ORIGINAL ARTICLE

# Undergraduate Student Nurses' Satisfaction, Self-confidence, and Perception of High-fidelity Simulation-based Learning on Critically-ill Patients

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## ABSTRACT

**Background and Objective.** Replicating critical care practice settings in high-fidelity simulation (HFS) provides more learning opportunities to develop competencies, improve self-confidence, and learner satisfaction in a safe environment. Simulation is increasingly adopted globally as an alternative teaching strategy. Yet, data on the HFS experience of Filipino undergraduate nursing students is limited. This study describes the satisfaction, self-confidence, and perception of undergraduate nursing students on the use of HFS-based learning on critically-ill adult and pediatric patients requiring advanced life support (ALS).

**Methods.** A quantitative, descriptive, correlational study was conducted using purposive sampling on all fourth-year BS Nursing students enrolled in Critical Care Nursing course in a state university. Data were collected through an online survey on demographic data, and the students' perceptions towards high-fidelity simulation-based learning (SBL) using three tools, namely: Simulation Design Scale, Educational Practices Questionnaire, and Student Satisfaction and Self-confidence in Learning. T-test and ANOVA were used to compare the means of the variables. Bivariate analysis (Pearson's product-moment correlation) was performed to find the relationship between variables.

**Results.** A total of 86 students participated in the survey. Overall, the students were highly satisfied with the simulation experience (4.46 out of 5.0, $SD$=0.47), and had high ratings of self-confidence in SBL (4.44 out of 5.0, $SD$=0.42). Overall satisfaction level was positively related to student's perception on simulation design ($r$=0.61, $p$<0.01) and educational practices ($r$=0.59, $p$<0.01). Similarly, the students' overall self-confidence with SBL was also positively correlated with their perceptions of the simulation design ($r$=0.32, $p$<0.01), and educational practices ($r$=0.34, $p$<0.01).

**Conclusion.** Effective use of technology through HFS-based learning is useful in increasing satisfaction and self-confidence of Filipino undergraduate nursing students in caring for critically-ill patients needing ALS. Educators must highly consider all parameters of simulation design and educational practices in planning and implementing HFS-based learning to achieve meaningful learner experience.

*Keywords: simulation, high-fidelity, critical care nursing, education*



eISSN 2094-9278 (Online)
Published: July 15, 2024
https://doi.org/10.47895/amp.v58i12.10240

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## INTRODUCTION

Various teaching-learning strategies in nursing education should be geared towards developing clinical reasoning and achieving essential program outcomes. Particularly, simulation is an effective and innovative strategy in the progression of healthcare professionals' critical thinking, decision-making, technical skills, teamwork, and strengthening self-confidence in a safe learning environment.[1-4] Teaching and learning critical care might pose challenges for students, faculty, and health professionals because of its complex nature. Notably, simulation has proved useful for such area while increasing students' confidence, communication skills, efficiency in

identification of clinical worsening of patients, development of technical skills, teamwork, and clinical decision-making.[5]

Globally, simulation is increasingly being accepted as a teaching-learning tool for nursing and other health professions. Simulation-based learning (SBL) in the health professions also gained an uptake in resource-limited countries like the Philippines. A review on the use of simulation in 2018 showed that healthcare simulation in developing countries seems feasible, but there existed a need for higher-quality studies to examine its educational value.[6] Various studies showed positive outcomes on the use of simulation in the Philippines, particularly with good acceptance and increased satisfaction, confidence, and knowledge among students; however, limited research focused on the use of high-fidelity SBL in nursing.[7-9] Moreover, the use of high-fidelity simulation in developing critical care competencies in undergraduate student nurses has yet to be studied.

The current study used Kolb's experiential learning theory, together with the principles of outcomes-based education (OBE) in designing simulation activities for the care of critically-ill patients. OBE is a curricular framework and an education system focusing and organizing around what students should be able to exhibit at the end of learning experiences.[1] OBE principles include clarity of focus, expanded opportunity and support for learning success, high expectations for all to succeed, and design down from culminating outcomes.[1]

This study aimed to determine the level of satisfaction, self-confidence, and perception of undergraduate student nurses toward high-fidelity SBL experiences. Specific objectives include the following: (1) Determine the students' perceptions of the simulation design and educational practices; (2) Determine the relationship between the student nurses' satisfaction levels, and their perception of the different parameters of simulation design, and educational practices; (3) Determine the relationship between the student nurses' self-confidence levels in high-fidelity simulation, and their perception of the simulation design and educational practices. To further describe the variables above, associations between the student nurses' demographic profile, and their satisfaction and self-confidence levels were also determined.

