Received: 11 August 2020 | Revised: 22 October 2020 | Accepted: 12 November 2020

DOI: 10.1002/nop2.748

RESEARCH ARTICLE

NursingOpen Open Access WILEY

Effectiveness of neonatal emergency nursing education through simulation training: Flipped learning based on Tanner's Clinical Judgement Model

Sun-Yi Yang

College of Nursing, Konyang University, Daejeon, Korea

Correspondence
Sun-Yi Yang, College of Nursing, Konyang University, Daejeon Medical Campus, 158, Gwanjeodong-ro, Seo-gu, Daejeon 35365, Korea.
Email: lavender799@gmail.com

Funding information
NIH

Abstract

Aim: To examine the effects of neonatal simulation-based practice by applying flipped learning based on Tanner's clinical judgement model to pre-simulation briefing for nursing students.

Design: A quasi-experimental non-equivalent control group pre- and postintervention design.

Methods: Using Tanner's clinical judgment model, flipped learning was developed and applied to the pre-simulation briefing curriculum prior to the neonatal nursing simulation exercise. Flipped learning was compared with a general pre-simulation briefing with 65 South Korean students. From September 7, 2019, to October 25, 2019.

Results: The experimental group's critical thinking, self-confidence and clinical judgement ability increased, but knowledge, satisfaction and anxiety did not differ from that of the control group. Pre-simulation briefing design focuses on improving students' environmental comfort and reducing anxiety rather than developing complex reasoning skills and clinical judgement abilities. Applying flipped learning based on Tanner's clinical judgement model to pre-simulation briefing increased critical thinking, self-confidence and clinical judgement ability.

KEYWORDS

distance, education, emergency nursing, midwives, nurses, nursing, simulation training

1 | INTRODUCTION

Clinical judgement is an essential component of nursing practice in medical institutions (McCartney, 2017). Nurses' clinical judgement can have profound effects on patient outcomes, so careful thinking and decision-making are needed (Manetti, 2018). However, studies mention that nursing students are not developing the complex reasoning skills and clinical judgement abilities to function effectively on graduation because of knowledge deficiency and lack of opportunity to practice in the ever-changing healthcare environment (Graan et al., 2016). Knowledge improvement and repetitive practice can assist to transform from a novice to an expert with more analytic, inductive and critical thinking contextual patterns (Pouralizadeh et al., 2017).

In clinical practice, due to high-risk newborns' safety and infection control, many hospitals do not allow nursing students to practice

in neonatal intensive care units. Therefore, even if clinical practice is allowed, the practice is observation only (Choi et al., 2015). Nursing students with experience in the neonatal intensive care unit (Choi, Kim, et al., 2015) reported that they were surprised and felt fear as they saw the treatment of high-risk newborns and various therapeutic devices (Choi, Kim, et al., 2015). The greater the exposure to emergencies, the better the proficiency to resolve the situation (Shin et al., 2015). Therefore, nursing students need training programmes to cope effectively and promptly in emergency situations frequently encountered in the neonatal intensive care unit, which may help nursing students transition to working there after graduation (Foster et al., 2016). To overcome these limitations in the clinical practicum, flipped learning and nursing simulation training methods were used (Peisachovich, 2016). The flipped learning with simulation training methods approach offers students opportunities for application of clinical judgement, attaining engagement knowledge and professional experience (Park & Ha, 2016; Shin et al., 2015). Flipped learning methodology provides increased class time for meaningful experiential education and active learning exercises with students' ownership of their learning processes and enables students to share their own views and perspectives and link the content to their personal and professional experiences. The methodology provides opportunities to apply clinical thinking and judgement and develop the ability to "think like a nurse" (Peisachovich, 2016).

2 | BACKGROUND

According to systematic review, the pre-simulation briefing may include additional simulation preparatory activities such as independent reading assignments, video- and web-based modules, assessment rubrics or laboratory practices (Tyerman et al., 2019). The pre-simulation briefing process is critical to ensure successful simulation experiences for students, because students are prepared and motivated by pre-scenario information through pre-simulation briefing (Tyerman et al., 2019). However, there were few studies that used a pre-simulation briefing method, which included a theory-based direct way to enhance clinical judgement ability. A possible solution to this problem was a flipped learning approach to the pre-simulation briefing process. Flipped learning is a pedagogical approach whereby students study the learning material or video clips prepared by the professors before class time, allowing students to discuss, role-play and problem-solve with classmates in class (Simko et al., 2019). Previous studies have demonstrated that flipped learning was significantly effective for academic achievement, teamwork, therapeutic communication, problem-solving and information management skills when applied to clinical practice and nursing courses (Lee et al., 2017; Peisachovich et al., 2016). To formulate education strategies that develop integrated clinical reasoning skills in nursing students, proposals have been made to nursing educators and researchers to arrange flipped learning classes that apply clinical judgement skills (Peisachovich et al., 2016). There are some rare studies on the development and assessment of pre-simulation briefing methods globally (Tyerman et al., 2016), and there are limited studies on pre-simulation briefing methods that apply flipped learning and are grounded in a theoretical framework.

Tanner's (2006) clinical judgement model consists of four stages: a noticing stage when a given clinical situation is perceived; an interpreting stage to develop an adequate understanding of the situation; a responding stage to determine the appropriate actions and responses to the situation and to provide appropriate intervention; and a reflecting stage to focus on the patient's condition and response, to analyse the response and to consider the appropriate measures for improved clinical judgement in the future.

Several previous studies have used Tanner's clinical judgement model as a conceptual framework for a simulation programme (Ashcraft et al., 2013; Dillard et al., 2009; Jeong & Yun, 2017). Some have also applied a Lasater's clinical judgement rubric—developed based on Tanner's clinical judgment model—to simulation debriefings, which had significant effects on the clinical judgement and clinical performance of nursing students. However, no previous studies have applied the clinical judgement rubric based on Tanner's clinical judgement model to the pre-simulation briefing process. The application of Tanner's (2006) clinical judgement model to the pre-simulation briefing as a theoretical basis is expected to provide an opportunity to learn and to improve the systematic thinking process step by step, thereby improving clinical judgement ability. In this study, a preliminary simulation briefing using flipped learning methodology based on Tanner's clinical judgement model is applied and its effects are investigated.

3 | THE STUDY

3.1 | Aims

This study aimed to examine the effects of neonatal simulation-based practice by applying flipped learning based on Tanner's clinical judgment model to the pre-simulation briefing for nursing students. To this end, six hypotheses were established.

