Design and Implementation Of Blended Learning Approach For Simulation Education Among Undergraduate Nursing Students

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Abstract: The importance of undergraduate nursing education has never been higher due to the aging population and complexity of patients. The blended simulation combined two and more educational methods and is an effective strategy in nursing education. This study was to evaluate the effectiveness of blended simulation using standardized patients and patients simulation. Using a convenience sampling, a quasi-experimental study was conducted. Forty undergraduate nursing students enrolled and were allocated into the experimental group (n=20) or the control group (n=20). CPX (clinical performance examination) was used to evaluate physical assessment skills. Self-reporting questionnaires were used for communication skill and learning satisfaction. $\chi 2$-test/Fisher's exact test and Mann-Whitney U test were conducted for statistical analysis. After completing the educational program, there were statistically significant higher levels of physical assessment and communication skills in the blended simulation group (p<.001) compared with the control group. Regarding learning satisfaction, there were also statistically significant differences with higher level of satisfaction among students in blended simulation group (p=.002). This blended simulation has high potential to successfully achieve learning outcomes in undergraduate nursing education. Providing students diverse educational methods ensures an optimal learning experience.

Keywords: Standardized patient, Simulation, Nursing students, Communication, Satisfaction.

INTRODUCTION

Due to the dramatic growth in population aging, patients' acuity and complexity has never been higher such that physical assessment is recognized as a core nursing skill to ensure patient safety and quality nursing care in nursing education (Buist & Stevens, 2013). Hospitalized patients, in particular, are admitted for more complicated treatment, which requires intensive nursing care and monitoring for changed physical status. Nurses as front-line staff are responsible for detecting individual patient problems in a timely manner. A patient's physical assessment is an important daily task that requires adequate training during undergraduate nursing curriculum.

In most nursing school curriculum, nursing students complete the program within a compressed timeframe, which challenges undergraduate nursing education (Posey & Pintz, 2017). Faculties must formulate optimal teaching strategies to equip students with sound theoretical knowledge as well as adequate skills for future clinical practice. Moreover, integration of theoretical knowledge into real-life clinical situation is a key to successful nursing education. Thus, undergraduate nursing education must offer various experiences, facilitating students' readiness before entering the clinical field as a registered nurse.

Simulation-based learning has been recognized as an effective teaching strategy in undergraduate nursing education. The strategy includes various activities with diverse devices such as high-fidelity simulators (HFS), standardized patients (SPs), role play, and simple patient mannequins (Barry Issenberg *et al.,* 2005). Well-developed scenarios based on clinical situations establish learning environment for nursing students where they are given opportunity to practice diverse skills, clinical and non-clinical skills, from communication to intricate nursing skills. This simulation-based learning has been applied to nursing education such that its effectiveness is well established in achieving high levels of nursing competency.

Technology development affects nursing education in that tertiary nursing education, especially simulation, adapts new technologies. Blended simulation is defined as a teaching strategy that involves integrating modern technology in teaching nursing practices (Johnson *et al.,* 2010). Combining conventional face-to-face interventions with technological methods offers higher potential for educators to cater to diverse student learning preferences (Chan *et al.*, 2010). As a matter of fact, previous studies reported higher levels of motivation occur through blended learning than from traditional, teacher-centered, passive educational

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approaches (Johnston *et al.,* 2017). Blended simulation easily engages students with activities, leading to a better understanding of educational contents. Previous "one size fits all" education strategies cannot ensure optimized learning satisfactions; thus, further efforts are necessary for faculties to integrate new teaching methods.

Blended simulation uses multiple modalities, which benefit health professional education (Benedict *et al.,* 2017; Coggins *et al.,* 2017). As students progress through their school curriculum, their skill evolves in stages and blended simulation can reconstruct these modalities according to students' progress. This comprise an essential element of learner-centered education which could result in beneficial effects in acquisition of theoretical knowledge and nursing skills (Ellis DM., 2016); therefore, rigorous efforts are necessary to seek diverse educational modalities, which lead to effective blended simulation in nursing curriculum.

Blended learning accommodates individualized learning opportunities in nursing education. Previous review identified the beneficial effect of blended learning in nursing education; improving clinical skill, acquisition of theoretical knowledge and clinical confidence, and the greater level of user satisfaction (McCutcheon *et al.,* 2015). Yet, only few previous studies adopted blended simulation on physical assessment. The purpose of this study was to examine the effects of blended simulation on undergraduate nursing education.

METHODS
Blended Simulation for Respiratory System Assessment
Two simulation technologies, SPs and HFS, were involved in this study [see Table 1]. The simulation program was designed to improve respiratory system assessment skills and patient communication skills. Six-hour simulation was implemented and the program contents consisted of the following three phases: respiratory system assessment lecture (1 hour), training using trained SPs and patient simulator (3 hours), and training using patient simulator and peers who play the patient's role (2 hours).

