiple tasks other than integrated practical training is often treated as post-graduation training. As such, as one measure to address the limited learning time and instructional support available, designing effective and efficient pre- and post-instruction in integrated practical training is essential.

2 Integrated Practical Training: Current Situation and Challenges

While nursing students typically care for a single patient during their on-site training as part of their basic nursing education, the reality is that employment settings (clinical settings) often involves managing multiple patients and tasks simultaneously. Given this issue, it is possible that integrated practical training, which involves caring for multiple patients, holds the potential to more closely mirror the realities of clinical settings, thereby smoothing the transition into the workforce. However, the specific legal framework for integrated practical training is left to the discretion of educational institutions, leading to a lack of transparency in their execution. To gain insight into practices that align with the Ministry of Health, Labour and Welfare's guidelines, we conducted an analysis of the syllabi from vocational schools (3-year programs) under the ministry's jurisdiction that clearly reflect the Ministry's policy in their curriculum [6]. These schools were identified through the Ministry's website. From the available online syllabi, those meeting the following criteria were selected for analysis:

- ① Mention of key integrated practical training concepts such as "managing multiple patients," "multitasking," and "prioritization."
- ② Detailed description of integrated practical training methods.
- ③ Inclusion of pre- and post-instruction or equivalent subjects.

Out of 429 schools nationwide, syllabi from 83 were available online. Of the 83 schools, 67 met the aforementioned criteria. These syllabi were analyzed to identify the types of practical training, the integrated practical training methods, and the approaches to pre- and post-instruction. Table 1 outlines the current status and challenges identified from the survey results related to pre- and post-instruction in integrated practical training.

3 Approaches to Enhancing Integrated Practical Training

The aim of integrated practical training is to allow nursing students to apply their skills under the supervision of practicing nurses in real medical settings (such as hospitals), thereby acquiring the necessary competencies and skills. As shown in Figure 1, integrated practical training comprises three main components: pre-instruction, on-site training, and post-instruction. The time and content of each component varies across different nursing education institutions as detailed in Chapter 2.

Table 1: Current Status and Challenges of Pre- and Post-instruction in Integrated Practical Training

No.	Current Status	Challenges
1	The definition of "multitasking" is not clearly stated, leading to varied interpretations	Clarifying the definition of "multitasking"
2	The lack of clear standards for practical nursing skills in multitasking scenarios makes it difficult to demonstrate the effect of integrated practical training on learning	Establishing clear standards for practical nursing skills in multitasking scenarios
3	The absence of detailed guidelines for lessons and exercises on multitasking leaves it to individual nursing education institutions to decide their approach	Designing lectures and exercises to develop the ability to handle multitasking
4	Teaching materials and methods for addressing multitasking are not well-established	Providing educational materials and support services for use by nursing education institutions, with a clear overview of integrated practical training



Figure 1: The Three Courses Comprising Integrated Practical Training

To improve integrated practical training, it is essential to address the challenges outlined in Table 1 while also incorporating proven concepts and methodologies from practical nursing education in the past. Sections 3.1 to 3.3 present results or methodologies for each of the four issues listed in Table 1.

3.1 Defining Multitasking

Surveys on the reality of integrated practical training in nursing education institutions have revealed that the definition of multitasking is vague and there is a lack of consistency in the nursing tasks involved in multitasking scenarios. Based on various literature and survey results, we defined multitasking as follows [7]:

Multitasking

Multitasking involves managing care for more than one patient and necessitates prioritizing nursing activities in response to dynamically occurring events for each patient.

We then established the following fundamental principles for determining priorities in multitasking scenarios:

Basic Principles for Determining Multitasking Priorities

- 1) Severity and urgency
- 2) Time management (patient schedules)
- 3) Other factors (safety management, requesting support/reporting, and consideration for other patients)

Furthermore, we defined the expertise necessary for handling multitasking as follows.

Expertise necessary for handling multitasking

The ability to predict the risk of patients suddenly deteriorating and potential future situations.