Hypothesis 1 *The experimental group that received the pre-simulation briefing based on Tanner's clinical judgement model will have a greater degree of knowledge of neonatal emergency care compared with the control group that received the normal pre-simulation briefing.*

Hypothesis 2 *The experimental group's critical thinking will increase in comparison to the control group.*

Hypothesis 3 *The experimental group will have greater confidence in nursing performance than the control group.*

Hypothesis 4 *The experimental group will have greater simulation practice satisfaction than the control group.*

Hypothesis 5 *The experimental group will have greater clinical judgement than the control group.*

Hypothesis 6 *The experimental group will have lower anxiety than the control group.*

3.2 | Design

A quasi-experiment using non-equivalent control group pre- and postintervention design was employed to identify the efficacy of neonatal nursing simulation training in pre-simulation briefings applied Tanner's clinical judgement model to flipped learning (Figure 1).

3.3 | Participants

This study was conducted at the Cheju Halla University after obtaining approval from the department head, to whom the study's purpose was explained. Senior nursing students were sampled; the recommended sample size was 21 students per group, according to a significance level of.05, a test power of.80 and a large effect size of.80, with 1 degree of freedom, using the one-tailed independent *t* test. The sample size was calculated using G*power 3.1.9 (Faul et al., 2007). The final analysis included 35 (100.0%) participants in the experimental group and 30 (85.7%) in the control group. Five participants were excluded from the control group because three failed to participate in the simulation practice and two did not complete the questionnaire.

3.4 | Method

3.4.1 | Procedure/Programme description

The simulation programme for improving neonatal nursing simulation training using flipped learning for clinical judgement was developed using the six-step approach to curriculum development (Thomas et al., 2015). In the first step (problem identification and general needs assessment), problems in neonatal nursing practice were analysed via a needs assessment, which was conducted by senior nursing students, Registered Nurses from the nursery and neonatal intensive care unit and paediatric nursing faculty members. In addition, the Korean Society of Nursing Science (2017) learning objectives for the Bachelor of Science in Nursing were analysed. The results indicated limitations in acquiring paediatric nursing skills through clinical practice due to difficulties in securing practice opportunities in neonatal intensive care units. The sub-learning objectives of the paediatric nursing curriculum included performing resuscitation care for high-risk neonates (Korean Society of Nursing Science, 2017). In the second step, a needs assessment was conducted with senior nursing students who completed their clinical practicum, which confirmed that the students desired the opportunity to experience high-risk neonatal care in simulation classes.

In the third step (goals and objectives), course outcomes were determined based on the nursing departments' learning outcomes and core competencies. Learning outcomes for each week were determined based on the learning outcomes of nursing job analysis, national nursing board examinations and paediatric nursing courses. Assessment details, methods and proportions were organized based on the learning outcomes of courses.

The topic selected for the simulation scenario in the fourth step (educational strategies) involved the most frequent situations requiring precise initial newborn assessment and care or quick judgement and emergency treatment in the neonatal intensive care units. Authentic clinical data were collected from nurses and physicians from the neonatal intensive care units of clinical institutions, and

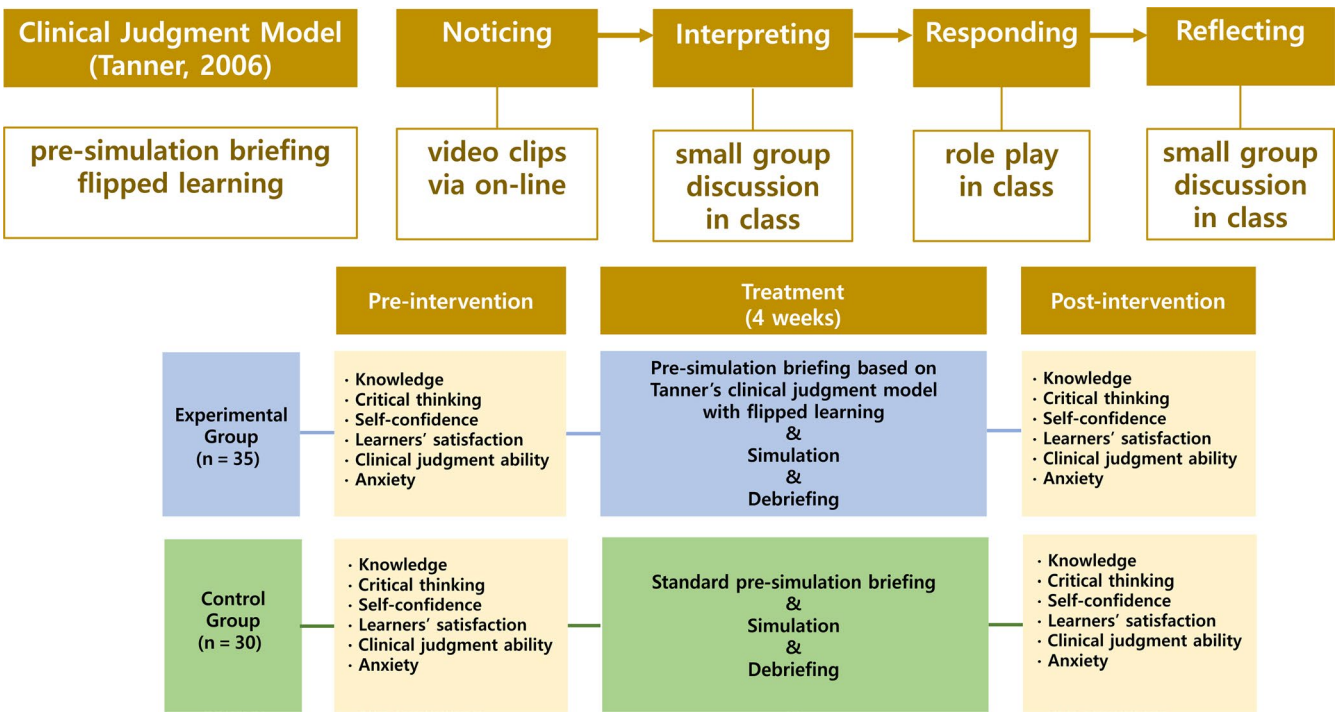

FIGURE 1 Research design

descriptions of clinical situations were considered when writing the scenario modules and flow scenario. For scenario re-enactment, a simulation scenario based on a high-technology manikin-based simulator and standardized participants as the high-risk baby's mother and paediatrician were used. As a pre-simulation briefing strategy, the flipped learning method was used. The protocols for APGAR scoring, gavage-tube feeding, Neonatal Escalation Situation–Background–Assessment–Recommendation (Raymond & Harrison, 2014) and neonatal resuscitation algorism (Wyckoff et al., 2015) were uploaded to an online education platform before the course, so students could learn them in advance. Moreover, a simulation briefing form based on Tanner's clinical judgement model was evaluated by six experts: a Registered Nurse at the neonatal intensive care unit, three nursing professors, one paediatrician and one professor of education. Only those with I-CVI (item-content validity index) scores higher than .80 were used for the experimental group.