Table 1: Educational contents of blended simulation for respiratory system assessment

| Session	Educational contents		Duration
	Experimental group	Control group	
1st session	Examination of respiratory system including anatomy		1 hour
2nd session	Educational video (how to assess the respiratory system) Lecturer demonstration Interview with trained standardized patients Practicing respiratory system assessment skills using patient simulator Students practiced discerning abnormal lung sounds	Educational video (how to assess the respiratory system) Lecturer demonstration Practicing respiratory system assessment skills with peer role play Audio recorded sound was provided for students to practice discerning abnormal lung sounds	2 hours
3rd session	Practicing respiratory system assessment skills on patients simulator. Scenario-based training with peer role play	Open lab for self-practice	2 hours
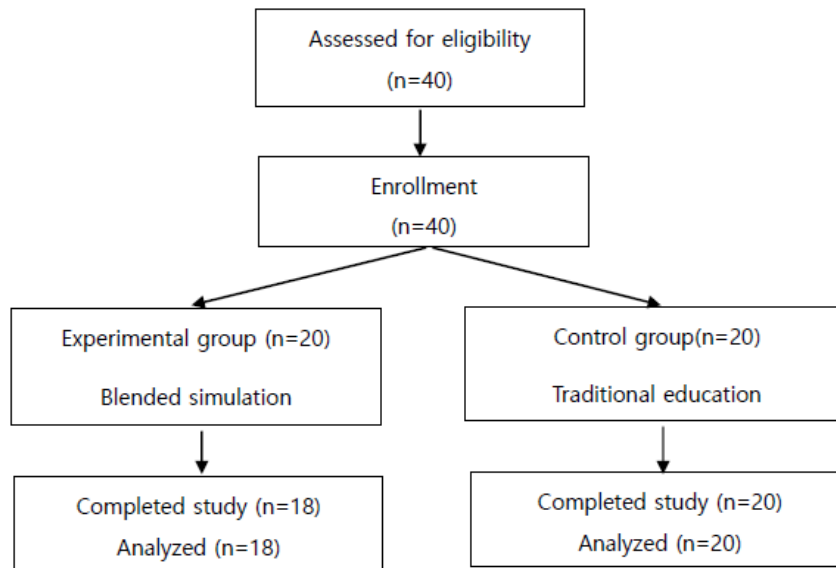
Figure 1: Study flow diagram

Participants
Forty nursing students in their second year enrolled and participated in blended simulation education. Twenty students were allocated to either the experimental or control group. Two experimental group students did not complete the post-test, thus, data from 18 students were used for statistical analysis [see Figure 1].

Instruments

Health assessment skill
Health assessment skills for the respiratory system were evaluated using CPX (Clinical Performance Examination). CPX is a tool to evaluate students' clinical reasoning ability, incorporating assessment and developing a care and treatment plan (Choi *et al.,* 2008).

Communication skill
Communication skills were assessed using a 6-item self-reporting questionnaire. The tool analyzes conciseness, clarity, connectivity, adequacy, reliability, and eye contact. [1]With a maximum score of 30, a higher score indicates a greater ability to communicate.

Learning satisfaction was assessed after revising the existing tool for analyzing education satisfaction, developed by Lee (1999). The tool consists of 5 subscales: learner attitude (1 item), learner satisfaction (3 items), suitability of educational contents (4 items), learning achievement (5 items), and adequacy of evaluation (6 items), a total of 20 items. A 5-point Likert scale was used. The average score ranged between 1–5, with the higher score indicating a greater learning satisfaction.

Data collection
Students in each croup completed CPX and the survey one day after the simulation program finished. Students' performance during the CPX assessment was video recorded and scored by two independent raters who were blinded. The independent reviewer's scores calculated the average.

Statistical Analysis
Using SPSS (version 24), statistical analysis was conducted. Demographic data, frequent, mean, standard deviation, and percentage were calculated. The homogeneity test between groups was performed using chi-squire test and independent t-test. Fisher's exact test and Mann-Whitney U test were used to compare the experimental and control group.

RESULT
The mean age of study participants were 20.22 and 20.54, respectably. The academic scores of previous semesters were 3.35 points in blended simulation group and 3.42 points in control group. Students in the

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experimental group (72.2%) and those in the control group (95.0%) reported satisfaction with nursing and the majority of students (94.5% in the experimental group and 90.0% in the control group) had fair-to-good abilities of self-expression. There was no statistically significant group difference in satisfaction with nursing ($\chi2 = 3.37$, p=.167), self-expression ($\chi2 = 1.45$, p=.402), age (t=-1.49, p=.146), and previous semester scores (t=-.48, p=.519) [see Table 2].