3.2 Multitasking: Standards for Practical Nursing Skills

As outlined in the previous section, the skill necessary for multitasking has been defined as the ability to predict the risk of sudden changes in patients' conditions along with potential future situations. To evaluate this skill, we adopted the Goal-Oriented Learning Method (GOLD method), a hands-on nursing training model widely recognized and utilized in the nursing field that visualizes the thought processes of competent healthcare professionals. The GOLD method visualizes the thought processes of experienced nurses and consists of six thought processes ranging from Scenario 1 to Scenario 6. Table 2 presents the hands-on nursing training model[8][9].

Table 2: Hands-on Nursing Training Model

Scenario	Hands-on Nursing Training Unit
Scenario 1	Organizing thoughts at the nurse station (Prediction and rehearsal)
Scenario 2	Approaching the patient (Quick judgment, overall observation)
Scenario 3	Interacting with the patient (Initial evaluation and identifying changes)
Scenario 4	Implementing chosen nursing interventions (Plan Red, Plan Yellow, Plan Green)
Scenario 5	Nursing documentation and reporting (SOAP [§] , I-SBAR-C ^{**})
Scenario 6	Reflection (Appreciating accomplishments, considering improvements)

3.3 Designing Lectures and Exercises

Pre- and post-instruction primarily focus on practical exercises. These exercises utilize simulation to replicate real nursing scenarios. This enables students to learn through various scenarios without the need for special computer environments or equipment. Instead, facilities within the institution are used to recreate actual nursing settings. Participants in these simulations play four roles: instructors, nurses, patients, and observers. Figure 2 illustrates the setup during a simulation exercise[10].

4 Designing Pre- and Post-instruction Methods Using Process Flow Diagrams

Chapter 3 presented approaches for improving integrated practical training, with a focus on simulations in pre- and post-instruction. Through these simulations, students are expected

[§] SOAP is a method of documenting a patient's progress in medical records, and it is characterized by the following four items: S (subjective): Subjective information, O (objective): Objective information, A (assessment): Evaluation, and P (plan): Plan (treatment).

^{**} I-SBAR-C is a communication tool for proper reporting, communication, and consultation by medical professionals. It stands for Identify (Reporter), Situation, Background, Assessment, Recommendation, and Confirm (confirm instructions).

to acquire the practical nursing skills shown in Table 2.



Figure 2: Simulation Exercise

When developing these pre- and post-instruction methods, the following considerations are essential:

- Uncertainty: Factors such as the schedule for on-site training and the conditions at these sites cannot be predetermined. There is also variability in the capabilities and experiences of both students and instructors
- Complexity: The range of potential patient symptoms and conditions is extremely complex
- Continuity: There is a need to apply what is learned in pre-instruction during on-site training and to utilize experiences from on-site training in post-instruction sessions

To maximize the value of integrated practical training, we must develop an approach that thoughtfully addresses the above aspects. Given the uncertainties and complexities involved, it is clear that a diverse range of information must be considered. Moreover, from a continuity perspective, the integration of outcomes from prior activities is crucial. This led us to the adoption of Process Flow Diagrams (PFDs) as a tool to design a logical process that links outcomes with processes.

4.1 What Are Process Flow Diagrams?

PFDs are an evolved form of Data Flow Diagrams (DFDs) that graphically represent processes and their outputs, connecting each process with its outcome through “flows.” Comprising three main elements, they are straightforward to create and have become a staple in many software development environments nowadays due to the simplicity behind their creation. By mapping out processes and their outputs, PFDs facilitate a shared understanding among stakeholders, making it easier to align on the project's direction. They also highlight any redundant processes, paving the way for more streamlined and efficient workflows. Figure 3 illustrates a PFD for the coding process in software development.

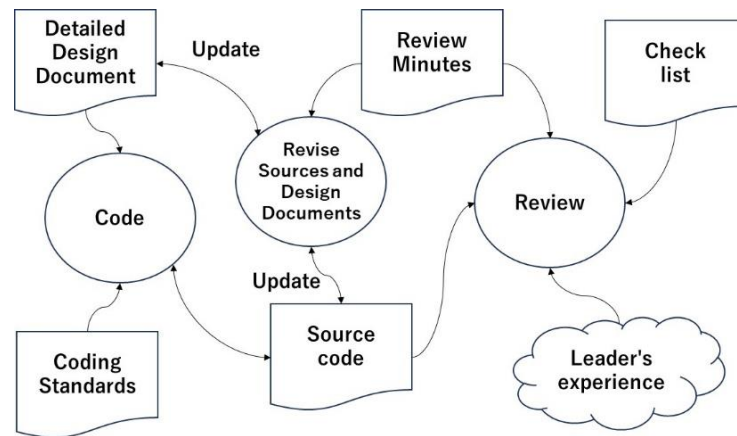






Figure 3: Coding Process in Software Development

The images shown in Figure 3 are explained in Table 3.