In the fifth step (simulation class implementation), each group, comprising of four or five people, performed neonatal resuscitation. During the course orientation, explanations were provided through the course outline and learning outcomes, assessment criteria and methods, distribution of flipped learning materials, course schedules and assignments.

The experimental group was provided with a short flipped learning lecture video on the 2017 American Heart Association neonatal resuscitation algorithm created by the principle investigator, who attended the 2018 Korean Society of Neonatology neonatal resuscitation workshop and worked as a Registered Nurse in a Neonatal Intensive Care Unit (NICU) for two years and paediatric nursing faculty for eight years. Six experts verified the content and difficulty of the video: a Registered Nurse at the neonatal intensive care unit, three nursing professors, one paediatrician and one professor of education. Experimental participants had to write a pre-simulation briefing form based on Tanner's clinical judgement model (Appendix S1).

In the sixth stage (evaluation and feedback), the Korean version of Lasater's Clinical Judgment in Simulation Rubric (Shim & Shin, 2015) was modified for resuscitation care for high-risk neonates by the principle investigator. It was evaluated by a Registered Nurse at the neonatal intensive care unit, three nursing professors, one paediatrician and one professor of education. Discrepancies between two evaluators were identified, evaluators were retrained through pilot education and thereafter the rubric was reconsidered. The final intraclass correlation coefficient was high ($r = .83$).

A content validity test (Item-Content Validity Index) for the course content and method was conducted by a Registered Nurse at the neonatal intensive care unit, three nursing professors, one paediatrician and one professor of education. Only content with an I-CVI of 0.8 or higher was included in the final programme. The scenario was about a premature baby born at 34 weeks due to pre-eclampsia. The baby had apnea and muscle weakness, so students had to recognize the need for neonatal resuscitation. The scenario was performed by using a high-fidelity simulator (Simbaby) to show breathing, cyanosis, oxygen saturation, heart rate and respiratory rate on the patient monitor. Equipment was prepared to create an environment as similar as possible to the hospital NICU. The scenario was implemented by one researcher and one operator driving the simulator and patient monitor from the operator room in the NICU simulation laboratory.

The programme ran for four weeks. A week before the first class started, the intervention group received the online flipped learning materials and short lecture videos (50 min) about neonatal resuscitation through the online educational platform. The control group only received simulation guidelines and lecture notes through the same platform. In the first class, the instructor demonstrated neonatal nursing and neonatal resuscitation care in the NICU simulation laboratory. The intervention group—comprising four to five people—were required to perform neonatal resuscitation and have a group discussion about resuscitation care for high-risk neonates (100 min). For the control group, a face-to-face lecture with an instructor demonstration about neonatal nursing and neonatal resuscitation was provided in the NICU simulation laboratory. In the third and fourth weeks, both the intervention and control groups had a pre-briefing orientation of the environment and high-fidelity simulator (Simbaby), planning expectations, setting the rules of engagement in the scenario and logistics (5 min), simulation running (15 min) and debriefing (30 min).

3.4.2 | Data collection

The pre-survey of the control and experimental groups was conducted to measure their general characteristics, knowledge of neonatal emergency care, critical thinking and confidence in performing nursing, satisfaction with simulation practice, clinical judgement and degree of anxiety before the commencement of the intervention. The postsurvey measured the dependent variables after the programme.

3.4.3 | Instruments

Neonatal emergency care knowledge

Following core knowledge areas of the American Heart Association's Neonatal Resuscitation Program (Hazinski et al., 2015), this study used Yoo's (2013) measure of knowledge tools for neonatal emergency situations. The tools to assess knowledge related to neonatal emergency care comprised 30 items. For each item, a score of 0 was assigned if the answer was incorrect or unknown and a score of 1 when correct. A higher score indicated a higher level of knowledge. A preceding study (Jeong & Choi, 2017) used the Kuder–Richardson formula 20 to assess this measure's reliability, which was 0.65; however, in this study, it was 0.71, indicating high reliability.

Example items from the Neonatal Emergency Care Knowledge Tool:

1. When aspirating a newborn, first aspirate the nose and then the mouth.

2. When aspirating a newborn, the pressure of the aspirator is 120–140 mmHg.
3. If the baby's heart rate is lower than 60 bpm, even after 30 s of positive pressure ventilation, chest compressions are performed.

Critical thinking

This study used Yoon's (2004) Critical Thinking Disposition Measurement, with standardization based on the verification of its reliability and validity. It comprises 27 items concerning seven areas: intellectual enthusiasm/curiosity, prudence, confidence, systematicity, intellectual fairness, healthy skepticism and objectivity. The responses are provided on a five-point Likert scale ranging from "not at all" (1 point) to "very much so" (5 points). Higher scores indicate a higher critical thinking capacity. Cronbach's α was 0.84 in a preceding study (Yoon, 2004) and 0.93 in the present study.

Example items from the Yoon's (2004) Critical Thinking Disposition Measurement:

1. Judgement is withheld and contemplated until valid, and sufficient evidence is obtained.
2. When dealing with complex problems, I judge and deal with the problems according to the criteria I set.
3. When you disagree with someone else's opinion, explain why.

Confidence in performing nursing

Following the core knowledge areas of the American Heart Association's NRPTM (Hazinski et al., 2015), this study used Yoo's (2013) measure of confidence based on the verification of its reliability/validity to standardize the nursing tools for neonatal emergency situations. The measure of Confidence in Performing Nursing Tool related to neonatal emergency care and included 15 questions. Each question was answered on a five-point Likert scale ranging from "not at all" (1 point) to "very much so" (5 points). Higher scores indicated higher confidence in performing nursing. Cronbach's α was 0.96 in a previous study (Yoo, 2013) and for this study, it was 0.83.

Example items from the Confidence in Performing Nursing:

1. The newborn's APGAR score can be calculated.
2. The newborn can be suitably oxygenated with a self-inflating bag and mask.
3. After intubation, the ET tube can be fixed in the correct position.

