Application of High Fidelity Simulation for Acquisitions of Nursing Skills: Nursing Students' Perspective

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Abstract

High fidelity simulation is known to improve problem solving and critical thinking skills as well as professional role acquisitions in nursing students. This descriptive study examined the perceptions of 186 culturally diverse baccalaureate nursing students enrolled in fundamentals of nursing and senior preceptorship courses about their experience in high fidelity simulation activities. Perceptions were examined in relation to the acquisition factors of nursing skills using the Simulation Evaluation Questionnaire and open-ended questions in two simulation labs at the end of each simulation session during academic years 2008-2011. The results indicated that the majority of students agreed or strongly agreed that the simulation experiences helped them prepare for clinical practice. Ninety five percent of the students reported that they were able to reflect on their own simulation experience; and 82% agreed or strongly agreed that they were able to problem solve and critically think while they participated in simulation activities. With the clearly defined scenario objectives, there were better ratings of problem solving and critical thinking of students during the simulation activity ($r = 0.61$, $p < 0.002$). Those who had the chance to problem solve and critically think were able to communicate more openly about simulation experiences during debriefing ($r = 0.704$, $p = 000$). The most important nursing techniques that they learned from simulation experiences included skills on how to assess patients' baseline data, communicate with patients/families using interpersonal communications, mediate a person's frustration efficiently while sticking to the goals, and deal with social aspects of care. Students reported that they least liked about simulations as they felt they were pressed and put on the spot and having to act in front of the class. Suggestions included sufficient scenario activity time and hands-on experiences for the future. Findings suggest that the students valued the high fidelity simulation as an effective medium for improving their clinical skill acquisitions.

Key words: *High fidelity simulation, nursing students, acquisition of nursing skills, problem solving and critical thinking*

1. Introduction

Currently, a substantial number of nursing educators utilize the high fidelity simulation as a teaching strategy to meet a variety of learning needs of students that are ever technologically competent. The high fidelity simulation has been useful for faculty teaching theoretical concepts, evaluating clinical skills, and assessing students' clinical judgment [1] as well as practitioners identifying and intervening the deteriorating patient as an effective teaching modality [2]. The use of high fidelity simulations allows students to build competency in nursing knowledge, skills and attitude while examining their performance without damaging to actual patients. The application of high fidelity simulated-learning environments also has escalated as a result of growing concerns relating to patient safety, patient litigation, lack of clinical opportunities for student nurses to gain experience, and integration of new teaching methods into nursing curricula [3]. Although there was no statistically significant change in the critical thinking scores [4], simulation activities helped students develop critical thinking and decisionmaking skills and increased clinical confidence [5, 6]. Simulation was seen as an effective learning medium for students to retain critical information [7] because it combined the use of cognitive, affective, and psychomotor skills [8] which provided students multidimensional aspects of learning. The best learning outcomes occurred when simulation was integrated into the curriculum rather than added to a crowded curriculum [9]. Consequently, students would value the integrated curriculum that utilizes simulation as a teaching-learning strategy whereby the students would receive the opportunity to practice caring for patients in a safe environment.

Simulation allows learners to exercise various nursing skills without feeling hurt due to their mistakes. Although some may feel distressed by their wrongful mistakes, learners understand that simulation is not real, and it is just an exercise in a controlled environment. This experience helps students to be aware of the importance of patient safety and improve their nursing skills. Students also have opportunities to express their learning and reflect on simulation activities. During debriefing, students could share their understanding and feelings about what went wrong. Each participant could receive feedback from the lead instructor to examine positive and negative aspects of performance so that they evaluate their perceptions on contributing their work during scenarios. To be successful, written scenarios must be realistic and workable. If scenarios are available, the facilitator needs to select most appropriate cases based on the levels of students' preparedness. It would be appropriate for students to prepare the simulation day by reviewing the major scenario along the nursing process cycles.

This study examined the perceptions of baccalaureate nursing students from diverse ethnic backgrounds about their high fidelity simulation experiences in relation to the level of competency in achieving the learning objectives and the degrees of applying problem solving and critical thinking during simulation activities; and evaluated their perceptions of establishing confidentiality and trust through their communication during simulation debriefing. The study specifically addressed the following research questions: (a) What were the perceptions of nursing students about the high fidelity simulation experiences?; (b) how competent did nursing students feel in applying problem solving and critical thinking during simulation scenario sessions?; (c) was there a relationship between the perceived level of achieving learning objectives and the self-perceived competency in applying problem solving and critical thinking during simulation activities in students?; (d) was there a relationship between the level of selfperceived competency in simulation scenario activities and the level of selfperceived debriefing skills in students?; and (e) was there a relationship between the level of self-perceived competency in simulation scenario activities and the level of self-perceived competency in the overall simulation experience?

2. Conceptual Framework

Kolb's experiential learning theory guided the study. Kolb's experiential learning theory [10] defines experiential learning as the process whereby knowledge is created through the transformation of experience. Knowledge would result from the combination of grasping and transforming experience. Kolb proposed four learning styles and stages of learning. Four learning styles identified by Kolb [10] corresponded to stages under which learners learned better. For example, (a) assimilators learned better when they were presented with logical theories to consider; (b) convergers learned better when they were provided with practical applications of concepts; (c) accommodators learned better when they were provided with hands-on experiences; and (d) divergers learned better when they were allowed to observe and collect a wide range of information [10]. Kolb [10] viewed learning as an integrated process with each stage being mutually supportive of and feeding into the next. It was possible for learners to enter the cycle at any stage and follow it through its logical sequence.