## METHODS

### Research Design

This study used a descriptive correlational research design to address the research objectives. This design is deemed appropriate because it describes factors associated with simulation outcomes (i.e., student satisfaction and self-confidence) as used by Smith and Roehrs.[10]

### Sampling Design and Sample Size

Using purposive sampling, the study involved undergraduate fourth-year student nurses who were enrolled in a critical care nursing interventions course at a state university. The course is offered during the first semester of the fourth year in the BS Nursing program. A total of 98 students were enrolled in the course, and using a non-probability purposive sampling, participants were recruited to voluntarily join the study, after grades were computed and released.

### Research Instruments

To determine the students' perceptions of their simulation experience, participants answered online surveys using the Simulation Design Scale (Student Version), Educational Practices Questionnaire (Student Version), and Student Satisfaction and Self-confidence in Learning Scale. These instruments were developed by the National League for Nursing (2005), and are used to assess different simulation parameters from the learners' point of view.[11-13] The Simulation Design Scale is composed of five elements with a total of 20 items, namely: Objectives and Information (5 items), Support (4 items), Problem Solving (5 items), Feedback/ Guided Reflection (4 items), and Fidelity (Realism) (2 items). The instrument has excellent reliability using Cronbach's alpha ($\alpha = 0.92$). Meanwhile, the Educational Practices Questionnaire has four main elements with 16 items: Active Learning (10 items), Collaboration (2 items), Diverse Ways of Learning (2 items), and High Expectations (2 items). It also has good reliability ($\alpha = 0.86$).

The Student Satisfaction and Self-confidence in Learning Scale is a 13-item tool that evaluates the learner's satisfaction (five items) with current learning and his/her self-confidence (eight items). Reliability of this scale was tested using Cronbach's alpha with 0.94 and 0.87 for satisfaction and self-confidence, respectively. In all three instruments, the student participants answered the items using a five-point Likert scale (1 - strongly disagree, 2 - disagree, 3 - undecided, 4 - agree, and 5 - strongly agree). Additionally, demographic data of the participants were collected, including sex, age, and number of years in the BSN program. It must be noted that these instruments were not part of the course evaluation and were solely used to evaluate the specific teaching-learning activity (i.e., simulation).

### Data Collection

A simulation activity on critically-ill patients needing advanced life support using adult and pediatric high-fidelity manikins was designed and implemented as part of the critical care nursing course in the BS Nursing Program. Data collection was performed from December 2018 to December 2019. An email was sent to all students who were enrolled in the course and underwent the simulation activity in their critical care nursing course. The email contained the URL link of the informed consent and online versions of the four survey questionnaires via *Google Forms* platform. All students enrolled in the critical care nursing course underwent the simulation using both adult and pediatric high-fidelity manikins. The simulation design was guided by the International Nursing Association of Clinical Simulation and Learning (INACSL) healthcare simulation standards of

best practice, specifically involving pre-briefing, simulation design, facilitation, debriefing process, and evaluation of learning and performance.[14] The simulation was done after course didactics and before deployment to actual critical care and special units. The simulation was done in the skills and simulation laboratory in a College of Nursing at a state university. The simulation sessions were implemented using two separate case scenarios of critically-ill adult and pediatric patients needing advanced life support using high-fidelity manikins (i.e., *METIman*® and *BabySIM*®, respectively). Students were assigned in groups of six members and they responded as the code team. Each group has a team leader, medication nurse, defibrillator/CPR coach, airway, timer/recorder, and compressor. Pre-briefing and briefing lasted for about 10 minutes. Case progressions ran for about 10 minutes, with additional time for debriefs lasting for about 15 to 20 minutes. Upon completion and release of student course grades, data collection for this study commenced.

### Data Analysis

After the data collection process was finalized, responses were collated and extracted as an MS Excel sheet, and then inputted to SPSS version 23 for data analysis. Descriptive statistics were performed using frequencies, percentages, and calculation of means and standard deviations. To examine the normal distributions of continuous variables and homogeneity of variances, inferential statistics were also conducted. T-test was used to report the comparison of the mean scores of two main dependent variables (satisfaction and self-confidence) with the independent variables (demographic characteristics: sex at birth). ANOVA was used to compare mean scores of the dependent variables with three groups or more (i.e., number of years in the BSN program). Lastly, the relationships between satisfaction and self-confidence, and the students' perception on simulation design and educational practices were calculated using Pearson's product-moment correlation, with a significance value of $p<0.05$.