Satisfaction with simulation practice

This study used the Korean version of the Simulation Experience Satisfaction Measurement Tool by Yoou and Kwon (2015)—a translation of the Satisfaction with Simulation Experience scale developed by Levett-Jones et al. (2011)—where the satisfaction with simulation practice was standardized based on the verification of its reliability and validity. This tool consisted of 18 questions concerning three areas: clinical learning, clinical effects and reflecting. Responses are recorded on a five-point Likert scale ranging from "not at all" (1 point) to "very much so" (5 points). Higher scores indicate higher satisfaction with the simulation exercise. Cronbach's α was 0.78 in a preceding study (Yoou & Kwon, 2015) and 0.82 in this study.

Example items from the Simulation Experience Satisfaction Measurement Tool:

1. The simulation caused me to reflect on my clinical abilities.
2. The simulation enabled me to demonstrate my clinical reasoning skills.
3. Reflecting on and discussing the simulation enhanced my learning.

Clinical judgement

Lasater's (2007) Clinical Judgment Rubric was developed based on Tanner's (2006) clinical judgement model and translated into Korean by Shin et al. (2015), based on the verification of its reliability and validity. This tool comprises 11 items in four areas: recognition, interpretation, response and reflection. Responses are measured on a four-point Likert scale: beginning (a), developing (b), accomplished (c) and exemplary (d). Higher scores indicate higher clinical judgment. Cronbach's α was 0.88 in both the original (Lasater, 2007) and translation studies (Shim & Shin, 2015).

The clinical judgement rubric tool can be used to observe video footage of nursing students' simulations and debriefings. In this study, Cronbach's α was 0.86 and the intraclass correlation was 0.83.

Example items from the Clinical Judgment Rubric:

1. *Components noticing*: Focused observation (Assessing if newborn resuscitation is necessary).
2. *Interpreting*: Prioritizing data (Grasp the evaluation results and identify the stage of Neonatal CPR algorithm).
3. *Responding*: Well-planned intervention/flexibility (Immediately assess changes in the newborn's condition and promptly contact physician).
4. *Reflecting*: Commitment to improvement (Identifying strengths and weaknesses of the nursing performed during simulation running).

Degree of anxiety

This study used the State-Trait Anxiety Inventory developed by Spielberger (1972) and translated into Korean by Kim and Shin (1978). This tool is designed to measure the degree of anxiety, with responses rated on a four-point Likert scale ranging from "not at all" (1) to "very much so" (4). A score below 30 indicates low or no anxiety and 31 or above indicates medium to high levels of anxiety. In a preceding study (Kim & Shin, 1978), Cronbach's α was 0.93 and in this study, it was 0.94.

Example items from the State-Trait Anxiety Inventory:

1. At the time of simulation, I am extremely nervous.
2. At the time of simulation, I am confused and do not know what to do.
3. At the time of simulation, I am excited and have no idea what to do.

3.5 | Analysis

The collected data were analysed using SPSS 19.0, and parametric methods were used as the data were normally distributed. Homogeneity tests on the general characteristics and dependent variables of groups were conducted using the chi-square test, Fisher's exact test and independent *t* test. Independent *t* tests for the pre-post-dependent variables of the two groups were also performed. Critical thinking, which showed a significant difference between the two groups in the homogeneity test, was analysed using Kolmogorov–Smirnov test, Fisher's exact test, chi-square test and independent two-sample *t* test. The average differences between the pre- and postintervention scores of the two groups were analysed using repeated-measures analyses of covariance.

3.6 | Ethics

This study was reviewed and approved by the institutional review board of Chungwoon University (IRB # 201906-001) before the start of the research. The participants were informed that their privacy and confidentiality were absolutely guaranteed and that they could leave the study at any time to no disadvantage. Further, the participants were informed that the survey data were used for research purposes only.

4 | RESULTS

4.1 | Pre-intervention characteristics

No significant differences were found between groups related to sex ($\chi^2 = 0.13$, $p = .205$) or academic performance ($\chi^2 = 4.79$, $p = .188$), verifying the homogeneity of variance between the groups (Table 1). The homogeneity of the pre-intervention dependent variables between the two groups was tested. Results showed that there were no significant differences between the groups in knowledge related to neonatal emergency care ($t = 0.61$, $p = .539$), confidence in nursing practice ($t = 0.69$, $p = .460$), satisfaction with simulation practice ($t = 0.58$, $p = .563$), clinical judgment ($t = 0.63$, $p = .169$) and anxiety level ($t = -0.82$, $p = .410$). Thus, the results indicated that the two groups were largely homogeneous. However, a significant difference was found in critical thinking ($t = -2.20$, $p = .031$) between the groups, indicating insufficient evidence of homogeneity of variance (Table 1).

4.2 | Hypothesis tests

Hypothesis 1. The knowledge score of neonatal emergency care of the experimental group increased from pre-intervention (13.23 *SD* 4.54) to postintervention (15.06 *SD* 5.01), while that of the control group decreased from pre-intervention (12.40 *SD* 3.34) to postintervention (12.20 *SD* 3.41). ANCOVA using the prior knowledge score as a covariate revealed no significant mean differences scores ($F = 0.64$, $p = .524$) between the two groups. Thus, Hypothesis 1 was rejected.

Hypothesis 2. The critical thinking score of the experimental group increased from pre-intervention (94.69 *SD* 10.67) to postintervention (98.54 *SD* 11.15), while that of the control group decreased from pre-intervention (101.50 *SD* 10.68) to postintervention (102.13 *SD* 12.14). ANCOVA using the prior critical thinking score as a covariate revealed statistically significant mean differences ($F = 2.28$, $p = .026$) between the two groups, respectively. Thus, hypothesis 2 was supported.

Hypothesis 3. The self-confidence score of the experimental group increased from pre-intervention (53.26 *SD* 7.34) to postintervention (57.57 *SD* 6.35), while that of the control group decreased from pre-intervention (52.40 *SD* 5.54) to postintervention (54.23

TABLE 1 General characteristics and dependent variables ($N = 65$)

Characteristics	Categories	Experimental group ($N = 35$) *N* (%)	Control group ($N = 30$) *N* (%)	χ^2 or *t*	*p*
Sex	Male	5 (14.2)	1 (3.3)	0.13[a]	.205
	Female	30 (83.8)	29 (96.7)		
Grade point average	<3.0	4 (11.4)	2 (6.7)	4.79	.188
	3.0–3.4	12 (34.2)	16 (53.3)		
	3.5–3.9	17 (48.5)	8 (26.7)		
	≥4.0	2 (5.7)	4 (13.3)		
Experiences of simulation – Yes		35 (100.0)	30 (100.0)		
Knowledge, *M* (*SD*)		13.23 (4.54)	12.40 (3.34)	0.61	.539
Critical thinking, *M* (*SD*)		94.69 (10.67)	101.50 (10.68)	−2.20	.031
Self-confidence, *M* (*SD*)		53.26 (7.34)	52.40 (5.54)	0.69	.460
Learner's satisfaction, *M* (*SD*)		45.63 (7.34)	43.73 (8.72)	0.58	.563
Clinical judgment ability, *M* (*SD*)		20.12 (5.52)	19.86 (3.65)	0.63	.169
Anxiety, *M* (*SD*)		45.42 (7.45)	43.97 (8.65)	0.82	.410

Abbreviations: M, Mean; *SD*, Standard Deviation.