Kolb's four-stage learning cycle [10] showed how simulation experience was translated through reflection into concepts, which in turn was used as guides for active demonstration and the choice of new clinical experiences: First stage, *concrete experience*, was where the learner actively experienced the nursing activity as participating in a simulation scenario with a given role; second stage, *reflective observation*, was when the learner consciously reflected on that experience as observed in debriefing after the simulation activity was completed; third stage, *abstract conceptualization*, was where the learner attempted to conceptualize a theoretical content of what was observed as in skills demonstration; fourth stage, *active experimentation*, was where the learner attempted to plan for a forthcoming experience as seen in patient care at clinical practice. Effective learning required a learner to progress through a cycle of all four stages [10]. For example, students having a concrete experience by attending simulation sessions followed by observation of and reflection on that simulation experience during debriefing, which would lead to the formation of new nursing concepts that would help them feel comfortable and apply experiences in practice, which then be used to experience future clinical situations resulting in new experiences.

3. Literature review

Current evidences show that students are expected to obtain knowledge and skills necessary for providing safe and effective patient care in the clinical setting. Promoting students' abilities to assimilate clinical knowledge and skills was the focus of teaching and learning strategies [11]. Although lecture was used as the primary method for teaching clinical information, it was well identified that experiential learning improved student assimilation, synthesis, and the application of clinical concepts to patient care situations [12]. Simulation was one of the strategies for implementing experiential learning that could be used across the nursing curriculum. For example, Shinnick and Woo [13] sought to determine the impact of learning style on knowledge gains after a simulation experience in prelicensure nursing students; and confirmed that knowledge gains occurred after having experiences with human patient simulation; and provided evidence that the simulation was an effective experiential teaching-learning method for nursing students in identifying types of learning styles.

High-fidelity human patient simulation (HFHPS) has been widely exploited by medical and nursing professions in the clinical setting [5, 14, 15, 16] and other disciplines such as counseling and psychology as a teaching tool. In HFHPS, fullscale, high fidelity computer-driven manikins that replicated human anatomy and patient functions, such as breathing, blinking, heartbeat and peripheral pulsating, could be programmed to reflect changes in clinical condition for skill and decisionmaking enhancement [12, 17, 18]. After each simulation, a debriefing session usually followed by a facilitator that would assist the reflective process with the students [19]. Students were able to improve their ability to communicate with other professionals and increase

confidence in providing patient care with interprofessional team members [20]. The aim of using high fidelity simulation and human patient simulation was to imitate realistic clinical events in a safe and secure environment to provide students with skills-based experiences that they might not encounter in a clinical rotation [12, 11, 18, 21].

A growing body of evidence based research documents the effectiveness and advantages of high fidelity and human patient simulation. The experience of participating in simulation addressed the diverse learning requirements of nursing students and facilitated their learning. The outcomes of studies indicated that the use of high fidelity simulation enhanced critical thinking skills [22], competence in clinical reasoning, leadership skills, decision-making, problem-solving and prioritization abilities [5, 14, 23, 24], motivation to learn [1, 23, 25]; being therapeutic [26]; and means to address quality improvement issues [27]. Although the confidence level among students participating in the high fidelity simulation method was not found to significantly differ from those students receiving the traditional lecture approach in studies [12, 28], results of other studies reported that simulations helped students gain more confidence [29, 11, 30], and nursing students participating in human patient simulation felt that their confidence in technical skills improved [31, 23, 25, 30]. Moreover, studies showed an increase in clinical judgment [32] and self-efficacy in nursing students after participating in high fidelity simulation [29, 23, 25, 33, 34]. While the evidence showing the advantages and beneficial effects of high fidelity simulation, research studies discovered several challenges and disadvantages of simulation. Research participants, for example, reported that they felt simulation situation was unreal because they already expected something would happen [35]. Sleeper and Thompson [36] claimed that the use of simulation could promote effective therapeutic communication skills and decrease student anxiety. However, when comparing a group participating in simulation activities to a control group not participating in simulation activities, there were no significant differences in critical thinking, delegation or communication skills in a study [37]. Moreover, simulation activities could cause the feelings of discomfort [26] and of anxiety or intimidation [23], which in turn might influence learning.

Both student and faculty perspectives regarding simulation have been reported in the literature. In general, students rated their simulation experiences positive [31, 38]. With high levels of satisfaction, students endorsed the integration of simulations into the curriculum [23, 21, 24]. Results of a descriptive correlational study indicated that design characteristics, particularly objectives and problem to solve, were significantly correlated with student satisfaction and selfconfidence [39]. Students identified team work [40], realism, and hands-on learning as essential characteristics when they used simulations [5, 1, 23]. Although several students reported that they "felt like an idiot" during the simulation scenarios [23], most students valued the debriefing and direct feedback as major advantages and the most important features of high-fidelity patient simulation [5, 1, 31, 23, 40].

Faculty could recognize the clinical knowledge, skills, and attitudes that students need to improve through simulation. The creative environment and repetitive practice were identified as positive factors of simulation [41]. Faculty believed that the high fidelity simulation to be an effective teaching strategy [13] however the substantial numbers of faculty did not receive formal simulation training and had limited experiences using the high fidelity simulator [42]. Nonetheless, underutilization of the high fidelity simulation by nurse faculty or reluctance to integrate simulation was prevalent [42, 43]. Faculty reported that they would increase the use of the simulation activities [44] if they had additional time, received support from lab personnel [41, 42], and more education or training.

The benefits and challenges of using the high-fidelity human simulator as a teaching strategy in nursing have been documented in the literature. It appears that it is an effective approach to prepare students for the ever-changing clinical environment. As faculty, we believe it is important to increase the utilization and implementation of high-fidelity simulation experiences for nursing students. The purpose of this study was to describe the high fidelity simulation experience of nursing students enrolled in fundamentals of nursing and

senior preceptorship courses, as well as to examine the acquisition factors of the nursing skills of students in relation to their simulation experience.