Table 2. Homogeneity for characteristics between groups (N = 38)

Characteristics	Experimental group (n=18) n (%) / M (SD)	Control group (n=20) n (%) / M (SD)	χ^2 / t	p
Satisfaction with nursing			3.37*	.167
Good	13(72.2)	13(65.0)		
Fair	5(27.8)	6(30.0)		
Poor	0(0.0)	1(5.0)		
Self-expression			1.45*	.402
Good	7(38.9)	6(30.0)		
Fair	10(55.6)	12(60.0)		
Poor	1(5.5)	2(10.0)		
Age (yr)	20.22(1.59)	20.54(1.78)	-1.49	.146
Score of previous semester (point)	3.35(1.96)	3.42(2.01)	-0.48	.519

After completing the educational program, there was statistically significant higher levels of health assessment skill (p<.001) and communication skill (p<.001). The experimental group's mean score totaled 4.22 (out of 5) and 3.89 in the control group after examining educational satisfaction. Comparing with control group, there was statistically significantly higher learning satisfaction in the blended simulation group (p=.002) [see Table 3].

Table 3. Comparisons of outcome variables between groups (N = 38)

Variables	Experimental group (n=18) M (SD)	Control group (n=20) M (SD)	t / z	p
Physical assessment skill (respiratory system)	83.44(8.02)	67.87(8.90)	7.06	<.001
Communication skill	4.12(0.43)	3.09(0.47)	7.43	<.001
Learning satisfaction				
Perceived self-attitude	4.17 (0.62)	4.00(0.54)	1.33	.193
Learner satisfaction	4.28 (0.51)	3.91(0.42)	4.02	<.001
Suitability of educational contents	4.30 (0.37)	3.78(0.48)	4.14	<.001
Learning achievement	4.27 (0.31)	4.11(0.35)	0.54	.591
Adequacy of evaluation	4.20 (0.48)	4.08(0.44)	0.80	.419
Learning satisfaction (total)	4.25(0.48)	3.89(0.43)	3.19*	.002

* Mann-Whitney U test

DISCUSSION

In this study, a quasi-experimental design was used to identify the effectiveness of blended simulation using contents of respiratory system assessment. In addition to lecture for knowledge acquisition, patient simulator and SPs were used to link theory and clinical practice during the simulation. Moreover, combining two methods of simulation allowed students to have a diverse experience, leading to better readiness of undergraduate students for future clinical practice.

Students in the experimental study were provided more diverse simulation activities, which ensures a greater opportunity to meet individuals' learning preferences. In previous studies, learning preferences has been identified as a predictor, promising good academic performance of undergraduate nursing students (Koch *et al.,*

2011). Students reported their learning preference using multiple approaches, which associated with the findings of the present study. Traditional, "one size fits all" education is no longer as effective as before; thus, these findings indicate the need for nursing education to transform into diverse educational methods.

The use of two kinds of patients in blended simulation enabled students to be more engaged in practice for communication. The flexibility of peer role play allows active participation in developing communication skills for diverse clinical situations. Considering the major restriction of SPs and cost, peer role play must also be well considered as an effective component for blended simulation (Bossee *et al.,* 2012). In addition, peer role play methods allow better empathic approaches to patients than SP simulations, which further fosters active communication.

HFSs provide students the opportunity of real-like practice as students are given opportunities to directly observe breathing and listen to abnormal lung sounds of patients with particular lung diseases. Although the audio record delivers real patient sounds, it may not be enough to engage students in learning (Kim *et al.,* 2016). Using patient simulators allows certain activities such as using a stethoscope to hear patients' lung sound, which fosters students' active participation in clinical simulation. Practicing the process of clinical decision-making on patient simulators, students work harder to make more sound clinical judgement (Loke *et al.,* 2020). The findings of this study indicate patient simulators clearly play a vital role in linking theoretical knowledge to nursing skills for clinical practice.

Since students' health assessment skills closely relate to intensity of practice, students in blended simulation achieve high levels of performance with opportunities for practice. Nursing faculties must use diverse educational approaches such as blended learning, which could help identify its effectiveness. There might be different educational approaches in other health professional or other disciplines; therefore, nursing faculties must carefully consider how to blend and integrate other approaches into nursing education. We are living in the world where healthcare and medicine are changing on a daily basis (Harden *et al.,* 2020); therefore, nursing education must also be ready for this constant transformation.

This study was not without limitations. Although we used convenience sampling, the study's sample size was relatively small due to restrictions on the number of students allowed in one class. In addition, using a self-reporting questionnaire for some variables (communication skill and learning satisfaction) means cautions are necessary when interpreting the study results.

CONCLUSION

This blended simulation using SPs and patient simulator successfully improved physical assessment and communication skills. In addition, students in blended simulation group reported statistically significantly higher level of learning satisfaction than control group. Providing opportunities to experience diverse educational methods could easily meet students' learning preferences, leading to better activity engagement. The development of blended simulation with professionally designed educational contents effectively improves undergraduate nursing students' competency.

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CONFLICT OF INTEREST
The authors declare that they have no conflict of interest.

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