Table 3: PFD Symbol Names and Explanations

Symbol	Name	Explanation
	Process	<ul style="list-style-type: none"> Represents work Use a bold or double line when there are levels
	Outcome	<ul style="list-style-type: none"> Indicates outcomes entering and exiting the process Can indicate data or conditions, not just explicit outcomes
	Flow	<ul style="list-style-type: none"> Line connecting outcomes and processes Can add arrows on both sides to indicate updates, or write explanations above the line
	Intangible outcome	<ul style="list-style-type: none"> Individual experience and know-how, etc.

As demonstrated in Figure 3, the process and its outcomes are clearly linked, and the input and output for each process are explicitly defined. The features of PFDs are as follows.

- **Can foster a common understanding**
 - The simple notation is intuitive and easy to understand
 - Because PFDs can be understood even at first sight, they allow for a common understanding among a diverse array of stakeholders
- **Can identify unnecessary tasks**
 - Visualizing the current status can reveal processes where inputs and outputs match (indicating no actual value is being added)
 - When designing an ideal state, starting with the desired outcome helps ensure that only necessary tasks are included
- **Documentation of tacit knowledge**
 - Allow for the documentation of tacit knowledge by recording intangible outputs (such as insights or expertise) as inputs or outputs for processes

- Allows for identification of areas reliant on individual skills, thereby facilitating knowledge transfer and process improvement

4.2 Developed Pre- and Post-instruction Methods

The structure of the designed pre- and post-instruction methods is depicted in Figure 4. Both pre- and post-instruction consist of a blend of pre-instruction and multitasking exercises (simulations), with simulations conducted according to a uniform schedule in both phases. We designated two days as the standard duration for these simulation exercises[11].

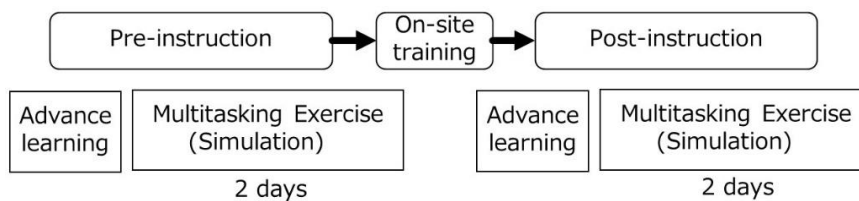


Figure 4: Structure of Pre- and Post-Instruction

Table 4 outlines the schedule for the multitasking exercises (simulations). In hands-on nursing training, a variety of scenarios are prepared and executed to mimic real-world nursing challenges, each lasting 30 minutes.

Table 4: Schedule for Multitasking Exercises (Simulations)

Time	Multitasking Exercise Day 1	Multitasking Exercise Day 2
9:00 a.m. - 9:20 a.m.	Orientation Organizing patient cases	Orientation Prepare the training environment
9:20 a.m.- 9:40 a.m.	Share case details	
9:40 a.m. - 10:00 a.m.	Prepare the training environment	Starting at 9:30 a.m. Hands-on nursing training (3)
10:00 a.m. - 12:00 p.m.	Hands-on nursing training (1)	
12:00 p.m. - 1:00 p.m.	Lunch break	Lunch break
1:00 p.m. - 3:00 p.m.	Hands-on nursing training (2)	Hands-on nursing training (4)
3:00 p.m. - 5:00 p.m.	Conference (identifying problems and considering solutions), organizing records, reflection	Conference, organizing records, reflection, overall summary

In the following sections (4.3 to 4.5), we delve into the strategies developed to tackle the uncertainties, complexities, and the need for continuity in crafting pre- and post-instruction methods.