[a]Fisher's exact test.

TABLE 2 Comparison of Dependent Variables between Groups at Postintervention ($N = 65$)

		Pre-intervention	Postintervention	Pre- and post-differences		Analysis of covariance
Variables	**Groups**	***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**	***t* (*p*)**	***F* (*p*)**
Knowledge	Experimental group	13.23 (4.54)	15.06 (5.01)	1.83 (6.52)	1.46 (.148)	0.64 (.524)
	Control group	12.40 (3.34)	12.20 (3.41)	−0.20 (3.53)		
Critical thinking	Experimental group	94.69 (10.67)	98.54 (11.15)	3.85 (12.37)	2.59 (.021)	2.28 (.026)
	Control group	101.50 (10.68)	102.13 (12.14)	0.63 (12.84)		
Self-confidence	Experimental group	53.26 (7.34)	57.57 (6.35)	4.31 (8.82)	1.27 (.020)	2.35 (.022)
	Control group	52.40 (5.54)	54.23 (4.85)	1.83 (5.81)		
Learners' satisfaction	Experimental group	45.63 (7.34)	44.00 (4.92)	−1.63 (8.97)	−1.30 (.198)	0.94 (.352)
	Control group	43.73 (8.72)	42.50 (7.83)	−1.23 (9.62)		
Clinical judgment ability	Experimental group	20.12 (5.52)	27.51 (3.98)	7.39 (7.42)	1.33 (<.001)	6.76 (<.001)
	Control group	19.86 (3.65)	23.81 (3.12)	3.95 (4.29)		
Anxiety	Experimental group	45.42 (7.45)	43.97 (8.65)	−1.63 (8.97)	0.90 (.373)	0.04 (.572)
	Control group	43.97 (8.65)	42.19 (7.93)	−1.78 (8.76)		

Abbreviations: M, Mean; *SD*, Standard Deviation.

SD 4.85). ANCOVA using the prior self-confidence score as a covariate revealed statistically significant mean differences ($F = 2.35$, $p = .022$) between the two groups, respectively. Thus, hypothesis 3 was supported.

Hypothesis 4. The satisfaction score of the experimental group decreased from pre-intervention (45.63 *SD* 7.34) to postintervention (44.00 *SD* 4.92) and that of the control group also decreased from pre-intervention (43.73 *SD* 8.72) to postintervention (42.50 *SD* 7.83). ANCOVA using the prior score of learners' satisfactions as a covariate revealed no significant mean differences ($F = 0.94$, $p = .352$) between the two groups. Thus, hypothesis 4 was rejected.

Hypothesis 5. The clinical judgement ability score of the experimental group increased from pre-intervention (20.12 *SD* 5.52) to postintervention (27.51 *SD* 3.98), while that of the control group decreased from pre-intervention (19.86 *SD* 3.65) to postintervention (23.81 *SD* 3.12). ANCOVA using the prior clinical judgement ability score as a covariate revealed statistically significant mean differences ($F = 6.76$, $p < .001$) between the two groups. Thus, hypothesis 5 was supported.

Hypothesis 6. The anxiety of the experimental group decreased from pre-intervention (45.42 *SD* 7.45) to postintervention (43.97 *SD* 8.65) and that of the control group decreased from pre-intervention (43.97 *SD* 8.65) to postintervention (42.19 *SD* 7.93). ANCOVA using the prior anxiety score as a covariate revealed no significant mean differences ($F = 0.04$, $p = .572$) between the two groups. Thus, hypothesis 6 was rejected (Table 2).

5 | DISCUSSION

First, there was no difference in knowledge of neonatal emergency nursing between the experimental and control groups postintervention. On the other hand, according to the previous systematic review and meta-analysis, the flipped learning approach had significantly improved academic knowledge compared with the traditional lecture (Tan et al., 2017). Flipped learning emphasizes the importance of students' voluntary learning capabilities. Failure to include in-depth concerns and strategies on ways to enhance the efficacy of flipped learning is believed to have produced these results. Additionally, editing the video not exceeding 10–15 min is recommended, for optimum concentration (Choi, Kim, et al., 2015). A study by Danker (2015) also mentioned that online video lecture should be relatively short, no longer than 20 min, to maintain students' attention; the online training video in this study lasted 90 min. Students had too much content to focus on and learn, which was probably a primary determinant in the apparent failure in increasing knowledge levels. Therefore, future research needs to reduce the learning time in online training materials. Teachers should strengthen their role as supporters and facilitators in encouraging learners to learn in online and offline environments. In addition, quizzes and oral tests were provided to both groups as pre-simulation briefing activities in this study may have indicated no knowledge gap between the two groups.

This study showed that critical thinking skills increased in the experimental group as compared with the control group. A previous study (Sharoff, 2015) also enhanced critical thinking skills after providing pre-simulation briefing materials. In research on the development of simulation scenarios and effectiveness verification of emergency care cases (Cerra et al., 2019), education and experience were highlighted as playing a major role in enhancing critical thinking. In this study, nursing students experienced neonatal emergency care through simulation, which was an unusual opportunity. Additionally, nursing students received neonatal care and resuscitation education using online video footage

through the flipped learning method in the pre-simulation briefing, which appeared to improve critical thinking. Evidence indicated that nurses' high critical thinking skills translate to better decision-making in emergencies and lower patient mortality rates (Chau et al., 2015; Tumapang, 2018).