### Ethical Considerations

The study was registered at the UP Manila Research Grants Administrative Office, and was granted an exempted review by the UP Manila Research Ethics Board. Student participants were recruited after course completion and release of their grades to limit any possible bias or coercion. Before reaching the survey questions, informed consent was acquired from the participants. The online informed consent outlined the objectives of the study, and emphasized how their anonymity, privacy, and confidentiality will be protected, which allowed students to decide whether or not to participate in the study. It was highlighted that their participation is voluntary, and engagement or non-participation in the survey would not have any bearing on academic standing. Only those who agreed to participate were able to proceed to answer the rest of the online survey. The participants were allowed to skip answering any question or stop replying anytime. Identifiable personal information was not collected, including names and email addresses, to guarantee anonymity and protect confidentiality. Only the authors had access to the data collected from the online surveys.

## RESULTS

### Demographic Characteristics of the Participants

Out of 98 students who participated in two sessions using high-fidelity simulators, 86 (or 87.8% response rate) were able to answer the survey regarding their simulation experiences; twelve (12) recruited participants opted not to complete the survey due to undisclosed reasons. Only those who provided informed consent and proceeded to answer the survey were included in the analyses ($n = 86$). All participants who provided informed consent also completed the survey, and there were no missing data. The results showed (Table 1) that the participants were aged 19 to 23 years ($M = 21.05$, $SD = 0.97$), with more female participants ($n = 72$, 83.7%). Although the participants belonged to only one year level (4th year), the results showed that more than half of the participants are studying BSN for 4 years ($n = 52$, 60.5%), while one-third of them ($n = 28$, 32.5%) are in their fifth year of study.

### Satisfaction and Self-confidence in Simulation-based Learning

As shown in Table 2, the participants' rating of their satisfaction with and self-confidence in SBL is high ($M = 4.46$, $SD = 0.47$) and ($M = 4.44$, $SD = 0.42$), respectively. It can also be noted that the participants are highly satisfied with SBL, and reported the following: the teaching methods used were helpful and effective ($M = 4.51$, $SD = 0.55$); the simulation provided various learning materials and activities ($M = 4.60$, $SD = 0.62$); enjoyed how the instructor or faculty facilitated the simulation ($M = 4.30$, $SD = 0.77$); the materials used were motivating ($M = 4.47$, $SD = 0.59$); and the way of teaching was suitable ($M = 4.42$, $SD = 0.73$). Overall, students rated their satisfaction as high with regard to their simulation experience ($n = 78$, 90.7%).

Participants' self-confidence in SBL is also high ($M = 4.44$, $SD = 0.42$). Particularly, the highest rating is for the

**Table 1.** Demographic Characteristics of the Participants

| Demographic characteristics | *n* (%) |
|---|---|
| ***Age (M, SD)*** | 21.05 (0.97) |
| Range | 19-23 years |
| ***Sex at birth*** | |
| Male | 14 (16.3) |
| Female | 72 (83.7) |
| ***Number of years in the BSN program*** | |
| 4 years | 52 (60.5) |
| 5 years | 28 (32.5) |
| 6 years | 6 (7.0) |

**M = mean; SD = standard deviation; n = sample*

statement denoting that it is the students' responsibility to learn what needs to be learned from the simulation activity (*M* = 4.70, *SD* = 0.51). Moreover, the participants were confident that the simulation activity covered necessary critical contents (*M* = 4.63, *SD* = 0.57), and that the instructors used helpful resources in conducting the simulation (*M* = 4.56, *SD* = 0.54). Results also showed that after the simulation activities, students knew how to use what they've learned to learn critical aspects of the skills needed (*M* = 4.53, *SD* = 0.50) (i.e., providing advanced life support in critically-ill adult and pediatric patients), and they are confident that they are developing the skills to perform necessary tasks in the clinical setting (*M* = 4.49, *SD* = 0.55).