4. Method and Design

A descriptive study assessed the acquisition factors of nursing skills, such as self-perceived problem solving and critical thinking skills of 186 culturally diverse students participated in simulation sessions. Students were enrolled in fundamentals of nursing and senior preceptorship courses in a baccalaureate nursing program at a State -funded California University. As the collaborative innovation project, we developed and implemented our high fidelity simulation technologies in the nursing program during academic year 2008. The format used for the program included student participation of two 3- hour simulation sessions during the quarter. Each simulation session consisted of 10 minutes of preparation, 30 minutes of simulation activities using the prewritten scenarios and 30-45 minutes of debriefing. Scenarios used for students in fundamentals of nursing included application of nursing process cycles, diabetes teaching, cardiopulmonary function, renal function, isolation techniques, insulin and injectable medications management; and the preceptorship course included code blues, sepsis, pneumonia and digital toxicity managements. Students signed the consent forms prior to participating in the study. Of the 242 available students, a sample of 186 completed the questionnaire. Demographic data indicated that the majority of students described as female (n = 145), beginning nursing students (n = 129). The students' age ranged from 20 to 52 years.

4.1 Instrument

The Simulation Evaluation Questionnaire was used to collect data from students. This instrument was developed and content analyzed by the authors. Three expert members teaching simulation and nursing courses reviewed the questionnaire which was then revised according to their recommendation. Evaluation of the questionnaire by the nursing faculty and staff helped to establish content validity. The questionnaire was also administered to new graduate nurses hired by the clinical agency as a pilot study for their feedback. After comments were evaluated, the questionnaire was again revised to the format used for this study.

The questionnaire was divided into four categories. The first category consisted of assessment of simulation scenario that evaluated perception of students' learning objectives and knowledge about scenario content. The second category consisted of debriefing experiences that evaluated perceptions of students' ability to reflect on their own simulation experience. The third category evaluated overall perception of students' simulation activities in preparation and applicability of clinical practice as results of the simulation experiences. The fourth category consisted of five qualitative questions that evaluated the overall narrative simulation experience; such items as the most important things that students learned, least liked about simulation, how they felt about the experience, suggestion for improvement, and future scenarios. Each item in categories was derived from literature and content analyzed by three expert nurses who received three levels of simulation trainings by Laerdal and expert trainers. This instrument was a self-administered 21-item questionnaire using a 5-point Likert scale (1 = strongly agree and 5 = strongly disagree). Specifically, Item 1 ('Learning objectives were clearly defined') to 21 ('I would like to participate in another simulation experience') were derived from the literature on the theoretical perspective of the nursing simulation and the anticipated outcomes of a simulation experience.

4.2 Data collection

After approval of the study by the institutional review board at the university, the questionnaire was administered to the students at the end of each simulation session. The study was explained during orientation, and each student was requested to read and sign the confidential informed consent voluntarily. Also students were informed that their responses would remain confidential. The questionnaires were completed approximately in 10-15 minutes. A designated simulation lab staff collected anonymous questionnaires after they were completed by participants. Collected materials were kept in the researcher's locked cabinet for data analysis.

Data were collected using the 21-item Likert scale Simulation Evaluation Questionnaire that elicited simulation scenarios, debriefing, and simulation experiences. Each category was coded for computer data analysis, using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics included means, medians, standard deviations and cross-tabulations. For six open-ended questions, major concepts and themes were identified and categorized.

Summary variables were computed to gauge the per-student average perception of simulation scenario from the first ten questions of the Simulation Evaluation Questionnaire, the per-student-average perception of debriefing rating from the second seven questions of the Questionnaire, and the per-student-average perception of the third four questions of the overall scenario experience respectively. The Pearson product moment correlation coefficient was used to show the relationships between individual items among the groups. Bonferonni's adjustment for multiple comparisons was used to adjust the level of significance. Findings are provided in Results section.

5. Results

The Simulation Evaluation Questionnaire measured nursing students' perceptions of understanding simulation scenarios and learning objectives used in scenarios; and their perception of competency in applying problem solving and critical thinking during simulation activities, participating in debriefing, and following ground rules of simulation activities such as confidentiality and trust.

The results here summarized (1) baccalaureate nursing students' perceptions of high fidelity simulation scenario experiences in acquiring learning objectives; (2) baccalaureate nursing students' self-perceived competency in applying problem solving and critical thinking during simulation scenario activities; (3) baccalaureate nursing students' perceptions of acquiring debriefing skills such as openly communicating about simulation experiences and establishing confidentiality and trust. The research questions addressed were: (a) was there a relationship between the perceived level of achieving learning objectives and the self-perceived competency in applying problem solving and critical thinking during simulation activities in students?; (b) was there a relationship between the level of selfperceived competency in simulation activities and the level of self-perceived debriefing skill in students?; and (c) was there a relationship between the level of self-perceived competency in simulation activities and the level of self-perceived competency in the overall simulation experience?

The demographic summary revealed that the participants ranged in their age from 20 to 54 years with a mean age of 25 (median age 26) and the most frequent age of 23. The majority of the students were female (78%). Over half (55%) reported having previous healthcare experience (see Table 1).

Table 1 Demographic characteristics of the baccalaureate nursing students (n = 186)

Demographic Characteristics	Number (n)	Percentage (%)
Age		
20 - 29	**92**	**50**
30 - 39	**54**	**29**
40 - 49	**21**	**11**
50 - 59	**10**	**5**
Missing data	**9**	**5**
Gender		
Female	**145**	**78**
Male	**41**	**22**
Ethnic Background		
Asian American	**84**	**45**
Black	**12**	**7**
Caucasian	**63**	**34**
Hispanic	**21**	**11**
Missing	**6**	**3**
Healthcare Work Experience		
Yes	**102**	**55**
No	**84**	**45**
Student Level		
Beginning	**129**	**69**
Senior	**57**	**31**