4.3 Addressing Uncertainty

The cornerstone of integrated practical training planning begins with drafting an integrated practical training plan. This plan is informed by various inputs, such as the expected type of patient bed (which differ by nursing specialty), the environmental and scheduling of on-site training, and information on instructors and students. For example, nursing encompasses a broad spectrum of specialties - adult, geriatric, pediatric, etc. Additionally, the on-site training environment and availability of instructor resources vary with each session. Integrated

practical training therefore must provide simulations that take these fluctuating conditions into account. To achieve this, a process for customizing teaching materials for integrated practical training is necessary, based on the integrated practical training plan and standard templates for schedules, facilities, pre-instruction materials, scenarios, and forms. This tailoring process is depicted in Figure 5. The tailoring conditions are laid out in the integrated practical training plan. In addition, the tailoring method involves establishing fixed and variable elements, methods for selecting appropriate equipment for patient rooms, and the absence/presence of omissions with regard to standard templates for schedules, facilities, scenarios, and forms [12].

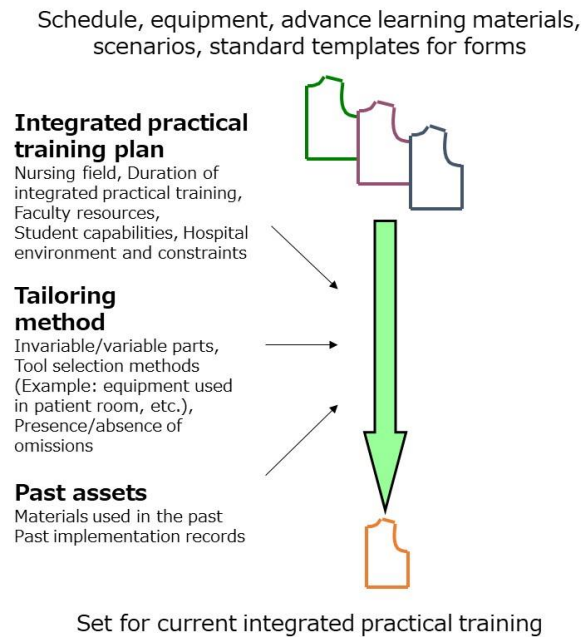


Figure 5: Tailoring Overview (Standard Template)

4.4 Addressing Complexity

To conduct simulations that take various patients into consideration, patient cases were created on the basis of information from patients that students managed in the past or during on-site training.

The patient cases utilized a patient case format that included the following details:

Recorded items: Assumed name, age group, gender, diagnosis, course of treatment, procedures/tests, medical history, ADL (Activities of Daily Living), IV status (illustrated with a diagram), personality, family, sleep status, excretion status, and food intake status

The patient information recorded by each student is explained and understood during the “Patient Information” session on the morning of the first day of the simulation.

Using this patient information, faculty members create scenarios for hands-on nursing training sessions (1) to (4) as shown in Table 4. Generally, scenarios are developed to gradually alter conditions and increase the challenge level. For example: no change in all four patients → no change in three and concerns about change in one → no change in two and concerns about change in two.

The basic pattern of the simulation is: Rehearsal (5 minutes) → Patient room visit (15 minutes) → Reporting (5 minutes) → Reflection (5 minutes), for a total of about 30 minutes per scenario. As shown in Figure 2, while preparing a practice patient room is essential, other

spaces are also needed for reporting and organizing various complex situations. Thus, we prepared a space (Nurse Station) where patient room discussions and information sharing can occur (Figure 6). This space must have a whiteboard, and there must be enough room for all participants to gather around it (for example, ①② in the figure are faculty, and ③-⑩ are students).

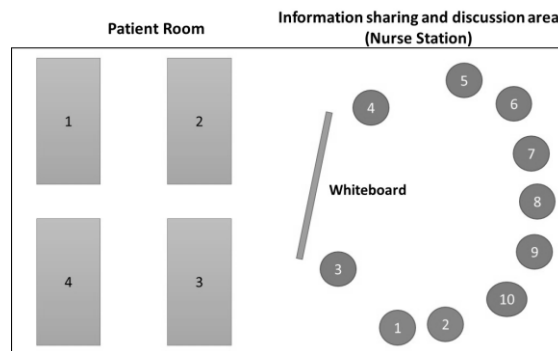


Figure 6: Area for Situation Updates and Discussion During Simulation

4.5 Addressing Continuity

During pre-instruction, the content and difficulty level of the simulation to be conducted are determined by analyzing the written responses to videos watched as part of the pre-instruction process. Post-instruction preparations are based on the content of the pre-instruction and on-site training. Moreover, after post-instruction, overall activities are reviewed on the basis of the implementation and outcomes of the integrated practical training, and proposals for improvement are prepared. In this way, we believe that optimization of the multitasking exercises (simulation) can be achieved by making sure that pre-instruction, post-instruction, and the subsequent integrated practical training session are all linked.