## Students' Perceptions on Simulation Design and Educational Practices

Table 3 showed that the scores of the participants' overall perception of the simulation design and educational practices were high (*M* = 4.45, *SD* = 0.32 and *M* = 4.50, *SD* = 0.31, respectively). The simulation design parameter with the highest score was *feedback and guided reflection* (*M* = 4.63, *SD* = 0.42), while *problem solving* came in second (*M* = 4.61, *SD* = 0.38) The following statements under *feedback and guided reflection* obtained the highest ratings: "*The simulation allowed me to analyze my own behavior and actions.*" (*M* = 4.72, *SD* = 0.45); "*There was an opportunity after the simulation to obtain guidance/feedback from the teacher in order to build knowledge to another level.*" (*M* = 4.65, *SD* = 0.61); and "*Feedback was provided in a timely manner.*" (*M* = 4.60, *SD* = 0.49). Notably, the following were also rated high by the student participants: "*I clearly understood the purpose and objectives of the simulation.*" (*M* = 4.74, *SD* = 0.44), and "*Independent problem-solving was facilitated.*" (*M* = 4.67, *SD* = 0.47).

On the other hand, *collaboration* (*M* = 4.55, *SD* = 0.32) and *diverse ways of learning* (*M* = 4.54, *SD* = 0.34) obtained the highest ratings under the educational practices parameter. The following specific statements received the highest perception ratings: "*The instructor was able to respond to the individual needs of learners during the simulation.*" (*M* = 4.57, *SD* = 0.30); "*Using simulation activities made my learning time more productive.*" (*M* = 4.56, *SD* = 0.32); and "*I had the chance to work with my peers during the simulation.*" (*M* = 4.55, *SD* = 0.32).

## Correlation between Satisfaction, Self-confidence, and Students' Perception on Simulation Design and Educational Practices

The results (Table 4) indicated that the participants' overall perception of the simulation design is positively correlated with their satisfaction ($r = 0.61$, $p<0.01$) and self-confidence ($r = 0.32$, $p<0.01$) in SBL. The simulation design parameter called *objectives and information* is positively correlated with both satisfaction and self-confidence levels ($r = 0.34$, $p<0.01$; $r = 0.27$, $p<0.05$). Meanwhile, satisfaction is positively correlated with *support* ($r = 0.64$, $p<0.01$), and *feedback/guided reflection* ($r = 0.56$, $p<0.01$). Although there

**Table 2.** Undergraduate Student Nurses' Satisfaction with and Self-confidence in SBL

| Satisfaction with Current Learning | Mean (*SD*) |
|---|---|
| 1. The teaching methods used in this simulation were helpful and effective. | 4.51 (0.55) |
| 2. The simulation provided me with a variety of learning materials and activities to promote my learning the medical surgical curriculum. | 4.60 (0.62) |
| 3. I enjoyed how my instructor taught the simulation. | 4.30 (0.77) |
| 4. The teaching materials used in this simulation were motivating and helped me to learn. | 4.47 (0.59) |
| 5. The way my instructor(s) taught the simulation was suitable to the way I learn. | 4.42 (0.73) |
| ***Total Satisfaction with Current Learning*** | 4.46 (0.47) |
| **Self-confidence in Learning** | **Mean (*SD*)** |
| 1. I am confident that I am mastering the content of the simulation activity that my instructors presented to me. | 4.07 (0.88) |
| 2. I am confident that this simulation covered critical content necessary for the mastery of medical surgical curriculum. | 4.63 (0.57) |
| 3. I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform necessary tasks in a clinical setting. | 4.49 (0.55) |
| 4. My instructors used helpful resources to teach the simulation. | 4.56 (0.54) |
| 5. It is my responsibility as the student to learn what I need to know from this simulation activity. | 4.70 (0.51) |
| 6. I know how to get help when I do not understand the concepts covered in the simulation. | 4.37 (0.78) |
| 7. I know how to use simulation activities to learn critical aspects of these skills. | 4.53 (0.50) |
| 8. It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time. | 4.16 (1.04) |
| ***Total Self-confidence in Learning*** | 4.44 (0.42) |

**SD = standard deviation*

**Table 3.** Student Nurses' Perception of Simulation Design and Educational Practices in SBL

| Students' Perception of Simulation Design | Mean (*SD*) |
|---|---|
| Objectives and Information | 4.45 (0.40) |
| Support | 4.09 (0.62) |
| Problem Solving | 4.61 (0.38) |
| Feedback/Guided Reflection | 4.63 (0.42) |
| Fidelity/Realism | 4.34 (0.67) |
| ***Overall Students' Perception of Simulation Design*** | 4.45 (0.32) |
| **Students' Perception of Educational Practices** | **Mean (*SD*)** |
| Active Learning | 4.48 (0.31) |
| Collaboration | 4.55 (0.32) |
| Diverse Ways of Learning | 4.54 (0.34) |
| High Expectations | 4.52 (0.37) |
| ***Overall Students' Perception of Educational Practices*** | 4.50 (0.31) |

