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Enhancing Clinical Nursing Skills of Undergraduate Nursing Students Through the Integration of the SimCapture Cloud-Based Management System: An Action Research Study

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Principal Investigator:
Kwo Chen Lee, professor]

1.Research Motivation

Nursing skills form the cornerstone of developing core competencies in nursing education and serve as a crucial medium for nurse–patient interactions, playing an essential role in the delivery of professional nursing care. To ensure quality and safety, nurses must perform clinical skills in accordance with nursing care principles, with confidence and competence (6). Although substantial time and resources have been devoted to teaching nursing techniques, both students and newly graduated nurses often lack confidence in performing basic clinical skills (7).

Traditionally, nursing skills education has relied on a teacher-centered approach in which the instructor explains the theoretical principles, demonstrates the procedures on a simulated patient, and subsequently allows students to practice. Learning outcomes are typically assessed through skills examinations or Objective Structured Clinical Examinations (OSCEs). However, with generational changes in learners and advancements in educational technology, such traditional methods no longer meet the demands of modern nursing education or clinical practice (8). In recent years, blended learning (9), immersive virtual reality (VR) instruction (10), and simulation-based teaching (8) have increasingly replaced traditional approaches, better preparing students for real-world clinical environments.

Over the past several years, our clinical skills teaching team has adopted blended learning and simulation-based methods to support students' skill acquisition. While these methods initially improved students' technical performance, performance scores have declined over the past three years as learning styles have shifted. Analysis of course data shows a downward trend in OSCE scores for second-year nursing students in the Clinical Nursing Skills I course between the 2019 and 2021 academic years (Table 1). This highlights an urgent need to develop innovative strategies for nursing skills instruction.

To explore possible causes, the principal investigator conducted end-of-semester interviews with students in the 2021 academic year. Among students in the bottom 15% of OSCE scores, the most frequently cited reasons for poor performance were nervousness, mental blanks, insufficient practice, and forgetting procedural steps. In contrast, students in the top 15% attributed their success to diligent practice, peer collaboration, error correction, and exchanging feedback (Table 2). Overall, poor performance appeared to be linked not only to insufficient practice but also to difficulties in memorizing detailed procedural steps, low learning motivation, lack of peer feedback, and low self-confidence.

Table 1. OSCE Performance in Clinical Nursing Skills I, 2019–2021 Academic Years

Academic Year	Midterm Score	Final Score	Overall Average
2019	70.4	52.6	61.5
2020	70.0	51.2	60.6
2021	68.2	52.3	60.25

Table 2. Experiences and Perceptions of Students in the Top and Bottom 15% of OSCE Scores

Performance Group	OSCE Perceptions	Learning Experiences
Top 15%	Nervousness, high pressure, focus on execution, avoiding distraction by teacher	Frequent practice, peer collaboration, error-sharing, attentive listening, targeted improvement on mistakes
Bottom 15%	Nervousness, mental blanks, inability to recall steps, lack of confidence	Minimal practice, unclear causes of errors, low interest, low self-confidence

Nursing skills are frequently acquired through **observational learning**, also known as modeling, whereby individuals acquire new behavioral patterns by observing and imitating the actions, attitudes, or emotional responses of others (11). This process combines generalized imitation, conditional reinforcement, and rule-governed behavior to enhance learners' self-efficacy and achieve learning goals (12). Prior studies have shown that observational learning is particularly effective in disciplines that require demonstration of procedural skills (13).

In the 21st century, shaped by rapid developments in information and communication technology (ICT), Industry 4.0, and 5G networks, students tend to process visual content more effectively than text and prefer interactive, student-centered learning environments (14, 15). Modern learning spaces should therefore employ multimodal, flexible, and ICT-based teaching strategies tailored to students' styles, interests, and needs.

SimCapture, developed by the Norwegian medical education company Laerdal (well known for the "Resusci Anne" manikin and emergency simulation scenarios), is an advanced medical education management platform that integrates audio, video, annotations, patient monitor data, and simulator outputs into a unified web interface.

As a mobile learning technology, SimCapture enables students to record their practice sessions, upload the videos to a cloud platform, and receive targeted instructor feedback alongside peer performance reviews (15, 16). By facilitating visual and interactive learning, SimCapture aligns closely with the principles of observational learning, enabling students to model correct procedures, self-reflect, and progressively improve their clinical skills and confidence.

2.Research Theme and Objectives

The purpose of this study is to design a SimCapture-based instructional approach grounded in the theory of observational learning, in order to enhance nursing students' performance in clinical technical courses. The specific objectives of the intervention are as follows:

- To improve students' OSCE scores in clinical technical skills.
- To increase students' learning motivation.
- To enhance students' self-efficacy.