To assess the perceptions of the nursing students about high fidelity simulation experiences and their competency in achieving learning objectives, items 1 through 10 on the Simulation Evaluation Questionnaire were used. Table 2 displays the mean and standard deviation for these ten items and the percentage of students who responded either 'agree' to 'strongly agree.' Ninety-five percent of the students indicated that they agreed or strongly agreed that the simulation objectives and expectations were made clear, and experiences helped

them prepare for clinical practice; only five percent (5%) indicated that they disagreed; and no students indicated that they strongly disagreed. The majority of the participants responded that they agreed or strongly agreed that they were able to recognize the knowledge gap (94%), received opportunities to work collaboratively with other participants (92%), and understood their roles (94%) and others' (95%) while experiencing scenario activities. These statements indicate that the majority of the students valued the structured simulation sessions and were aware of the importance of working collaboratively with others and understanding their roles and others' while participating in simulation activities. Data indicated that 82% of the participants agreed or strongly agreed that they were able to problem solve and critically think while they participated in simulation activities; 87% reported that they were comfortable with their knowledge of the clinical content covered during the simulation scenario; and 74% of the participants felt comfortable using the simulation equipment. Twenty-four percent of the students disagreed that they were comfortable using simulation equipment. Ninety-one percent agreed or strongly agreed that simulation scenarios resembled a real life clinical situation. However nine percent of the participants disagreed on simulation scenario resembling a real life clinical situation.

Table 2 Summary statistics of the student responses to simulation scenarios of (n = 186)

Simulation Scenarios	N (%)	*Mean (SD)	% Responses on agree to strongly agree
1. Having clearly defined learning objectives	**183 (98%)**	**1.31 (0.53)**	**95%**
2. Able to recognize knowledge gap	**179 (96%)**	**1.29 (0.56)**	**94%**
3. Opportunity to work collaboratively with other participants	**179 (96%)**	**1.39 (0.71)**	**92%**
4. Understanding my roles in simulation	**174 (94%)**	**1.38 (0.64)**	**94%**
5. Understanding the roles of others	**179 (96%)**	**1.36 (0.52)**	**95%**
6. Preparation of simulation content	**179 (96%)**	**1.86 (0.85)**	**77%**
7. Comfortable with clinical simulation content	**174 (94%)**	**1.63 (0.71)**	**87%**
8. Able to problem solve and critically think	**179 (96%)**	**1.59 (0.74)**	**82%**
9. Comfortable using simulation equipment	**179 (96%)**	**1.83 (0.87)**	**74%**
10. Simulation scenario resembles a real life clinical situation	**183 (98%)**	**1.46 (0.65)**	**91%**

***Note. 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree**

The second part of the Simulation Evaluation Questionnaire addressed the content on debriefing that evaluated students' ability to reflect on their simulation experience. All participants reported that they agreed or strongly agreed on the following four items: Establishing confidentiality and trust; given opportunity to express their thoughts and feelings; receiving constructive feedback; and teaching strategies used being helpful and effective. Furthermore, 98% of the students agreed or strongly agreed to actively participating in debriefing and giving open communication channels. Ninety five percent (95%) of the students reported that they were able to reflect on their own simulation experience. Table 3 shows the mean and standard deviations for the average of the items on the debriefing category. The average response for the each item was between

agreed and strongly agreed. There was only one item with 'disagree' indicated; for example, two students reported that they disagreed to be 'able to reflect on their own simulation experience.'

Table 3 Summary statistics of the student responses to debriefing items (n = 186)

Evaluation of Debriefing	N (%)	Mean (SD)	% Responses on Agree to Strongly Agree
11. Establishing confidentiality and trust	179 (96%)	1.20 (0.4)	100%
12. Actively participating in debriefing	179 (96%)	1.15 (0.4)	98%
13. Given opportunity to express my thoughts, ideas and feelings	179 (96%)	1.20 (0.4)	100%
14. Given open communication channels	179 (96%)	1.18 (0.42)	98%
15. Receiving constructive feedback	185 (98%)	1.04 (0.2)	100%
16. Able to reflect own simulation experience	179 (96%)	1.23 (0.5)	95%
17. Communication and teaching methods used being helpful and effective	179 (96%)	1.04 (0.2)	100%

Note. 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree

The third part of the Simulation Evaluation Questionnaire addressed the overall simulation experience of students' ability in preparing for clinical practice as a result of simulation activities. The majority of the students reported that they agreed or strongly agreed on each item of the overall category. For example, 98% of the students reported that they agreed or strongly agreed that they prepared for their clinical practice as a result of the simulation experience. Table 4 shows the mean and standard deviations for overall simulation experience items. The average response for the each item was between agreed and strongly agreed; the small standard deviations indicate very few students responded on the lower end of the scale (strongly disagree).

Table 4 Summary statistics of the student responses to overall simulation experiences (n = 186)

Overall Simulation Experience	N (%)	Mean (SD)	% Responses on agree to strongly agree
18. Establishing the simulation ground rules clearly before the scenario began	182 (98%)	1.21 (0.44)	98%
19. Simulation experience better prepared me for clinical practice	179 (96%)	1.23 (0.45)	98%
20. Enjoying the simulation experience	182 (98%)	1.21 (0.44)	98%
21. Willing to participate in another simulation experience	182 (98%)	1.22 (0.51)	95%

***Note. 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree**

To further examine the relationships, Pearson product moment correlation coefficients were calculated between the individual items. Each simulation scenario item was correlated with each debriefing and overall simulation experience item on the Simulation Scenario Questionnaire. In addition, simulation scenario items were correlated with themselves. Bonferonni's adjustment for multiple comparisons was used to adjust the level of significance. There was a significant correlation (r = 0.61, $p < 0.002$) between having clear learning objectives and the chance to problem solve and critically think during the simulation scenario. The chance to problem solve and critical think during the simulation scenario session was significantly correlated with the following debriefing items; openly communicating about the simulation experiences (r = 0.704, p = 000), reflecting on their own simulation experience (r = 0.508, p = 000), and expressing their thought and feelings (r = 0.468, p = 000) during the debriefing. The chances to problem solve and critically think of the simulation scenario item was also correlated with the following overall simulation experience items; liking to participate in future simulation experience (r = 0.470, p = 000), enjoying the simulation (r = 0.437, 0 = 000), and better prepared for clinical practice as a result of their simulation experience (r = 0.402, p = 0.001).