The experimental intervention was effective in increasing nursing confidence in the experiment group relative to the control group. In a previous study, when pre-simulation briefing based on Tanner's clinical judgement model was provided instead of the general pre-simulation briefing, confidence in nursing performance increased (Tyerman et al., 2016). In another previous study, where structured pre-simulation briefing was provided, nursing students' self-confidence increased more after general pre-simulation briefing (Kim et al., 2017, 2019). The International Nursing Association for Clinical Simulation and Learning (INACSL) clarified essential components of the pre-simulation briefing, namely, providing simulation background, discussing expectations about simulation, providing enough student preparation time and logical details about in-simulation situations and informed evaluation methods such as rubrics and evaluation tools (The INACSL Standards Committee, 2016; Leigh & Steuben, 2018). Previous research (Gray et al., 2017) mentioned that novice students had a lack of confidence about simulation caused by the lack of understanding the scenario and what to do. Thus, providing more specific and detailed orientation and information will make students feel adequately prepared and more confident for problem-solving and clinical decision-making (Kim et al., 2019). Moreover, flipped learning using online materials in a clinical practice showed greater improvement of nursing confidence than traditional learning (Lee & Park, 2018). This suggests that providing structured and written pre-simulation briefing materials prior to the simulation enabled learners to improve their ability to interpret and analyse scenarios independently and increased their confidence in nursing. Nevertheless, there is a lack of evidence on which the pre-simulation briefing method is more effective and preferred. Therefore, further research will be needed to compare the effectiveness of the validated pre-simulation briefing methods.

The experimental group did not have significantly higher levels of satisfaction with simulation practice than the control group. On the other hand, in a previous study, when pre-simulation briefing based on Tanner's clinical judgement model was provided instead of the general pre-simulation briefing, satisfaction with practice did increase relative to the provision of normal pre-simulation briefing (Tyerman et al., 2016). In addition, another previous study (Kim et al., 2017) showed that students who received multiple step-based pre-simulation briefings were more satisfied than those who received single or double pre-simulation briefing activities. In this study, there was no difference in satisfaction with simulation practice between the experimental and control groups, probably because the professor provided multiple pre-simulation activities and acted as a collaborator and facilitator, thus encouraging learning activities in both groups.

The experimental group had significantly higher levels of clinical judgement skills than the control group. In previous studies, when a theory-based structured pre-simulation briefing was provided instead of the normal pre-simulation briefing, clinical judgement increased, supporting this study's findings (Page-Cutrara & Turk, 2017; Sharoff, 2015). In this study, an opportunity was given to apply the components of Tanner's clinical judgement model on the cognitive thought process of the pre-simulation briefing, which played a key role in enhancing clinical judgement. In particular, the results of clinical judgment in this study were derived through observation by two experts, which is particularly significant as it provided more validity than measurement based solely on self-report.

The experimental group did not have significantly lower anxiety levels than the control group. In this study, the anxiety levels of both groups fell within the mid-range on average in pre- and postintervention, indicating that systematizing the cognitive thinking process did not lower anxiety levels. On the other hand, according to the previous study (Sharoff, 2015), receiving the pre-briefing preparatory material had significantly decreased anxiety levels. The study mentioned that cognitive demands and overload increased anxiety (Hepsomali et al., 2019). In this study, the intervention group received too much content by the online training video that lasted 90 min, which may be a major factor in the failure to decrease anxiety levels. In addition, offline group discussion, which is a learner-centred method, was not comfortable for the eastern nursing students, who were culturally more conservative in sharing personal opinions than western students (Iyer, 2015). Felicity (2018) mentioned that the professor had to encourage students to rely on themselves during the learning process. However, the study showed that faculties did not provide enough encouragement and feedback to students. Future research should explore methods to lower anxiety during nursing students' simulation practice by addressing the above problems and applying the proposed approach, such as by providing a virtual reality game instead of lecture-based materials.

5.1 | Limitations

The limitations of this study are as follows. First, the data were collected from students of a single college; therefore, the results of this study should be generalized with caution. In future studies, it is necessary to select students from various schools and countries and conduct repeated studies. Second, this programme was developed and operated in a mixed form involving face-to-face and non-face-to-face classes. It seems necessary to develop education through non-face-to-face instructions due to the coronavirus (COVID-19) pandemic. It is necessary to develop a nursing programme that incorporates non-face-to-face learning and to verify its effectiveness. Third, in this study, video lectures were provided to the intervention group during the week before simulation, while only lecture notes were provided to the control group. In this process, although the intervention group was not contacted directly, voice contact was provided one week earlier than for the control group. This could be

interpreted as an additional contact opportunity and longer contact duration; hence, careful attention was necessary in the study design and application. In future studies, to determine whether the results are due to a difference in contact period or a difference in method, it is necessary to provide a lecture video and discussion to the intervention group and to provide face-to-face lectures to the control group during the same period. In addition, it should be determined whether there are differences in results between the online video materials provided one week prior and during the first week of the simulation class. When designing a study, it is necessary to block factors other than the educational method from affecting exogenous variables through strict control.

6 | CONCLUSION

The development and application of scenarios based on the application of simple clinical skills are insufficient in preparing students for various clinical situations requiring clinical judgment and inference. Using Tanner's clinical judgement model, flipped learning was developed and applied to the pre-simulation briefing curriculum prior to the neonatal nursing simulation exercise and critical thinking, self-confidence and clinical judgement ability were significantly increased in implementation. The experience gained through the simulation training for neonatal emergency nursing—which is difficult to experience through clinical practice—has helped to promote critical thinking and build confidence. In addition, it has been reported that clinical judgement increased when a theory-based structured pre-simulation briefing was provided, instead of the normal pre-simulation briefing (Page-Cutrara & Turk, 2017; Sharoff, 2015). In this study, the components of Tanner's clinical judgement model were applied to pre-simulation briefing, which played an important role in enhancing clinical judgement ability. Due to the coronavirus disease (COVID-19) pandemic, reinforcement of non-face-to-face online education is being discussed as an educational alternative; thus, future studies should verify that online pre-simulation briefings and online simulation scenario discussions are part of clinical practice and are alternatives to a face-to-face simulation class.

ACKNOWLEDGEMENTS

I would like to extend my thanks to Prof. Yun-Hee Oh and the students who enthusiastically participated in the classes.

CONFLICT OF INTEREST

The author reports no conflict of interest.