3.Literature Review

(1). Observational Learning

Observational learning, sometimes referred to as modeling or social learning, is a process by which individuals acquire knowledge and skills through observing and imitating the behaviors of others. During this process, reinforcement, punishment, or conditional control can lead to behavioral changes, whether the observation occurs intentionally or incidentally. Within observational learning, coding and rehearsal are essential concepts. Coding involves transforming observed behaviors into internal representations that can be stored and later reproduced, while rehearsal refers to the practice of these internalized behaviors. Particularly, symbolic coding—in which observed behaviors are encoded using numbers or letters and immediately rehearsed—has been shown to yield the most effective results. Coding without symbolic rehearsal, or symbolic rehearsal without coding, is insufficient to achieve optimal learning outcomes.

The process of observational learning consists of four key stages: attention, retention, reproduction, and motivation (Figure 1). Coding and rehearsal are therefore critical mechanisms that enable individuals to convert observed behaviors into internal codes that can be memorized and imitated, forming the foundation for learning and behavioral modeling.

Empirical studies support the effectiveness of observational learning in procedural skill acquisition. For instance, Huun (2023) demonstrated that medical students who viewed instructional videos on high-risk patient assessment showed improved accuracy, higher satisfaction, and greater confidence. Another study involving nursing students learning intramuscular injection techniques compared three groups: one observed instructor demonstrations only; one observed and conducted self-evaluation followed by instructor discussion; and one observed, self-evaluated, engaged in instructor discussion, and participated in peer group evaluations. The third group, which combined observation, self-assessment, and peer feedback, performed significantly better than the other two groups.

(2). Theory of Learning Motivation

Motivation is defined as the process that initiates, directs, and sustains goal-oriented behaviors, guiding individuals to act in order to achieve objectives or satisfy needs. Learning motivation, in particular, provides learners with the drive to persevere in their studies despite difficulty and challenge. It serves as a powerful force that directs learners toward their academic goals. Students' level of motivation is reflected in their degree of engagement: highly motivated students participate actively without requiring external rewards, whereas students with lower motivation often require extrinsic incentives to participate. Factors that support motivation include challenge, curiosity, control, imagination, competition, collaboration, and recognition.

According to Ryan and Deci's (2000) self-determination theory, motivation can be categorized into intrinsic and extrinsic forms. Intrinsic motivation drives individuals to engage in academic activities for enjoyment, challenge, or uniqueness, without external rewards or pressures. Such motivation is highly self-sustaining and long-lasting. Extrinsic motivation, in contrast, is driven by external influences such as rewards, obligations, or punishments. Although extrinsic motivation may foster short-term persistence and effort, it does not provide the same durability as intrinsic motivation. Importantly, both intrinsic and extrinsic motivation play roles in learning: extrinsic factors may initiate motivation in the early stages of learning, but should ideally transition into intrinsic motivation as the learning process deepens.

In summary, motivation represents a cornerstone of the learning process. Students must cultivate strong intrinsic and extrinsic motivation to face challenges, comprehend processes, and apply knowledge effectively in practical contexts.

(3). Theory of Self-Efficacy

In addition to acquiring effective learning skills, students must also develop the confidence to perform these skills. Self-efficacy is defined as an individual's belief in their capability to organize and execute the actions required to achieve specific goals. For nursing students, this refers to their perceived ability and confidence to perform technical tasks and achieve competence. Self-efficacy can be enhanced through four pathways: successful mastery experiences, vicarious experiences (observing others' successes), verbal persuasion, and maintaining willpower and persistence. Previous studies have identified self-efficacy as a mediating factor between learning strategies and academic achievement. For example, a longitudinal study of 87 Italian university students found that self-efficacy mediated the relationship between learning strategies and academic performance. Similarly, Chen et al. (2018), analyzing the Taiwan Education Panel Survey, reported that students' self-efficacy was significantly associated with learning achievement, and that higher self-efficacy at the beginning of a course positively influenced both the rate and level of learning achievement.

Bandura's (1980) self-efficacy theory emphasizes that self-efficacy is not merely the possession of skills but the confidence in applying them across diverse contexts. It can be differentiated along three dimensions:

- Level: the perceived ability to perform tasks of varying difficulty. For instance, students may select tasks appropriate to their capability, with efficacy expectations differing according to task difficulty.
- Generality: the transferability of self-efficacy beliefs from one learning context to other similar or distinct contexts. Some experiences yield limited success, while others generalize across multiple situations.
- Strength: the resilience of efficacy beliefs when faced with obstacles. Stronger efficacy beliefs increase persistence and the likelihood of task completion, whereas weaker beliefs are easily undermined by failure.

4. Instructional Objectives and Methods

This study will be implemented in the mandatory courses Clinical Nursing Skills I and Clinical Nursing Skills II (2 credits each, 4 hours per week) for second- and third-year undergraduate nursing students. Each course covers 16 essential nursing techniques. The instructional objectives are as follows:

- To perform nursing procedures accurately.
- To demonstrate humanistic care, empathy, and communication skills when performing nursing procedures.
- To apply critical thinking to problem-solving in clinical practice.

