

Development of Curriculum and Scenarios Using Constructive Alignment Theory for Simulation-based Education for Nursing Students to Enhance Clinical Skills and Nursing Knowledge

Hyun-Young Kim¹⁺ and Yul Ha Min²

¹ College of Nursing, Eulji University, Daejeon, Korea

² College of Nursing, Seoul National University, Seoul, Korea

Abstract. This study was conducted to identify the most important skills in fundamental nursing and adult nursing and to combine these skills to develop a curriculum for simulation-based education using a high-fidelity simulator. The goal of the simulation-based education is to progressively enhance the psychomotor and cognitive skills of nursing students. The constructive alignment theory was applied to develop the curriculum including intended learning outcomes and scenarios. Ten educators from different universities and hospitals participated in identifying these learning outcomes. In addition, five nurses and five nursing students participated in developing two scenarios corresponding with the learning outcomes. The curriculum consisted of five subject areas: oxygenation, medication administration, safety, wound healing, and nutrition and elimination. These subject areas were established according to the nursing students' year in the program and had intended learning outcomes. Two scenarios were developed to facilitate integrating psychomotor and cognitive skills for preoperative nursing care for the second year nursing students and shock management nursing care for the third year nursing students. We will apply the simulation-based curriculum and these scenarios to the coursework in the appropriate years in the program and analyze how to enhance the students' problem solving skills, clinical skills, and nursing knowledge.

Keywords: Simulation, Constructive Alignment, Psychomotor Skill, Cognitive Skill.

1. Introduction

Clinical education for nursing students has changed in South Korea. Since many nursing colleges have been established recently, the opportunity for clinical practice for each student has steadily decreased because the number of hospitals offering clinical education has remained the same. In addition, patient safety and best practices have become the most important values in hospitals; patients are reluctant to undergo nursing care by nursing students who are underqualified. On the other hand, hospitals desire to hire new nurses who have good clinical skills and nursing knowledge. Therefore, simulation-based education that mimics real clinical situations is becoming more important in nursing education.

Simulation-based education is an active learning strategy; educators should act as learning facilitators of learning centred around the learners themselves [1]. This education serves to compel nursing students to be self-motivated to learn clinical skills and nursing knowledge and to improve their problem solving and critical thinking skills. A multitude of factors are involved in the creation of successful simulation-based education [2, 3]. A well-designed curriculum and scenarios based on clinical situations in Korean hospitals are essential in order to replace clinical practice in real settings with simulation-based education.

The purpose of this study is to develop a well designed simulation-based education curriculum combining both fundamental nursing to help nursing students acquire psychomotor skills and adult nursing to help nursing students to obtain nursing knowledge. This curriculum is more effective than a curriculum that teaches these components separately since nursing practice in a real setting is very complex and dynamic. In order to develop the curriculum, we applied constructive alignment theory. Biggs & Tang (2011) described constructive alignment as learning outcomes, learning activities, and assessments that match each other and allow students to practice and verify what they have learned. There are two main themes in constructive alignment: One theme is that learners construct what they do to learn in a specific context; the

⁺ Corresponding author. Tel.: + 82 42 2591716; fax: +82 42 2591709.
E-mail address: flowhykim@gmail.com.

other theme is that educators align the curriculum with the planned learning activities and learning outcomes [4]. Accordingly, ten educators, five nurses, and five nursing students participated in developing the curriculum including learning outcomes and scenarios for enhancing psychomotor and cognitive skills. This curriculum will be applied to simulation-based education as a teaching and learning activity according to each year in the program and be analysed to determine how to enhance problem solving skills, clinical skills, and nursing knowledge [1, 5].

2. Methods

This study was conducted in four steps. Figure 1 shows that these four steps correspond with critical components of constructive alignment [4].