**SD = standard deviation*

was no significant positive correlation between self-confidence and *feedback/guided reflection*, the results showed that there was a moderate positive correlation between self-confidence and *problem solving* ($r = 0.25$, $p<0.05$) and *fidelity/realism* ($r = 0.48$, $p<0.01$). This means that as the students' overall perception on the simulation design increases, their overall satisfaction with and self-confidence in SBL also increases, and vice versa.

Table 5 showed that the overall students' perception of educational practices (i.e., *active learning, collaboration, diverse ways of learning, high expectations*) in the instructor-developed simulation, is significantly positively correlated with their satisfaction with and self-confidence in SBL, respectively ($r = 0.59$, $p<0.01$; $r = 0.34$, $p<0.01$). It must also be noted that all four parameters of educational practices are positively correlated with their satisfaction and self-confidence in SBL. This means that as the students' perception of the educational practices increases, their satisfaction with and self-confidence in SBL increases, too.

**Table 4.** Correlation between Satisfaction and Self-confidence, and Student's Perception of Simulation Design

| Students' Perception of Simulation Design (*r*) | Satisfaction with current learning (*r*) | Self-confidence in learning (*r*) |
|---|---|---|
| Objectives and Information | 0.34** | 0.27* |
| Support | 0.64** | 0.19 |
| Problem Solving | 0.21 | 0.25* |
| Feedback/Guided Reflection | 0.56** | -0.08 |
| Fidelity/Realism | 0.17 | 0.48** |
| ***Overall Perception of Simulation Design*** | 0.61** | 0.32** |

**significant at p<0.05 **significant at p<0.01*

**Table 5.** Correlation between Satisfaction and Self-confidence, and Student's Perception of Educational Practices

| Students' Perception of Educational Practices (*r*) | Satisfaction with current learning (*r*) | Self-confidence in learning (*r*) |
|---|---|---|
| Active Learning | 0.60** | 0.32** |
| Collaboration | 0.51** | 0.30** |
| Diverse Ways of Learning | 0.56** | 0.26* |
| High Expectations | 0.41** | 0.41** |
| ***Overall Perception of Educational Practices*** | 0.59** | 0.34** |

**significant at p<0.05 **significant at p<0.01*

Upon further examination, the students' satisfaction ($t = 0.36$, $p = 0.36$) and self-confidence levels ($t = 0.35$, $p = 0.36$) did not have any significant differences between the type of simulator (i.e., adult versus pediatric simulator patient) used by the students during the simulation.

### Demographic Profile and Satisfaction and Self-confidence in Simulation-based Learning

There were no significant differences between male and female students regarding their satisfaction ($t = -1.71$, $p = 0.09$), and self-confidence in SBL ($t = -1.13$, $p = 0.13$) (Table 6). Similarly, there were no significant differences between the students' number of years in the college and their satisfaction ($F = 1.55$, $p = 0.22$), and self-confidence in SBL ($F = 1.00$, $p = 0.37$).

## DISCUSSION

Nursing education continued to evolve over the years, with integration of technology-assisted learning focused on learner-centered approaches and modalities. One of these approaches is simulation-based learning (SBL). The use of high-fidelity simulation as a teaching-learning strategy in nursing education has been demonstrated to enhance critical thinking, caring behaviors, and collaboration in an ethical, legal, and evidence-based environment.[15]

Demographic characteristics of student nurses who participated in this study were described. The average student age is comparable to the expected age for first-time Bachelor's course takers as projected in the Philippine context. The sex distribution of the participants is also comparable to most nursing institutions where there are more females than males because nursing has been considered a female-oriented profession.[16] Although the BS Nursing course is only a four-year program, this study had participants who have been in the program for more than four years since it included both regular and irregular (i.e., with delays caused by needing to retake course/s, or taking leave of absence) students. A variety of reasons are related to a high or increased satisfaction with HFS; and according to Jeffries' Nursing Education Simulation Framework, the outcomes of satisfaction and self-confidence are due to a combination of factors related to the demographic characteristics of the learners.[17] This is