5 Integrated Practical Training Design

Integrated practical training is conducted in the final year of nursing training institutions and is crucial for applying what has been learned to on-site practice and channeling the experience and knowledge gained during on-site practice into one's own experiences and skills. Based on the details explained in 4.3. to 4.5., the overall design of the integrated practical training was as shown in Figure 7. Since on-site practice is dependent upon the environment and situation at the training site, it can be challenging for instructors to provide active guidance. As such, it is important that the content learned and the environment provided by the pre- and post-instruction sessions are more realistic. To achieve this, we decided to incorporate nursing site simulations[13].

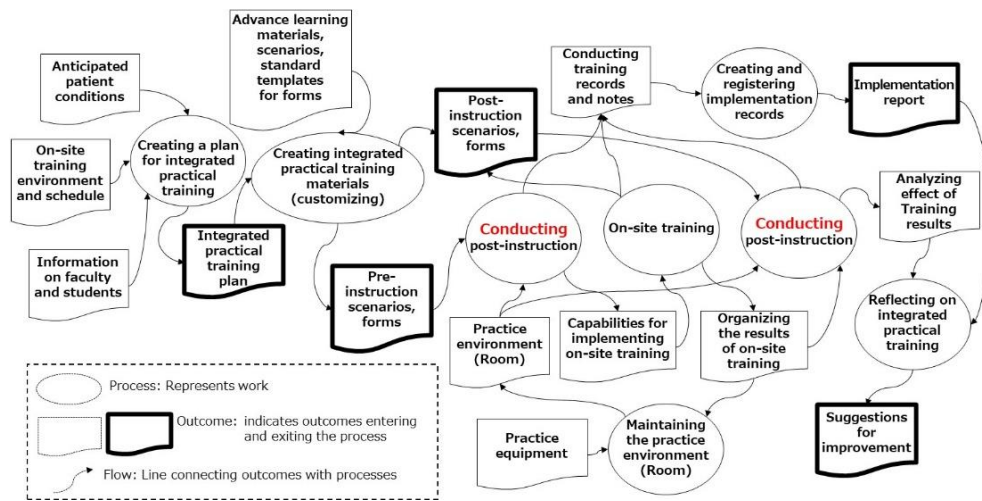


Figure 7 : Overall Design of Integrated Practical Training

Defining the process (formulating an integrated practical training plan, developing educational materials for integrated practical training, creating and registering implementation records, and reflecting on the integrated practical training) to produce the outcomes indicated in the bold frame in the figure is crucial for providing educational materials and support services that can be utilized by nursing training institutions.

By utilizing the PFD, the following five deliverables were defined as the main deliverables as mentioned above.

- Integrated practical training plan
- Pre-instruction scenarios, form
- Post-instruction scenarios, form
- Implementation report
- Suggestions for improvement

As a result, the PFD enabled us to design an integrated practical training plan with these deliverables at its core.

6 Evaluation of Pre- and Post-Instruction Developed

We developed methods for pre- and post-instruction and summarized the results based on their actual use with nursing students.

In the advance learning included in the pre-instruction (exercise) before the integrated practical training, students were asked to record the six thought processes from Scenario 1 to Scenario 6 of the hands-on nursing training model while watching videos of patient cases and to master the thought process of the hands-on nursing training model. While the nursing interventions in Scenario 4 were not actually performed, they recorded what nursing they would provide. Table 5 shows the goals of the multitasking exercises and the details to be recorded in the record sheet.