The simulation scenario item, comfortable using the simulation equipment, was correlated with the following debriefing and overall experience items; reflected on their own simulation experience (r = 0.414, p = 001) of the debriefing item, enjoyed the simulation experience (r = 0.397, p = 001) and better prepared for clinical practice as a result of their experience (r = 0.356, p = 0.004) of the overall simulation experience items. Furthermore, students who understood their roles during simulation scenario sessions were significantly correlated with the following four overall experience items; better prepared for their clinical practice as a result of the simulation experiences (r = 0.739, p = 000), enjoyed the simulation experience (r = 0.563, p = 000), and liked to participate in future simulation activities (r = 558, p = 000) as well as the simulation ground rules were clearly established before the scenario started (r = 0.669, p = 000).

The constructive feedback received from a facilitator(s) during the debriefing session was significantly correlated with the communication effectiveness (r = 0.58, $p < 0.001$) and enjoyable simulation experiences (r = 0.55, $p = 0.001$) of the overall items, and recognizing the knowledge gap (r = 0.40, $p <$ 0.002) of the simulation scenario item. The results are shown in Table 5, 6 and 7.

Table 5 Significant correlates of simulation scenario items (n = 186)

Simulation scenario	Simulation scenario item	Debriefing item	Overall simulation experience item
1. Clearly defined learning objectives	**Chance to problem solve and critically think (r = 0.61): Understood their roles in simulation (r = 0.54)**	**Was able to reflect on their own simulation experience (r = 0.44)**	**Enjoyed the simulation experience (r = 0.41)**
4. Understood their roles	**Understood roles of others (r = 0.84):**	**Openly talked about simulation experience (r**	**Better prepared for their clinical practice (r = 0.74):**

	Worked collaboratively (r = 0.66): Comfortable with clinical knowledge in simulation (r = 0.62)	**= 0.47): Reflected on their own experience (r = 0.42): Established confidentiality and trust (r = 0.42)**	**Ground rules were clearly established before the scenario (r = 0.67): Enjoyed simulation experience (r = 0.56): Liked to participate in future simulation (r = 56)**
8. Chance to problem solve and critically think	**Comfortable with my clinical content in simulation (r = 0.64): Understood their roles in simulation (r = 0.53): Understood others' roles (r = 0.56)**	**Openly talked about simulation experience (r = 0.70): Able to reflect on experience (r = 0.51): Expressed thoughts & feelings (r = 0.47): Actively participated in debriefing (r = 0.43)**	**Liked to participate in future simulation experience (r = 0.47): Enjoyed the simulation (r = 0.44): Better prepared for clinical practice as a result (r = 0.40)**
9. Comfortable using simulation equipment	**Resembled a real life situation (r = 0.55)**	**Reflected on their own simulation experience (r = 0.41)**	**Enjoyed the simulation experience (r = 0.40): Better prepared for clinical practice as a result of their experience (r = 0.36)**

Note. *p* values ≤ 0.000 – 0.004

Table 6 Significant correlates of debriefing items (n = 186)

Debriefing	**Debriefing item**	**Simulation scenario item**	**Overall simulation experience item**
11.Confidentiality and trust were established	**Communication and teaching method were helpful (r = 0.44): Constructive feedback received from facilitator (r = 0.44)**	**Understood their role (r = 0.42): Felt prepared for the simulation (r = 0.34)**	**Communication and teaching method were helpful (r = 0.44): Enjoyed simulation experience (r = 0.37)**
15. Constructive feedback received from a facilitator	**Established confidentiality and trust (r = 0.44): Given opportunity to express my feeling (r = 0.44)**	**Recognized the knowledge gap (r = 0.40)**	**Communicated effectively (r = 0.58): Enjoyed simulation experiences (r = 0.55)**

Note. *p* values ≤ 0.000 – 0.005

Table 7 Significant correlates of overall simulation experience items (n = 186)

Overall simulation experience	Overall simulation experience item	Simulation scenario item	Debriefing items
18, Ground rules established	**Better prepared for clinical practice as a result of the experience (r = 0.66): Liked to participate in future simulation experience (r = 0.52)**	**Understood their roles in simulation (r = 0.67): Comfortable with my clinical content in simulation (r = 0.62): Understood others' roles (r = 0.54)**	**Openly talked about simulation experience (r = 0.36): Able to reflect on my own simulation (r = 0.32)**
19. Better prepared for clinical practice as a result of the experience	**Ground rules established (r = 0.66): Enjoyed simulation experiences (r = 0.59): Liked to participate in future simulation experience (r = 0.56)**	**Understood their roles (0.74): Understood roles of others (r = 0.68)**	**Scenario resembled a real life situation (r = 0.51).**
21. Liked to participate in future simulation experience	**Enjoyed simulation experiences (r = 0.58): Better prepared for clinical practice as a result of the experience (r = 0.56): Ground rules established (r = 0.52)**	**Understood their roles in simulation (r = 0.56): Understood others' roles (r = 0.55): Chance to work collaboratively with others (r = 0.46)**	**Given an opportunity to express thoughts and feelings (r = 0.37)**

***p* values < 0.000 – 0.005**

Students' written comments were organized into five categories as followings: (a) the most important nursing skills that they learned from the simulation experience; (b) the skills they least liked about; (c) skills that they learned from this experience; (d) things that they did well during the scenario; and (e) suggestions for improvement and future scenario sessions. Table 8 provides results of qualitative data described by students after simulation experiences.