ETHICAL APPROVAL

This study was conducted at Chungwoon University after obtaining approval (IRB # 201906–001).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Sun-Yi Yang https://orcid.org/0000-0002-7635-4812

REFERENCES

Ashcraft, A. S., Opton, L., Bridges, R. A., Caballero, S., Veesart, A., & Weaver, C. (2013). Simulation evaluation using a modified Lasater Clinical Judgment Rubric. *Nursing Education Perspectives*, *34*(2), 122–126. https://doi.org/10.5480/1536-5026-34.2.122

Cerra, C. L., Dante, A., Caponnetto, V., Franconi, I., Gazhja, E., Petrucci, C., Alfes, C. M., & Lancia, L. (2019). Effects of high-fidelity simulation based on life-threatening clinical condition scenarios on learning outcomes of undergraduate and postgraduate nursing students: A systematic review and meta-analysis. *British Medical Journal Open*, *9*(2), e025306. https://doi.org/10.1136/bmjopen-2018-025306

Chau, J. P. C., Lo, S. H. S., Choi, K. C., Chan, E. L. S., McHugh, M. D., Tong, D. W. K., Kwok, A. M. L., Ip, W. Y., Lee, I. F. K., & Lee, D. T. F. (2015). A longitudinal examination of the association between nurse staffing levels, the practice environment and nurse-sensitive patient outcomes in hospitals. *BMC Health Services Research*, *15*, 538. https://doi.org/10.1186/s12913-015-1198-0

Choi, E. A., Lee, K. E., & Lee, Y. E. (2015). Nursing students' practice experience in neonatal intensive care units. *Child Health Nursing Research*, *21*(3), 261–271. https://doi.org/10.4094/chnr.2015.21.3.261

Choi, H. S., Kim, J. E., Bang, K. S., Park, Y. H., Lee, N. J., & Kim, C. H. (2015). Applying the flipped learning model to an English-medium nursing course. *Journal of Korean Academy of Nursing*, *45*(6), 939–948. https://doi.org/10.4040/jkan.2015.45.6.939

Danker, B. (2015). Using flipped classroom approach to explore deep learning in large classrooms. *IAFOR Journal of Education*, *3*(1), 171–186. https://doi.org/10.22492/ije.3.1.10

Dillard, N., Sideras, S., Ryan, M., Carlton, K. H., Lasater, K., & Siktberg, L. (2009). A collaborative project to apply and evaluate the clinical judgment model through simulation. *Nursing Education Research*, *30*, 99–104.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Felicity, M. (2018). Speaking anxiety and its effects on participation in group discussions in L 2 classrooms. *International Journal of English Language Teaching*, *6*(3), 20–33.

Foster, J., Taylor, C., Patterson, T., & Psaila, K. (2016). Experiences of new graduate nurses working in a neonatal intensive care setting: A systematic review protocol of qualitative evidence. *JBI Database Systematic Reviews Implementation Reports*, *14*(10), 105–111. https://doi.org/10.11124/JBISRIR-2016-003169

Graan, A. C. V., Williams, M. J. S., & Koen, M. P. (2016). Professional nurses' understanding of clinical judgement: A contextual inquiry. *Health SA Gesondheid*, *21*, 280–293. https://doi.org/10.1016/j.hsag.2016.04.001

Gray, M., Rogers, D., Glynn, B., & Twomey, T. (2017). A multi-level approach to pre-briefing and debriefing in a pediatric interdisciplinary simulation. *Pediatrics and Neonatal Nursing Open Journal*, *3*(2), 27–33. https://doi.org/10.17140/PNNOJ-4-122

Hazinski, M. F., Nolan, J. P., Aickin, R., Bhanji, F., Billi, J. E., Callaway, C. W., Castren, M., de Caen, A. R., Ferrer, J. M. E., Finn, J. C., Gent, L. M., Griffin, R. E., Iverson, S., Lang, E., Lim, S. H., Maconochie, I. K., Montgomery, W. H., Morley, P. T., Nadkarni, V. M., … Zideman, D. A. (2015). Part 1: Executive summary: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Circulation*, *132*(16 Suppl 1), S2–S39. https://doi.org/10.1161/CIR.0000000000000270

Hepsomali, P., Hadwin, J. A., Liversedge, S. P., Degno, F., & Garner, M. (2019). The impact of cognitive load on processing efficiency and

performance effectiveness in anxiety: Evidence from event-related potentials and pupillary responses. *Experimental Brain Research*, *237*, 897–909. https://doi.org/10.1007/s00221-018-05466-y

INACSL Standards Committee (2016). December). INACSL standards of best practice: Simulation^{SM} simulation design. *Clinical Simulation in Nursing*, *12*(S), S5–S12. https://doi.org/10.1016/j.ecns.2016.09.005

Iyer, R. B. (2015). Blending East and West for holistic education. *Educational Research and Reviews*, *10*(3), 244–248. https://doi.org/10.5897/ERR2014.2015

Jeong, K. I., & Choi, J. Y. (2017). Effect of debriefing based on the clinical judgment model on simulation-based learning outcomes of end-of-life care for nursing students: A non-randomized controlled trial. *Korean Society of Nursing Science*, *47*(6), 842–853. https://doi.org/10.4040/jkan.2017.47.6.842

Kim, H. K., Ryu, S., & Jang, K. S. (2019). Effect of structured pre-simulation preparation and briefing on student's self-confidence, clinical judgement and clinical decision-making in simulation. *Contemporary Nurse*, *55*(4–5), 317–329. https://doi.org/10.1080/10376178.2019.1641420

Kim, J. T., & Shin, D. K. (1978). A study based on the standardization of the STAI for Korea. *New Medical Journal*, *21*(11), 69–75.

Kim, Y. J., Noh, G. O., & Im, Y. S. (2017). Effect of step-based prebriefing activities on flow and clinical competency of nursing students in simulation-based education. *Clinical Simulation in Nursing*, *13*(11), 544–551. https://doi.org/10.1016/j.ecns.2017.06.005

Korean Society of Nursing Science (2017). *Learning objectives of Bachelor of Science in nursing* (pp. 37–46). Korean Society of Nursing Science.