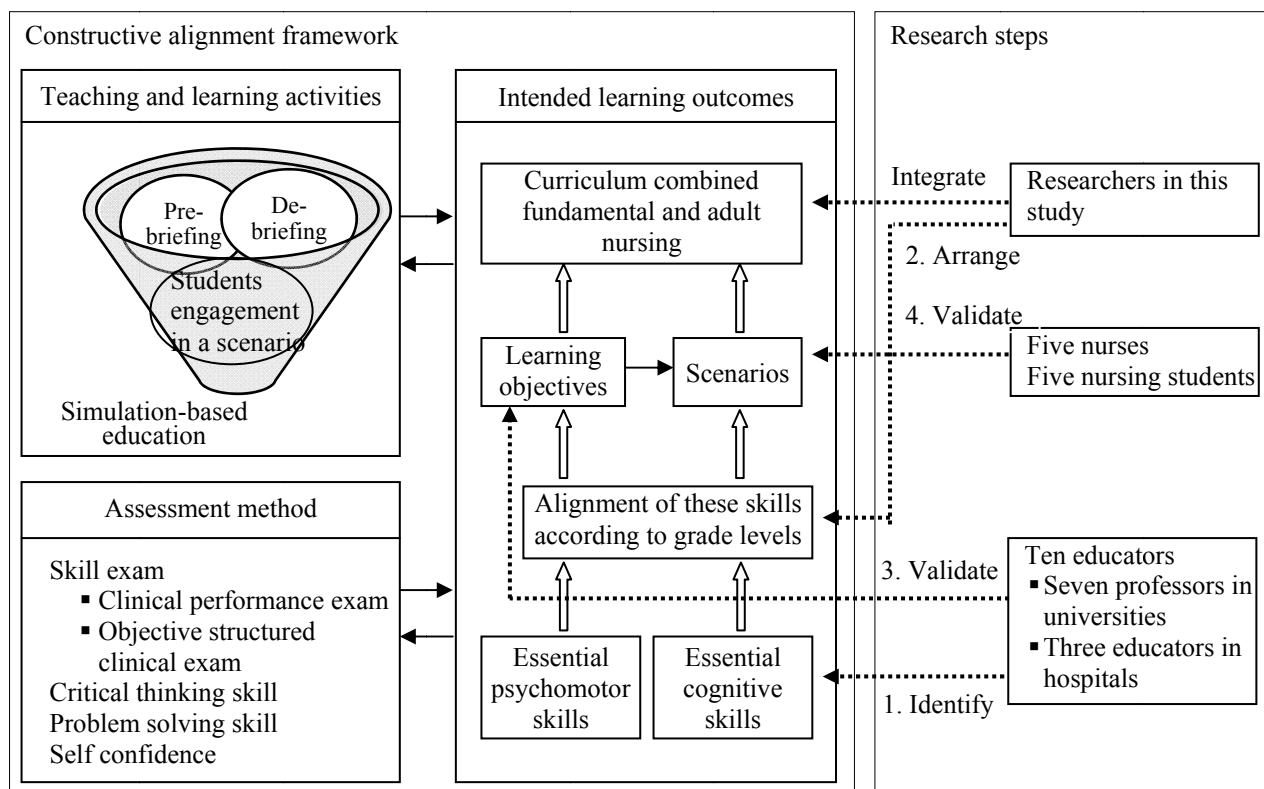


Fig. 1: Research steps related to constructive alignment

2.1. Identifying main skills for simulation-based education

Ten educators (seven professors who teach fundamental or adult nursing from seven different universities and three education managers for nursing education from three different university hospitals) participated in this step. The purpose in this step was to independently identify the most important psychomotor skills of fundamental nursing and cognitive skills of adult nursing. Eighty-eight psychomotor skills and 76 cognitive skills were evaluated by using a three-point rating scale. These skills were released as mandatory learning contents by the Korean Academy of Fundamental Nursing and the Korean Society of Adult Nursing. In addition, they evaluated which specific psychomotor skills should be combined with which specific cognitive skills to create the most effective learning experience.

2.2. Arranging the essential skills according to year in the program to design the curriculum

The essential skills were arranged according to the results of 2.1 and categorized as subject areas such as medication administration, oxygenation, and so on. Each subject area had three or five course names which reflected each essential skill. There were two considerations in designing the curriculum. The first was the level of difficulty of the skills; the more difficult skills were allocated to the more advanced student levels. The second was the effectiveness of combining psychomotor and cognitive skills; these skills were combined in light of the educators' opinions.