Table 5: Goals and Details for Record Sheet

Scenario	Goals of Multitasking Exercises	Details to be Recorded on Record Sheet
Scenario 1	<input type="checkbox"/> Can propose the necessary nursing interventions in order of priority for Plan B, including purposeful observation <input type="checkbox"/> Can anticipate the first change likely to occur in the patient	Review patient information from the electronic medical records and simulate nursing care based on the anticipated condition of the patient before engaging with them. Predict the initial changes in the patient that could lead to rapid deterioration.
Scenario 2	<input type="checkbox"/> Can prioritize in accordance with changes <input type="checkbox"/> Can perform purposeful observations and nursing interventions	Quickly assess whether the patient is conscious at first glance. Conduct an overall observation of the patient while approaching.
Scenario 3		Evaluate the patient's condition through palpation. Assess the changes noted during the overall observation with initial evaluations and vital signs.
Scenario 4		Select and implement the necessary nursing interventions for the patient.
Scenario 5	<input type="checkbox"/> Can report using the I-SBAR-C framework	Document (SOAP) and report (I-SBAR-C) the nursing interventions carried out.
Scenario 6	<input type="checkbox"/> Can articulate what was accomplished <input type="checkbox"/> Can suggest improvements for future actions	Reflect on what you were able to do and consider the next steps for nursing interventions.

This advance learning module was conducted as an online self-study activity. Initially, students watched a video of the case for Patient A, reviewed the nursing practices documented for that video, and then proceeded to watch a video of the case for Patient B and filled in the record sheet. In terms of how many students managed to fill out the record sheets in accordance with the hands-on nursing training model after viewing the videos, the rates for the six processes were: Scenario 1 (Prediction): 75%, Scenario 2 (Observation): 76%, Scenario 3 (Observation): 76%, Scenario 5 (Reporting): 97%, and Scenario 6 (Reflection): 83%. Over 90% of students managed to complete Scenario 5 (Reporting). This advance learning module served as a practical exercise in mastering the thought processes for nurses before practical training.

After post-instruction, a survey using questions ① to ⑥ listed in Table 6 was conducted on a five-point scale. Over 70% of students managed to suggest priorities for multitasking and make purposeful observations and decisions. Additionally, the majority of students felt confident that they were able to report using the I-SBAR-C model, which gave them confidence that they would be able to apply it in the future. Furthermore, positive feedback related to the goals listed in Table 5, such as "I learned to anticipate patient changes and worst-case scenarios (risks)" and "I learned to prioritize," was received from all students based on statements extracted from a free entry-style survey conducted after the integrated practical training. These outcomes suggest that the pre- and post-instruction methods developed here effectively meet the objectives set out in Table 5.

Table 6: Post-Instruction Survey Results

Question	Five-Point Scale	Agree	Some-what agree	Neutral	Some-what disagree	Disagree
①	Felt confident about reporting before the practice	13%	25%	25%	25%	13%
②	Was able to suggest the necessary nursing interventions in order of priority for Plan B, including purposeful observations	<u>50%</u>	<u>50%</u>	0%	0%	0%
③	Was able to prioritize in accordance with changes and conduct purposeful observations	<u>25%</u>	<u>50%</u>	25%	0%	0%
④	Was able to report purposefully using I-SBAR-C	<u>63%</u>	<u>25%</u>	13%	0%	0%
⑤	Feel capable of using I-SBAR-C for reporting in future scenarios	<u>88%</u>	<u>13%</u>	0%	0%	0%
⑥	Could articulate achievements and suggest improvements during debriefing	<u>63%</u>	<u>38%</u>	0%	0%	0%

7 Future Challenges and Expansion Methods

While we developed a comprehensive set of pre- and post-instruction methods, this is intended as a standard model. Since it was only applied within a single nursing field and university setting, future work is needed to evaluate its adaptability to different contexts in order to extend these pre- and post-instruction methods to various educational institutions.

Our study's focus on teaching methods and implementation processes in pre- and post-instruction aimed at addressing multitasking sets it apart from previous studies in nursing education that dealt with multitasking. Demonstrating that pre- and post-instruction can enhance students' critical thinking and practical nursing skills would not only make the learning content more transparent for both students and instructors, but could also address human- and time-related challenges. Moreover, it could serve as a model applicable to education at other universities and for training novice nurses.

Acknowledgement

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