Table 8: Summary of qualitative data described by students after simulation experiences

Qualitative Questions	Main themes derived from student responses
What was the most important thing that students learned from the simulation experience?	• **Learning how to conduct the baseline assessment** • **How to use SBAR communications** • **How to use interpersonal communication skills** • **How to talk around a person's frustration efficiently while sticking to their goals** • **How to deal with the social aspect of nursing care** • **How to deal with and solve real life situations** • **How to provide safe patient care** • **How to work efficiently and effectively in a real life situation**
What did students like least about the simulation experience?	• **Feeling pressed and put on the spot** • **Having to act in front of the class** • **Unclear role definition**
	• **Not enough time** • **The size of the group is too large and not all can actively participate** • **Not knowing where everything was: Unfamiliarity on what to expect** • **Difficult to view a simulator as real because it was a machine • Pre simulation nervousness**
What did students learn from this experience?	• **Learned to look at big picture and base interventions from there** • **Prioritization skills** • **Looking at the patient from different perspectives and reasons for their symptoms** • **To think more thoroughly about what all of the primary assessments are and think out of the text more** • **To think critically about patients' conditions and tailor the quick baseline assessment** • **To pay attention to the previous shift report** • **Learned the problem solving techniques** • **How to handle stressful situations and to think critically** • **Being competent and confident** • **Impact of real life situations and value of clinical judgment**
What did students do well during the scenario?	• **Effectively communicating with patients, families, and other healthcare team members** • **Teamwork** • **Speaking to family members and explaining them more things than others** • **Felt confident in playing the role**

What are their suggestions for the future scenario sessions?	• **Adequate preparation** • **Increase time in scenario** • **Additional written materials** • **Clearly defined roles** • **More hands-on experience** • **More scenarios to work on** • **Inclusion of head to toe assessment in each scenario** • **Scenarios with patients having call lights at all times and uncooperative behaviors to healthcare personnel**

6. Discussion

This descriptive study examined the perceptions of baccalaureate nursing students about their high fidelity simulation experiences in relation to the degree of achieving the learning objectives; and evaluated their perceptions of acquiring nursing skills such as improving problem solving and critical thinking during simulation activities. The premise for this study was to explore perceptions of students' strengths and weaknesses by having them identify the most and least important things that they learned from simulation as well as to evaluate the value of using the simulation activity as a teaching strategy. The majority of the students reported that they agreed or strongly agreed that they were better prepared for their clinical practice as a result of the simulation experience. This outcome is consistent with the following study: With a sample consisting of 134 third year nursing students, Nevin, Neill and Mulkerrins [3] found the simulation sessions to be realistic and the majority of participants reported the simulation was useful in developing clinical skills, knowledge and confidence for clinical practice. The result of the current study is also supported by Butlas, Hassler, Ercor, and Haas [2] that asserted the use of high fidelity simulation providing a foundation for supporting an effective teaching modality. Students reported that the simulation experience helped them recognize their knowledge gap and prepared them understanding the scenario content. Furthermore participants reported that the simulation experience provided them the opportunity to problem solve and critically think the situations during the simulation sessions. This finding concurs with Kaddoura's study [45] in that the report indicate simulation has helped new graduates learn to improve their critical thinking and confidence, and made sound clinical decisions to improve patient outcomes. Students were comfortable with their knowledge of the clinical content covered during the simulation scenario and able to reflect on their own simulation experience.

High fidelity simulation training offers a safe and reproducible environment in which to practice nursing interventions during high risk events. In this study, simulation experiences have shown to be effective in acquiring nursing skills proficiency and improving performance in both beginning and senior nursing students, especially in acquiring a deeper understanding of technical nursing skills, communication, problem solving, and team work as well as socialization. The majority of students reported that the simulation experiences increased their nursing knowledge and skills. This result concurs with Bartlett and Thomas-Wright [46] in that their study sample also reported developing heightened skills in applying basic life-saving measures and increasing knowledge of caring and awareness of the emotions elicited by the simulation experience. It was noted that scenarios with clearer learning objectives allowed better problem solving and critical thinking for the students during simulation activities. And those who had the chance to problem solve and critically think during simulation activities were able to communicate more openly and express their thoughts and feelings during the debriefing; and became active participants in debriefing. The application of the simulation scenario also helped students understand the importance of practicing safety in patient care. This outcome is important as nurses provide a vital role in improving the quality of patient care and safety in clinical settings. Furthermore,

constructive feedback received from faculty facilitated effective communication and enjoyable simulation experiences in students, and it helped increasing their nursing knowledge. Students who prepared for the simulation activities demonstrated better understanding of their role, communicated effectively with others, and ultimately increased nursing knowledge.

Data also indicated that students obtaining constructive feedback from faculty improved their effective communication skills and demonstrated enjoyable simulation experiences. Furthermore, students who prepared for simulation sessions were better able to understand their role, increase effective communication, and therefore increase nursing knowledge.

The most important nursing skills that they learned from the simulation experience included skills on taking the baseline assessment, speaking with patients and their family using interpersonal communication skills, dealing with the social aspect of nursing care which could be overwhelming, and providing safe patient care. Students also reported that the simulation helped them learn how to address the patient concerns through effective communication, reducing anxiety, and prioritizing the patients' needs.

Several students reported that they least liked about simulations as they felt they were pressed and put on the spot and having to act in front of the class. They experienced unclear role definition and felt that they did not have sufficient time. Students in Nevin and colleagues' study identified the issues of requiring preparation for simulation and more formalized structure for debriefing as their suggestions [3]. Students in our study suggested the following content in the future simulation activity; increasing scenario time, additional written materials and preparation, more hands-on, and inclusion of head to toe assessment. Although the substantial numbers of issues were reported, the majority of participants perceived the simulation activities to be lively experiences and as an effective teachinglearning strategy in improving their clinical skills, especially clinical judgment and problem solving.

Simulation based teaching has been popular improving critical thinking and skills acquisitions of students who are technologically competent. The uses of simulation in this study have shown the following advantages: Simulation helped students a deeper understanding of technical skills and team work, problem solving, communication. It also helped students the importance of practicing safety in patient care, and consequently helping students improve critical thinking skills.