**Table 6.** Demographic Characteristics and Student Nurses' Satisfaction and Self-confidence in SBL

| Demographic Characteristic | Satisfaction with SBL | | | Self-confidence in SBL | | |
|---|---|---|---|---|---|---|
| | *M (SD)* | *t/F* | *p* <0.05 | *M (SD)* | *t/F* | *p* <0.05 |
| ***Sex at birth*** | | -1.71 | 0.09 | | -1.13 | 0.13 |
| Male | 4.66 (0.24) | | | 4.55 (0.40) | | |
| Female | 4.42 (0.50) | | | 4.42 (0.42) | | |
| ***Number of years in the college*** | | 1.55 | 0.22 | | 1.00 | 0.37 |
| 4 years | 4.39 (0.49) | | | 4.45 (0.41) | | |
| 5 years | 4.54 (0.47) | | | 4.46 (0.43) | | |
| 6 years | 4.67 (0.27) | | | 4.21 (0.45) | | |

*M = mean; SD = standard deviation*

incongruent with the study findings, which showed that there were no significant differences in the satisfaction and self-confidence levels of participants in terms of sex. Comparatively, a study conducted in a university-based College of Nursing in Saudi Arabia had similar results and revealed that there was no statistically significant correlation between students' self-confidence and demographic characteristics.[18] The above findings are consistent with a few studies on simulation, where it was found that the experiences of student nurses of different sexes do not significantly differ.[19,20]

Remarkably, it was also found that there were no significant differences in the students' satisfaction and self-confidence levels, regardless of their number of years in the BSN program. On the contrary, a study conducted in a private university in Jordan showed that the level of self-confidence significantly varied between students with different levels of education or various number of years in the BSN program.[20] Meanwhile, the same study also found that satisfaction towards SBL did not differ among students from different year levels, i.e., new admissions versus licensed practical nursing (LPN) to registered nurse (RN) students.[20] Regardless of students' demographics, teaching critical care nursing skills and competencies is challenging because of the unique and complex nature of patients needing critical care. Opportunities for learning important skills for critical care are often limited. Simulation of critical care events using high-fidelity manikins is an ideal method to recreate complex situations because scenarios are realistic, reproducible, and eliminate threats to patient safety. Students can learn in a safe and controlled environment through HFS before handling actual critical care situations and events.

The study also revealed that the participant's satisfaction with and self-confidence in SBL are both high, similar to other studies on high-fidelity simulation.[21,22] Particularly, students were satisfied with the SBL because of the helpful and effective methods of teaching and the provision of various learning materials. Moreover, participants perceived that the instructor's strategy in facilitating the simulation fitted their way of learning and was enjoyable. Similar to previous studies involving health science and nursing students, there is a high level of satisfaction with SBL and learners' confidence in their skills.[17,23,24] Studies that utilized HFS in critical care nursing also indicated that students had high levels of satisfaction and self-confidence with SBL.[23-29] Other studies using other fidelity levels (low to medium) revealed that students' confidence levels increased after their simulation-based activities.[30,31] Meanwhile, a recent phenomenological study conducted in Italy emphasized that learners' repeated exposure to high-fidelity simulation, coupled with confidence and good attitude, could facilitate positive feelings toward the learning environment where students had to simulate caring for a critically-ill patient.[32]

This study highlighted the advantage of using simulation methods in nursing education, specifically in advanced life support. Consequently, this could impact the quality of patient care provided by student nurses. With the high satisfaction and self-confidence levels of students toward SBL, it can be established that simulation in nursing education is beneficial. Similarly, other studies have noted that SBL enhances student's satisfaction and self-confidence.[19,33] The findings of this study are consistent with other studies, which showed a high student satisfaction after palliative care simulations and OSCE in psychiatric and mental health nursing simulations.[34,35] In addition, a study conducted in the USA validates the students' increased self-confidence after undergoing high-fidelity simulation-based activities.[36]

