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Development and validation of the simulation-based learning evaluation scale

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ABSTRACT

Background: The instruments that evaluate a student's perception of receiving simulated training are English versions and have not been tested for reliability or validity.
Purpose: The aim of this study was to develop and validate a Chinese version Simulation-Based Learning Evaluation Scale (SBLES).
Methods: Four stages were conducted to develop and validate the SBLES. First, specific desired competencies were identified according to the National League for Nursing and Taiwan Nursing Accreditation Council core competencies. Next, the initial item pool was comprised of 50 items related to simulation that were drawn from the literature of core competencies. Content validity was established by use of an expert panel. Finally, exploratory factor analysis and confirmatory factor analysis were conducted for construct validity, and Cronbach's coefficient alpha determined the scale's internal consistency reliability. Two hundred and fifty students who had experienced simulation-based learning were invited to participate in this study.
Results: Two hundred and twenty-five students completed and returned questionnaires (response rate = 90%). Six items were deleted from the initial item pool and one was added after an expert panel review. Exploratory factor analysis with varimax rotation revealed 37 items remaining in five factors which accounted for 67% of the variance. The construct validity of SBLES was substantiated in a confirmatory factor analysis that revealed a good fit of the hypothesized factor structure. The findings tally with the criterion of convergent and discriminant validity. The range of internal consistency for five subscales was .90 to .93. Items were rated on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree).
Conclusions: The results of this study indicate that the SBLES is valid and reliable. The authors recommend that the scale could be applied in the nursing school to evaluate the effectiveness of simulation-based learning curricula.

1. Introduction

To bridge nursing education and clinical practice settings, simulation-based learning (SBL) has blended with traditional nursing curricula. The role of SBL has been affirmed internationally, notably in the landmark report *To Err Is Human* (Kohn et al., 2000) and *The Future of Nursing* (Institute of Medicine, 2011). Emerging research supports that SBL improves student learning efficacy in nursing education (Leonard et al., 2010; Mager and Campbell, 2013; Moreland et al., 2012; Zahara-Such, 2012).

The National Council of State Boards of Nursing (2005) noted that feedback following simulation is crucial for improving both the performance of a person and a team in simulation. Several English-version scales have been established to evaluate nursing students in the simulation environment; however, most of them have not been tested for reliability or validity (Cant and Cooper, 2010; Moreland et al., 2012; Mould et al., 2011). A valid and reliable Chinese version simulation scale is valuable to nursing education. The purpose of this study was to develop and validate a Chinese version nursing competency scale regarding SBL.

2. Background

SBL used in medical education has increased rapidly in recent years, and nursing education has kept pace with this trend (Gaba, 2004). This increased use is caused by the application of nursing knowledge and narrowing the "know" versus "do" gap (Cant and Cooper, 2010; Norman, 2012). Kolb's (1984) experiential learning theory is the theoretical base for the implementation of SBL. Kolb (1984) noted that learning is based on a four-stage learning cycle that encompasses concrete experience, reflection, abstract conceptualization, and active

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experimentation. The learning cycle begins when a learner experiences actual events that are incorporated into learning through reflective observation. Abstract conceptualization means that the learner gains further insight using logic and ideas to clarify situations and problems. Abstract conceptualization might alter learner behavior and cause active experimentation. A learner who passes the active experimentation stage might obtain a new experience and restart the process.

Nursing studies have identified the multiple benefits of SBL for nursing students, such as applying and synthesizing knowledge, improving psychomotor skills, assessment ability, decision-making, teamwork, communication, enhancing self-confidence, promoting critical thinking, and increasing satisfaction (Kaplan et al., 2012; Mager and Campbell, 2013; Mould et al., 2011; Norman, 2012; Weaver, 2011). SBL is also advantageous to nursing students at various learning levels. A study involving 48 undergraduate nursing students in intraprofessional teams, consisting of various level students managing acute pediatric and adult simulation scenarios (Leonard et al., 2010), showed that students could recognize the nursing role based on their current level of education. For instance, first-year students focused on basic assessment and communication skills, and fourth-year students addressed leadership roles. Weaver (2011) reviewed and synthesized existing evidence in 24 studies from five literature databases to answer the question, "Is it necessary to examine the effect of high-fidelity patient simulation on nursing students?" She observed that high-fidelity patient simulation is valuable for students in the areas of knowledge, value, realism, and learner satisfaction. Other benefits, such as student confidence, knowledge transfer, and stress reduction, exhibited mixed results.