Lasater, K. (2007). Clinical judgment development: Using simulation to create a rubric. *Journal of Nursing Education*, *46*(11), 496–503. https://doi.org/10.3928/01484834-20071101-04

Lee, M. K., Chang, S. J., & Jang, S. J. (2017). Effects of the flipped classroom approach on the psychiatric nursing practicum course. *Journal of the Korean Academy of Psychiatric and Mental Health Nursing*, *26*(2), 196–203. https://doi.org/10.12934/jkpmhn.2017.26.2.196

Lee, M. K., & Park, B. K. (2018). Effects of flipped learning using online materials in a surgical nursing practicum: A pilot stratified group-randomized trial. *Healthcare Informatics Research*, *24*(1), 69–78. https://doi.org/10.4258/hir.2018.24.1.69

Leigh, G., & Steuben, F. (2018). Setting learners up for success: Pre-simulation and prebriefing strategies. *Teaching and Learning in Nursing*, *13*(3), 185–189. https://doi.org/10.1016/j.teln.2018.03.004

Levett-Jones, T., McCoy, M., Lapkin, S., Noble, D., Hoffman, K., Dempsey, J., Arthur, C., & Roche, J. (2011). The development and psychometric testing of the Satisfaction with Simulation Experience Scale. *Nurse Education Today*, *31*(7), 705–710. https://doi.org/10.1016/j.nedt.2011.01.004

Manetti, W. (2018). Sound clinical judgment in nursing: A concept analysis. *Nursing Forum*, *54*(1), 102–110. https://doi.org/10.1111/nuf.12303

McCartney, M. (2017). Nurses must be allowed to exercise professional judgment. *The BMJ*, *356*, j15548. https://doi.org/10.1136/bmj.j1548

Page-Cutrara, K., & Turk, M. (2017). Impact of prebriefing on competency performance, clinical judgment and experience in simulation: An experimental study. *Nurse Education Today*, *48*, 78–83. https://doi.org/10.1016/j.nedt.2016.09.012

Park, M., & Ha, S. (2016). Strategies of simulation training for improving nursing practice skills in Korea. *International Journal of Nursing and Clinical Practices*, *3*, 173. https://doi.org/10.15344/2394-4978/2016/173

Peisachovich, E. H. (2016). Succeeding on the Canadian NCLEX-RN: Incorporating experiential learning approaches in the education of internationally educated nurses. *Journal of Nursing Education and Practice*, *6*(7), 101–108. https://doi.org/10.5430/jnep.v6n7p101

Peisachovich, E. H., Murtha, S., Phillips, A., & Messinger, G. (2016). Flipping the classroom: A pedagogical approach to applying clinical judgment by engaging, interacting and collaborating with nursing students. *International Journal of Higher Education*, *5*(4), 114–121. https://doi.org/10.5430/ijhev5n4p114

Pouralizadeh, M., Khankeh, H., Ebadi, A., & Dalvandi, A. (2017). Factors influencing nursing students' clinical judgment: A qualitative directed content analysis in an Iranian context. *Journal of Clinical and Diagnostic Research*, *11*(5), JC01–JC04. https://doi.org/10.7860/JCDR/2017/25753.9822

Raymond, M., & Harrison, M. C. (2014). The structured communication tool SBAR (Situation, Background, Assessment and Recommendation) improves communication in neonatology. *South African Medical Journal*, *104*(12), 850–852. https://doi.org/10.7196/SAMJ.8684

Sharoff, L. (2015). Simulation: Pre-briefing preparation, clinical judgment and reflection. What is the connection? *Journal of Contemporary Medicine*, *5*(2), 88–101. https://doi.org/10.16899/ctd.49922

Shim, K. K., & Shin, H. S. (2015). The reliability and validity of the Lasater clinical judgement rubric in Korean nursing students. *Child Health Nursing Research*, *21*(2), 160–167. https://doi.org/10.4094/chnr.2015.21.2.160

Shin, H. S., Park, C. G., & Shim, K. K. (2015). The Korean version of the Lasater Clinical Judgment Rubric: A validation study. *Nurse Education Today*, *35*(1), 68–72. https://doi.org/10.1016/j.nedt.2014.06.009

Simko, T., Pinar, I., Pearson, A., Huang, J., Mutch, G., Patwary, A. S., Lui, M., Carberry, J., & Ryan, K. (2019). Flipped learning – a case study of enhanced student success. *Australasian Journal of Engineering Education*, *24*(1), 35–47. https://doi.org/10.1080/22054952.2019.1617650

Spielberger, C. D. (1972). *Anxiety: Current trends in theory and research* (pp. 23–29). Academic Press.

Tan, C., Yue, W. G., & Fu, Y. (2017). Effectiveness of flipped classrooms in nursing education: Systematic review and meta-analysis. *Chinese Nursing Research*, *4*(4), 192–200. https://doi.org/10.1016/j.cnre.2017.10.006

Tanner, C. A. (2006). Thinking like a nurse: A research-based model of clinical judgment in nursing. *Journal of Nursing Education*, *45*(6), 204–211. https://doi.org/10.3928/01484834-20060601-04

Thomas, P. A., Kern, D. R., Hughes, M. T., & Chen, B. Y. (2015). *Curriculum development for medical education: A six-step approach* (2nd ed., p. 300). Johns Hopkins University Press.

Tumapang, L. G. (2018). Critical thinking and decision making in nursing administration: A philosophical analysis. *International Journal of Nursing Science*, *8*(4), 73–76. https://doi.org/10.5923/j.nursing.20180804.03

Tyerman, J., Luctkar-Flude, M., Graham, L., Coffey, S., & Olsen-Lynch, E. (2016). Pre-simulation preparation and briefing practices for healthcare professionals and students: A systematic review protocol. *JBI Database System Reviews and Implement Reports*, *14*(8), 80–89. https://doi.org/10.11124/JBISRIR-2016-003055

Tyerman, J., Luctkar-Flude, M., Graham, L., Coffey, S., & Olsen-Lynch, E. (2019). A systematic review of healthcare pre-simulation preparation and briefing effectiveness. *Clinical Simulation in Nursing*, *27*, 12–25. https://doi.org/10.1016/j.ecns.2018.11.002

Wyckoff, M. H., Aziz, K., Escobedo, M. B., Kapadia, V. S., Kattwinkel, J., Perlman, J. M., Simon, W. M., Weiner, G. M., & Zaichkin, J. G. (2015). Part 13: Neonatal resuscitation: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*, *132*(suppl 2), S543–S560. https://doi.org/10.1161/CIR.0000000000000267

Yoo, S. Y. (2013). Development and effects of simulation-based education program for newborn emergency care. *Journal of Korean Academy Nursing*, *43*(4), 468–477. https://doi.org/10.4040/jkan.2013.43.4.468

Yoon, J. (2004). *Development of an instrument for the measurement of critical thinking disposition*. Catholic University, Seoul. In nursing. [Unpublished doctoral dissertation].

Yoou, S. K., & Kwon, H. J. (2015). Study about the satisfaction with simulation practice course experience on ACLS of paramedic students. *Journal of the Korea Academia-Industrial Cooperation Society*, *16*(10), 6647–6654. https://doi.org/10.5762/KAIS.2015.16.10.6647

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Yang S-Y. Effectiveness of neonatal emergency nursing education through simulation training: Flipped learning based on Tanner's Clinical Judgement Model. *Nurs Open*. 2021;8:1314–1324. https://doi.org/10.1002/nop2.748