2.3. Identifying and validating learning objectives

Learning objectives in each course name were initially identified by the researchers from textbooks according to the result of 2.2. In addition, these learning objectives were validated by the ten educators using a five-point rating scale.

2.4. Developing scenarios to achieve learning objectives

A specific scenario should be evaluated by either nursing students or clinical experts. Educators as the learning facilitators of simulation-based education have to assess whether the intended learning outcomes and the learner's performance are coincident or not. In addition, clinical experts need to validate whether the clinical situation is an ordinary case or not since a clinical situation in a scenario may be have been drawn from the developers' own experience.

Therefore, five clinical experts validated whether the patient's demographics, previous history, signs, and symptoms mimicked those of an ordinary clinical situation by using a five-point rating scale. Five nursing students participated in a preliminary scenario to confirm that the learning objectives would be met the learner's performance during the scenario.

3. Results

3.1. Main skills for simulation-based education

Twenty psychomotor skills of fundamental nursing were selected with over 27 out of 30 points including assessment of pressure ulcer risk, assessment of pain, fall prevention, subcutaneous injection, inhalation medication, and preparing and exchanging intravenous solutions. Twenty cognitive skills of adult nursing were selected with over 23 out of 30 points including ischemic heart disease, cerebrovascular disease, glucose metabolism disorder, increased intracranial pressure, shock, and dysrhythmia.

3.2. The curriculum for each year in the program

Five subject areas (medication administration, oxygenation, safety, wound healing, and nutrition and elimination) were arranged for nursing students to acquire psychomotor and cognitive skills progressively by combining certain, selected important skills of fundamental and adult nursing. Each subject area consisted of three or five scenario topics according to the students' year in the program. Table 1 shows two subject areas as among them: medication administration and oxygenation.

Table 1: Examples of subject areas combined psychomotor and cognitive skills in the curriculum

| Subject area Year | Medication Administration | | | Oxygenation | | |
|----------------------|--|--------------------------------|--------------------------------|---|---|---------------------------------|
| | Scenario topics | Psychomotor | Cognitive | Scenario topics | Psychomotor | Cognitive |
| Year 2 | A 68-year-old man has been diagnosed asthma | Oral / Inhalation medication | Obstructive pulmonary disease | A 28-year-old male patient is scheduled to have surgery tomorrow. | Education on deep breathing / active coughing | Preoperative care |
| | A male patient with MRSA has a fever | Saline lock injection | Infection | | | |
| Year 3 | A male patient has suddenly lost consciousness | Dose calculation / IV dripping | Shock | An female patient with brain damage has difficulty breathing. | Tracheostomy suction | Increased intracranial pressure |
| | The symptoms of a patient with pneumonia have aggravated | Intradermal injection | Inflammatory pulmonary disease | | | |
| Year 4 | A patient who received CABG has been transferred from OR | Central venous catheter | Ischemic heart disease | A female patient with severe breathing problems has been intubated. | Endotracheal suction | Complex pulmonary disorder |

3.3. Learning objectives

Each scenario topic had four or five learning objectives according to the nursing students' year in the program. Table II shows the learning objectives on preoperative nursing care for the second year nursing

students and shock management nursing care for the third year nursing students. The learning objectives were rated at 4.0-4.7 points on the five-point rating scales.

Table 2: Examples learning objectives related to two scenario topics

| Scenario topics | Learning objectives Students will: | Rating score | |
|---|---|---|-----|
| A 28-year-old male patient is scheduled to have surgery tomorrow. | Cognitive skills | Assess respiratory status before surgery. | 4.3 |
| | | Explain possible lung complications after lung surgery under general anaesthesia. | 4.4 |
| | | Determine the risk factors for lung complications. | 4.4 |
| | Psychomotor skills | Establish nursing care plans to prevent lung complications after surgery. | 4.7 |
| | | Demonstrate appropriate lung care to prevent lung complications. | 4.7 |
| A male patient has suddenly lost consciousness | Cognitive skills | Assess patient status related to unconsciousness. | 4.5 |
| | | Determine the reason for the sudden unconsciousness: septic shock. | 4.0 |
| | | Establish the most crucial nursing diagnosis. | 4.7 |
| | | Establish nursing care plans according to the nursing diagnosis. | 4.0 |
| | Psychomotor skills | Change IV solution and set according to the appropriate procedure. | 4.7 |
| | | Calculate hourly infusion rate (cc/hr). | 4.5 |
| | Administer IV solution when an infusion pump is used. | 4.5 | |