Although numerous studies have identified the advantages of implementing SBL in nursing education, many nurse educators continue to struggle with how to evaluate the effectiveness of simulations. In the United States, both the National Council of State Boards of Nursing and the National League for Nursing are conducting simulation evaluation methods (National League for Nursing, 2013). However, nursing educators continue to search for meaningful approaches and valid tools to evaluate student performance after experiencing SBL (Cant and Cooper, 2010; Foronda et al., 2013; Kardong-Edgren et al., 2010).

SBL evaluation tools include objective structured clinical examinations (OSCEs) and questionnaires. OSCEs are the most valid assessment measures and have been used to examine student knowledge and skill; however, OSCE is a time-consumer and the expense is huge (Bartfay et al., 2004). The most common evaluation tool is the questionnaire. Kardong-Edgren et al. (2010) reviewed published articles in two major simulation journals (*Simulation in Healthcare* and *Clinical Simulation in Nursing*) and observed 22 simulation evaluation questionnaires and seven development questionnaires. They synthesized and observed that the measurement contents of these evaluation questionnaires included cognitive, affective, and psychomotor domains. Most of the questionnaires were developed for measuring multiple scenarios, and half of the 22 articles did not report the reliability and validity of the questionnaires. Kardong-Edgren et al. concluded that psychometric reinforcement of these instruments is a high priority. Cant and Cooper (2010) analyzed studies published between 1999 and 2009 on the use of SBL in nurse education. The review comprised 12 studies, all of which used experimental or quasi-experimental designs. Knowledge, critical thinking ability, satisfaction, and confidence were the most common competences. Cant and Cooper (2010) observed that reliability was unclear in five studies, and the sample size for half of the studies was less than 50. A Taiwanese researcher developed a measurement instrument consisting of five learning domains: clinical ability, debriefing, problem-solving, confidence, and collaboration (Chen, 2010). This instrument facilitates students in progressing toward achieving objectives rather than measuring outcomes or achieving learning objective. Rubaish et al. (2010) indicated that teaching evaluation should focus on assessing effectiveness in meeting course objectives using objective assessment methods. In summary, the emphasis on process rather than on outcome of simulation learning, insufficient evidence for psychometric factors, and small sample size are concerns for the existing instruments.

3. Methods

3.1. Research Design

The research design comprised two major phases: development of the Simulation-Based Learning Evaluation Scale (SBLES) and psychometric testing of the SBLES. The processes were in accordance with DeVellis (2011) method and included four stages, as outlined below.

3.1.1. Stage 1: Identification of Nursing Competence

According to the National League for Nursing (NLN, 2012) and the Taiwan Nursing Accreditation Council (TNAC, 2010), the core competencies for baccalaureate nursing students include critical thinking, clinical skills, basic biomedical science knowledge, cooperation and communication, caring, ethics, accountability, and lifelong learning. Three nursing teachers with experience of simulation implementation were invited to clarify the application of these core competences in simulation classes. Five core competencies were retained: professional knowledge (i.e. biomedical and nursing knowledge), clinical skills, nursing process, cooperation and communication, and critical thinking.

3.1.2. Stage 2: Development of Item Pool

The initial item pool for the SBLES was drawn from the literature related to five core competencies. The initial item pool consisted of 74 items. Three nursing teachers were then invited to refine the items in the initial item pool using focused group discussion. The SBLES must be developed for measuring five core competencies rather than being developed to measure a single simulation scenario. Fifty items were retained. To avoid rating overload for scale users, 5-point rating scale was decided for users to rate their level of agreement with each of the items. Each item of SBLES was rated from 1(strongly disagree) to 5 (strongly agree).

3.1.3. Stage 3: Review of Item Pool by an Expert Panel

Five external experts, three professors and two lecturers who had backgrounds in simulation research or education, were invited to assess preliminary content validity. A 4-point ordinal rating scale was used for judging content validity. The content validity index (CVI) was calculated as the proportion of experts who rate each item as a 3 or 4, and the CVI for the total instrument was calculated as the proportion of total items judged as a 3 or 4. If the CVI was less than .80, the item was discarded (Lynn, 1986).

3.1.4. Stage 4: Psychometric Testing of the SBLES

When the redundant items of the item pool were removed, further analysis of the SBLES was conducted. The methods of analysis included item analysis examining for item appropriation, exploratory factor analysis (EFA) for extracting potential factors, confirmatory factor analysis (CFA) for testing construct validity, and Cronbach's coefficient alpha for computing the reliability.

3.2. Sample

The study university has a 2-year senior college program and 4-year college program in nursing. A convenience sample was recruited from these two colleges. A total of 250 questionnaires were distributed to the participants, including 80 senior students in four classes of the 2-year senior college program, 100 senior students in 3 classes of the 4-year college program, and 70 junior students in 3 classes of the 4-year college program. All the participants had experienced at least three scenarios of simulation in their curriculum.