The limitations of the study include the use of sample from only two simulation labs under one type of the nursing program. This may have had not captured additional ideas if students from a greater number of nursing programs were considered. A second limitation was variables that were beyond control including: individual students' experiences in technologies. Further research in this area that increases types of nursing program and additional geographical representation is warranted. Additionally, research using all levels of nursing students may provide resourceful information that would be valuable for the simulation.

7. Conclusion

The simulation experience provides the basic nursing students with an experience as close to an actual patient scenario as possible in a less threatening environment. It provides students to gain nursing knowledge, skills, and attitudes necessary for improving their knowledge gaps, importance of teamwork, and communication as well as problem solving and clinical judgment skills. Results of the overall study showed that the students acquired various nursing skills during and after simulation scenarios and debriefing. Outcomes of the study indicated that most of the students felt that they were better prepared for their clinical practice as a result of the simulation experience. The important finding in this study was that the clearer the learning objectives were provided, the better chance of problem solving and critical thinking in nursing students during the simulation scenario session. The selection of relevant scenario was related to increasing students' knowledge and

understanding of their roles during simulation activities. Obtaining constructive feedback from faculty facilitated effective communication of students.

7.1 Implications

Findings suggest that the students valued the simulation as an effective medium, improving their clinical skills acquisitions. Students were able to problem solve and critically think during simulation session. Findings have implications for nursing education, research and practice. Outcomes provide the evidence to support the simulation as a teaching strategy that may promote problem solving, critical thinking, and socialization as well as communication skills in students.

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9. References

[1] C.S. Bearnson, and K.M. Wiker, "Human patient simulators: A new face in baccalaureate nursing education at Brigham Young University," Journal of Nursing Education, 2005, 44(9), pp. 421-425. [2] M.W. Butlas, M. Hassler, P.M. Ercole, and G. Rea, "Effectiveness of high-fidelity simulation for pediatric staff nurses education," Pediatric Nursing 2014, 40(1), pp. 27-32, 42.

[3] M. Nevin, F. Neill, J. and Mulkerrins, "Preparing the nursing student for internship in a preregistration nursing program: Developing a problem based approach with the use of high fidelity simulation equipment," Nurse Education in Practice, 14(2), 2014, 154-159.

[4] M.A. Shinnick, and M.A. Woo, "The effect of human patient simulation on critical thinking and its predictors in prelicensure nursing students," Nurse Education Today, 33(9), May 6, 2013, pp. 1062-1067. [5] A.D. Ackermann, G. Kenny, and C. Walker, "Simulator programs for new nurses' orientation: A retention strategy," Journal for Nurses in Staff Development, 23(3), 2007, pp. 136-139.

[6] A.N. Lucas, "Promoting continuing competence and confidence in nurses through highfidelity simulation-based learning," Journal of Continuing Education in Nursing, 45(8), Aug 2014, pp. 360-365.

[7] T.R. Kirkman, "High fidelity simulation effectiveness in nursing students' transfer of Learning," International Journal of Nursing Education Scholarship, 2013, doi: 10.1515/ijnes-2012-0009. [8] D. Spunt, D. Foster, and K. Adams, "Mock code: A clinical simulation module," Nurse Educator, 2004 Sep-Oct, 29(5), pp. 192-194.

[9] K. Masters, "Journey toward integration of simulation in a baccalaureate nursing curriculum," The Journal of Nursing Education, 53(2), Feb 2014, pp. 102-104.

[10] Kolb, D. "Experiential learning: Experiences as the source of learning development," Saddle River, NJ, 1984, Prentice Hall.

[11] R.P. Cant, and S.J. Cooper, "Simulation-based learning in nurse education: systematic review," Journal of Advanced Nursing, 66(1), 2010, pp. 3-15.

[12] J.D. Brannan, A. White, and J.L. Bezanson, "Simulator effects on cognitive skills and confidence levels," Journal of Nursing Education, 47(11), 2008, pp. 495-500.

[13] M.A. Shinnick, and M.A. Woo, "Learning style impact on knowledge gains in human patient simulation," Nurse Education Today, 2015, pii: S0260-6917(14)00197-X. doi: 10.1016/j.nedt.2014.05.013.

[14] M.E. Bussard, "Clinical judgment in reflective journals of prelicensure nursing students," The Journal of Nursing Education. Dec 24 2014, pp. 1-5.

[15] A. Nuzhat, R.O. Salem, F.N. Al Shehri, and N. Al Hamdan, "Role and challenges of simulation in undergraduate curriculum," Medical Teacher, 2014 Apr;36 Suppl 1, pp. S69-73. doi: 10.3109/0142159X.2014.886017.

[16] E.A. Olejniczak, N.A. Schmidt, and J.M. Brown, "Simulation as an orientation strategy for new nurse graduates: An integrative review of the evidence," Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare, 5(1), 2010, pp. 52-57.

[17] R.A. Kuiper, C. Heinrich, A. Matthias, M.J. Graham, and L. Bell-Kotwall, "Debriefing with the OPT model of clinical reasoning during high fidelity patient simulation," International Journal of Nursing Education Scholarship, 5(1), 2008, Article 17.

[18] S.J. Lee, S.S. Kim, and Y.M. Park, "First experiences of high-fidelity simulation training in junior nursing students in Korea," Japan Journal of Nursing Science. Nov 2014. doi: 10.1111/jjns.12062. [19] J.T. Paige, S. Arora, G. Fernandez, and N. Seymour, "Debriefing 101: training faculty to promote learning in simulation-based training" American Journal of Surgery. Jan 2015, 209(1):126-131.

[20] P.L. Smithburger, S.L. Kane-Gill, M.A. Kloet, B. Lohr, and A.L. Seybert, "Advancing interprofessional education through the use of high fidelity human patient simulators," Pharmacy Practice (Granada), 11(2), Epub Jun 30 2013, 61-65.

[21] M.B. Parr, and N.M. Sweeney, "Use of human patient simulation in an undergraduate critical care course," Critical Care Nursing Quarterly, 29(3), 2006, 188-198.