3.4. Scenarios

Table 3: A scenario in oxygenation subject area for the second year nursing students

| Scenario topic: A 28-year-old male patient is scheduled to have surgery tomorrow. | | | |
|--|--|--|--|
| Scenario sequence | Patient status | Expected student behavior | Debriefing issues |
| <p>Demographics: A 28-year-old man, programmer, height: 182 cm, weight: 68 kg smoking: 1Pack/day</p> <p>Medical diagnosis: Recurrent pneumothorax</p> <p>Previous history: Previous healthy, pneumothorax at a year ago</p> <p>Current status: He was brought to the emergency room four days ago with complaints about sudden pain on the left side of his chest, dyspnea, and coughing. He was diagnosed as having pneumothorax and a chest tube has been put in. Now, the drainage is very slight and air leakage continues. The breathing sounds have decreased in the LUL. In addition, his breathing is shallow since he has chest pain when he moves. He will have VATS surgery tomorrow and wants to know how to prevent lung complications after surgery since he observed his grandfather experience lung complications after surgery.</p> | <p>Vital signs: Blood Pressure: 120/70 mmHg Temperature: 37°C Pulse rate: 78/min, regular Respiration rate: 22/min</p> <p>Evaluation: Chest HRCT: LUL bullae CBC (4 days ago) 7200-16.0-44.8-181 K CBC (1 day ago) 12,600-14.5-38.0-174 K ABGA (1 day ago) 7.37-42.1-79.6-25.2 O2 saturation: 96.5</p> | <p>Assessment: Check vital signs Assess lung status</p> <p>Nursing problem: Prevention of lung complications after surgery</p> <p>Intervention: Demonstrate the method for using incentive spirometer Demonstrate deep breathing and active coughing Demonstrate percussion Keep semi-Fowler's position</p> | <p>How should nursing students assess this patient's lung status?</p> <p>Which specific findings would cause lung complications?</p> <p>What is the most effective nursing intervention?</p> <p>How should nursing students demonstrate the method for using the incentive spirometer?</p> <p>How should nursing students demonstrate deep breathing and active coughing?</p> <p>How should nursing students demonstrate percussion?</p> |

Two scenarios for preoperative nursing care and shock management nursing care were developed to help nursing students to achieve learning objectives. Table III shows an example of the scenarios for the second year nursing students; the topic is: "A 28-year-old male patient is scheduled to have surgery tomorrow."

The scenario was scored at 3.8-4.6 points on the five-point rating scales in eight evaluation categories. The category that had the lowest score was “Vital signs that mimicked those of an ordinary clinical situation;” therefore the vital signs were revised according to the recommendations of the experts. In addition, the nursing students engaged in a preliminary scenario and confirmed that the scenario met the learning objectives.

4. Discussion

Nurse educators for simulation-based education should develop curriculum and scenarios in consideration of students’ year in the program to help nursing students become nursing professionals who can perform nursing tasks in dynamic and complicated hospital settings [1, 6]. The curriculum developed from this study consisted of five subject areas to enhance psychomotor and cognitive skills according to the nursing students’ year in the program. In addition, learning objectives and scenarios for two scenario topics were developed. The constructive alignment theory contributes to program specification as a teaching and learning method, declaration of intended learning outcomes, and assessment methods; therefore, the development process for the curriculum, learning objectives, and scenarios followed the constructive alignment theory [4]. The curriculum was validated by ten educators, five nurses, and five nursing students and evaluated for its appropriateness.

We will apply the simulation-based curriculum and these scenarios for each year in the program accordingly and analyze how to enhance problem solving skills, clinical skills, and nursing knowledge.

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