- To exhibit professionalism and responsibility in the execution of nursing tasks.

4.1. Course Design and Planning

The curriculum is aligned with the Fundamentals of Nursing course, which is structured according to Gordon's 11 Functional Health Patterns. Each week, the clinical skills course corresponds to the same week's theoretical content. The remaining five weeks cover techniques that are not directly linked to weekly theoretical content, such as vital sign measurement, medication administration, and injection techniques. Two additional weeks are allocated for skills examinations.The course content integrates theoretical and technical components. The theoretical component includes anatomy, physiology, pathology, pharmacology, health assessment, and ethical considerations related to each nursing skill, incorporating the concept of evidence-based practice. The technical component relies on instructional videos produced by faculty members, covering equipment preparation, procedural steps, and key considerations. The main reference text is the OSCE skills manual co-authored by the clinical faculty.

Teaching activities include both online and in-person sessions. Online learning allows students to independently review theoretical content and instructional videos outside of class. In-person sessions (4 hours per week) are held in the skills demonstration laboratories, where nine faculty members provide demonstrations and guided practice in small groups. Faculty members evaluate each student's performance using structured checklists, providing individualized feedback on strengths and areas for improvement.

During practice, instructors emphasize patient perspectives, encouraging students to demonstrate empathy, compassion, and communication skills. As observational learning accumulates from peer performances, later-performing students often demonstrate improved techniques. At this stage, instructors introduce potential procedural challenges, guiding students to apply critical thinking and develop problem-solving abilities. Following each class, students are provided with two hours of independent practice time in the laboratory (without instructor supervision or course credit), and they are encouraged to post questions and engage in online discussions when encountering difficulties.

4.2. Student Assessment and Evaluation Tools

Student performance will be assessed using the following tools:

Skills Examinations: Practical OSCEs evaluating core clinical skills.
Written Examinations: Theoretical assessments through multiple-choice and short-answer questions.
Quizzes: Short tests to reinforce knowledge and monitor progress.
Independent Practice Participation: Records of students' engagement in self-directed practice sessions.

5. Research Participants and Setting

This study will be conducted in the Clinical Nursing Skills courses for second- and third-year undergraduate nursing students in the 2024–2025 academic year. The study population will include approximately 170 students (about 85 students per year, with possible attrition due to withdrawal or leave of absence).

Before class, students will engage in pre-class learning through the Moodle system, which includes theoretical principles of nursing skills and instructor-produced instructional videos, supplemented by a technical procedures manual. In the practical sessions, the SimCapture simulation-based training platform will be introduced to support course integration, management, and evaluation in a cloud-based format, thereby facilitating effective post-class learning.

All participants must complete a video-recording consent form prior to participation. Students who decline recording will be excluded from the study and will not be provided with an account or password. Video recordings will capture only hand movements to minimize facial identification. Each student will receive a unique account and password, and students will only have access to their own group's videos.

6. Research Methods and Instruments

This study will adopt an Action Research approach. Action research is a methodology designed to improve practice and address real-world problems, commonly applied in fields such as education, social sciences, and healthcare. It involves iterative cycles of problem identification and planning, action implementation, observation and reflection, and revision and re-planning. A defining feature of action research is its emphasis on practical change, participatory collaboration, and reflective practice.The implementation steps of this study are as follows:

(1) Planning the Intervention

The research theme is defined as "designing nursing procedural instruction based on observational learning theory." The intervention plan will be grounded in relevant literature on symbolically coded procedural steps, enhancement of learning motivation, and reinforcement of self-efficacy.

(2) Executing the Intervention

The SimCapture teaching management platform will serve as the central tool for course delivery. This cloud-based system captures audio, video, annotations, and various types of data to facilitate effective training management, documentation, and evaluation. In this study, SimCapture will be applied in the following ways:
Each faculty member and student will be provided with a personal account, and the platform will group participants accordingly.

Faculty will develop digital assessment and evaluation tools for each nursing skill. During in-class rehearsal, instructors will annotate student performance using tablets on the cloud system, while students will record their own procedures on mobile devices and upload them to the cloud platform. Students will be able to view their group members' videos, along with instructor feedback, to learn from peers' strengths and correct errors, thereby improving learning outcomes. The platform will be accessible both in the simulation laboratory and remotely, enabling students to review, practice, and participate in asynchronous discussions without time or location restrictions. Students can document their learning progress, which enhances motivation, self-efficacy, and confidence in skill mastery. Faculty will be able to monitor student learning, respond to questions, and review learning histories to design individualized or remedial instructional plans.