[22] L. Goodstone, M.S. Goodstone, K. Cino, C.A. Glaser, K. Kupferman, and T. Dember-Neal, "Effect of simulation on the development of critical thinking in associate degree nursingstudents" Nursing Education Perspective, 34(3), 2013, pp. 159-62.

[23] K. Lasater, "High-fidelity simulation and the development of clinical judgment: Students' experiences," Journal of Nursing Education, 2007, 46(6), pp. 269-276.

[24] M.L. Rhodes, and C. Curran, "Use of the human patient simulator to teach clinical judgment skills in a baccalaureate nursing program," CIN: Computers, Informatics, Nursing, 2005, 23(5), pp. 256-262. [25] G.T. Leigh, "Examining the relationship between participation in simulation and the levels of self-efficacy reported by nursing students" Dissertations Abstracts International, 2008a, 68(11), DAIB. (UMI No. 3288617).

[26] J.K. Anderson, and K. Nelson, "Patterns of communication in high-fidelity simulation," Journal of Nursing Education, Dec 28 2014, pp.1-6.

[27] A.W. Calhoun, M.C. Boone, A.K. Dauer, D.R. Campbell, and V.L. Montgomery, "Using simulation to investigate the impact of hours worked on task performance in an intensive care unit," American Journal of Critical Care, 2014, 23(5), 387-395.

[28] R. Maneval, K.A. Fowler, J.A. Kays, T.M. Boyd, J. Shuey, S. Harne-Britner, and C. Mastrine, "The effect of high-fidelity patient simulation on the critical thinking and clinical decision-making skills of new graduate nurses," Journal of Continuing Education in Nursing, 2012, 43(3), pp. 125-134.

[29] S.C. Beyea, L. von Reyn, and M.J. Slattery, "A nurse residency program for competency development using human patient simulation," Journal for Nurses in Staff Development, 2007, 23(2), pp. 77-82.

[30] I.J. Thidemann, and O. Söderhamn, (2013). "High-fidelity simulation among bachelor students in simulation groups and use of different roles" Nurse Education Today, Dec 2013, 33(12), pp. 15991604.

[31] J.C. Childs, and S. Sepples, "Clinical teaching by simulation lessons learned from a complex patient care scenario," Nursing Education Perspectives, 2006, 27(3), pp. 154-158.

[32] H. Shin, and M.J. Kim, "Evaluation of an integrated simulation courseware in a pediatric nursing practicum," The Journal of Nursing Education. 2014, 53(10), pp. 589-94.

[33] J.T. Paige, D.D. Garbee, V. Kozmenko, Q. Yu, L. Kozmenko, T. Yang, L. Bonanno, and W. Swartz, "Getting a head start: high-fidelity, simulation-based operating room team training of inter-professional students," Journal of the American College of Surgeons, 2013, 218(1), pp. 140-149, doi: 10.1016/j.jamcollsurg.2013.09.006.

[34] Y.S. Roh, "Effects of high fidelity patient simulation on nursing students' resuscitation-specific selfefficacy," Computer Informatics in Nursing, 2014, 32(2), pp. 84-89.

[35] G.T. Leigh, "High-fidelity patient simulation and nursing students' self-efficacy: A review of the literature," International Journal of Nursing Education Scholarship, 2008b, 5(1), Article 37.

[36] J.A. Sleeper, and C. Thompson, "The use of hi fidelity simulation to enhance nursing students' therapeutic communication skills," International Journal of Nursing Education Scholarship, 2008, 5(1), Article 42.

[37] K. Radhakrishnan, J.P. Roche, and H. Cunningham, "Measuring clinical practice parameters with human patient simulation: A pilot study," International Journal of Nursing Education Scholarship, 2007, 4(1), Article 8.

[38] H. Shin, H. Ma J. Park, E.S. Ji, and D.H. Kim, "The effect of simulation courseware on critical thinking in undergraduate nursing students: Multi-site pre-post study," Nurse Education Today, Dec 12 2014, pii: S0260-6917(14)00399-2. doi: 10.1016/j.nedt.2014.12.004

[39] S.J. Smith, and C.J. Roehrs, "High fidelity simulation: Factors correlated with nursing student satisfaction and self-confidence," Nursing Education Perspectives, 2009, 30(2), pp. 74-48.

[40] M.A. Severson, P.M. Maxson, D.S. Wrobleski, and E.J. Dozois, "Simulation-based team training and debriefing to enhance nursing and physician collaboration," Journal of Continuing Education in Nursing, Jul 1 2014, 45(7), pp. 297-303.

[41] S.E. Kardong-Edgren, A.R. Starkweather, and L.D. Ward, "The integration of simulation into a clinical foundations of nursing course: Student and faculty perspectives," International Journal of Nursing Education Scholarship, 2008, 5(1), Article 26.

[42] C.J. King, S. Moseley, B. Hindenlang, and P. Kuritz, "Limited use of the human patient simulator by nurse faculty: An intervention program designed to increase use" International Journal of Nursing Education Scholarship, 2008, 5(1), Article 12.

[43] A.R. Starkweather, and S. Kardong-Edgren, "Diffusion of innovation: Embedding simulation into nursing curricula," International Journal of Nursing Education Scholarship, 2008, 5(1), Article 13.

[44] H. Richardson, L.A. Goldsamt, J. Simmons, M. Gilmartin, and P. Jeffries, "Increasing faculty capacity: Findings from an evaluation of simulation clinical teaching," Nursing Education Perspectives. 2014 Sep-Oct, 35(5), pp. 308-14.

[45] M.A. Kaddoura, "New graduate nurses' perceptions of the effects of clinical simulation on their critical thinking, learning, and confidence." Journal of Continuing Education for Nurses, 2010, 41(11), pp. 506-516.

[46] J.L. Bartlett, J. Thomas-Wright, and H. Pugh, "An end of life simulation experience," The Journal of Nursing Education, 2014, 53(11), 659-662.