This study also determined the student nurses' satisfaction levels and perception of the different parameters of simulation design and educational practices. Other benefits of SBL are molded by educational theories. One of which is Kolb's experiential learning theory.[37] This is based on constructivism stating that knowledge results from the process of grasping and transforming experiences. For optimal learning, Kolb's cycle must be fully experienced by the student.[37] Each phase of the cycle can be aligned in the different phases of simulation namely, concrete experience (i.e., the simulation activity), reflective observation, abstract conceptualization, and active experimentation (i.e., debriefing and evaluation). The study findings on the relationships between the students' perceptions of the simulation design and educational practices, and their satisfaction and self-confidence levels are also similar with other studies. Specifically, a study among new student nurses delivering intimate patient care reported that environment and debriefing (which are included in specific parameters of the simulation design under objectives and information, support, fidelity/realism, and feedback/guided reflection) are important elements in simulation that increase the students' satisfaction and self-confidence.[38] Furthermore, a study in a Saudi Arabian government university, showed that fidelity and objectives/information are positively correlated with the students' self-confidence in advanced cardiac life support simulations.[39] Similar to this study, a Best Evidence Practice Guide[40] emphasized that providing students with objectives before the simulation activity increased their satisfaction levels.

Receiving feedback from the simulation instructor/s is a crucial aspect of the simulation design. The current study revealed that there is a significant correlation between satisfaction and receiving feedback/guided reflection, as confirmed by previous papers.[41,42] In contrast, the study did not find significant correlations between self-confidence and feedback/guided reflection. For the students' perceptions of the educational practices in simulation, it was found that all parameters (active learning, collaboration, diverse ways of learning, and high expectations) were significantly correlated with satisfaction and self-confidence. A study that utilized a simulation group-based approach showed that interactions between the students and simulation instructors (active learning) are positively associated with their self-confidence.[43] In this study, participants had high ratings on the practices that allowed them to discuss the objectives with the instructor

and explain the concepts taught in the simulation, together with the instructor's ability to respond to individual needs of the learners before, during, and after the simulation. Lastly, the study revealed that the students' satisfaction and self-confidence did not depend on the different types of patients handled by the students (adult or pediatric). This result is congruent with a study that stated that there was no association between course type and self-confidence.[18]

In summary, the study revealed that high-fidelity simulation as a teaching-learning strategy in critical care nursing might increase undergraduate student nurses' satisfaction and self-confidence in SBL, where they may develop skills and competencies needed as future healthcare professionals in a safe environment. This study showed that SBL for nursing education, particularly involving high-fidelity manikins, is feasible in the Philippines and could offer positive outcomes. The value of SBL is also demonstrated to bridge the challenges and gap in developing undergraduate nursing competencies in the care of critically-ill patients needing advanced life support. Highlighting appropriate simulation design and considering educational practices in creating quality high-fidelity simulations for undergraduate nursing is also important to outcomes such as student satisfaction and self-confidence.

### Limitations

Despite the positive results of the study, certain limitations need to be acknowledged. First is the use of a non-probability purposive sampling in one educational institution in the Philippines, which raises concerns about the generalizability of the findings. Possible systematic sampling error or systematic bias is also acknowledged considering that the survey was distributed to participants after they received a grade in the critical care nursing course. Additionally, the use of a non-experimental, descriptive, correlational design may not fully capture the complete experience of undergraduate student nurses with simulation-based education.

Furthermore, the tools used in this survey, although found to be valid and reliable, do not assess the students' behavioral outcomes in terms of real patient interactions. Another limitation to consider is the potential influence of the Dunning-Kruger effect, where novices with limited competence in a particular domain (i.e., providing advanced life support in critically-ill patients) may overestimate their skills and self-confidence, as observed in the current sample of student nurses. With these in mind, it is recommended that future studies should explore more objective, longitudinal, experimental, or qualitative approaches to address these limitations.

## CONCLUSION

The findings of this study support the idea that high-fidelity simulation-based learning (SBL) is a valuable tool in nursing education. This study showed that undergraduate student nurses have high levels of satisfaction and self-confidence in the SBL teaching-learning activity for providing care to critically-ill patients.

Most of the parameters of simulation design and educational practices have positive correlations with the students' satisfaction and self-confidence levels; thus, nurse educators must consider all SBL parameters in designing, planning, implementing, and evaluating HFS-based activities to achieve a more meaningful learner experience. Using high-fidelity simulation in nursing education provides undergraduate student nurses with valuable hands-on experience and prepares them for real-world patient care situations. By engaging in realistic scenarios, i.e., advanced life support, they can develop critical thinking skills, sharpen their clinical judgment, and improve their ability to make efficient and accurate decisions.

### Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

### Author Disclosure

All authors declared no conflicts of interest.

### Funding Source

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. This is a researcher/self-funded study.

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