(3) Monitoring the Intervention (Data Collection and Feedback)

Throughout the intervention, feedback data will be continuously collected (Table 3), including:

- Student learning portfolios
- SimCapture backend learning records
- Self-efficacy questionnaires
- Learning motivation questionnaires

These data will serve as the basis for reflection and revision of the action plan. Additionally, trained teaching assistants (TAs) and part-time assistants will serve as observers to support the teaching process and document observations.

(4) Data Analysis, Reflection, and Adjustment of the Action Plan

The feedback data collected will be preliminarily organized and analyzed to continuously identify areas where the technical learning process can be strengthened and to explore difficulties encountered by students. Based on these findings, the action plan will be critically reviewed, reflected upon, and adjusted accordingly.

(5) Research Report Writing

The results and research findings observed during the process of strengthening collaborative learning will be documented and compiled into a comprehensive research report.

7. Research Instruments

The primary aim of action research is to collect data in order to better understand the characteristics of the teaching context (Johnson, 2004, 2006). Accordingly, this study will employ multiple research instruments, including a self-efficacy scale, a learning motivation scale, OSCE scores, and qualitative learning portfolios. A brief description of the instruments is provided below:

(1). Self-Efficacy Questionnaire

Based on Bandura's (1986) theory of self-efficacy, which encompasses the three dimensions of level, generality, and strength, this study will develop a self-designed self-efficacy scale tailored to the nursing technical skills course. To minimize the burden on students of responding to multiple items, the scale will consist of three items. The questionnaire will undergo expert review for content validity and subsequent revisions.

(2). Learning Motivation Questionnaire

This study will adopt the Learning Motivation Scale (LMS) developed by Liu Cheng-Hung (2010) in Taiwan. The LMS was adapted from the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich, Smith, Garcia, and McKeachie (1991), with modifications to reflect the Taiwanese cultural context. The scale consists of 14 items and is widely recognized as one of the most commonly used instruments for evaluating learning motivation.

(3). OSCE Scores

Students' technical performance will be assessed using OSCEs, administered twice per semester (midterm and final). Each OSCE will cover nursing skills taught during the course. The OSCE blueprint includes examinee guidelines, standardized patient instructions, examiner guidelines, scoring criteria, evaluation forms, equipment lists, and a demonstration video. The scoring rubric evaluates preparation, procedural performance, communication and caring expressions, health education content, and overall logical flow of operations. Exam content will be determined by the Clinical Nursing Skills teaching committee and validated by five clinical nursing experts and faculty members prior to implementation.

8. Data Analysis

(1) Quantitative Data

Questionnaire data will first be organized in Excel, and the accuracy of data entry will be verified. Preliminary descriptive statistics will be conducted using SPSS, followed by appropriate statistical analyses according to the nature of each research question. A significance level of $p < 0.05$ will be adopted to determine statistical significance. The corresponding research questions and statistical methods are summarized in Table 6.

Correspondence Between Research Questions and Statistical Methods

Research Question	Statistical Method
What are the differences in self-efficacy, learning motivation, and OSCE performance between the two groups at the first measurement?	Independent samples *t*-test
What are the trends in changes in self-efficacy between the two groups?	Generalized Estimating Equations (GEE)
What are the pre- and post-test changes in learning motivation and OSCE scores within each group?	Paired samples *t*-test
What are the post-test differences in learning motivation and OSCE scores between the two groups?	Independent samples *t*-test

(2) Qualitative Data

Qualitative data will be analyzed using content analysis. Learning portfolio records will be systematically coded and categorized, with each entry labeled by collection date and source (e.g., file, questionnaire, observation, or reflection). Students will be assigned identification codes in the format *S-n-*****.

The principal investigator will first classify and organize the collected data, then repeatedly review and integrate the categorized materials. Data will be refined and regrouped into appropriate categories, with iterative reading and reclassification until the categories adequately represent distinct characteristics. This cyclical process ensures analytic rigor and reliability.

To protect participants' rights, identifiable student learning records will not be directly presented, and particular care will be taken to avoid any breach of confidentiality or learning equity.

8. Ethical Considerations

Prior to study implementation, the research protocol will be submitted to and approved by the Institutional Review Board (IRB) of the study site. All data will be de-identified before analysis. Before participation, students will be fully informed of the purpose of the study and the evaluation procedures. They will be explicitly advised that participation is entirely voluntary, that they retain the absolute right to refuse to answer any question, and that they may withdraw from the study at any time without providing a reason. Students who withdraw will still complete written examinations, OSCEs, coursework, and self-directed learning sign-in records and will remain eligible to receive course credits. Students who agree to participate will be asked to provide written informed consent. All questionnaires will be collected

anonymously. Interview data will be kept strictly confidential, and all collected data will be coded to ensure participants' names are not disclosed. Hard-copy data will be stored in locked cabinets, while electronic data will be password-protected to prevent unauthorized access.

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