Review Article

Does the Timing of High-Fidelity Simulation Impact Student Self-Confidence and Clinical Competence? A Comparative Study: Before Clinical versus During Clinical

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Abstract

Simulation is an easily modifiable teaching method that aids in the development of critical thinking skills as well as providing opportunities to increase self-confidence levels, knowledge gains, and clinical competency. The use of simulation, more specifically, high-fidelity patient simulation has been extensively studied for use in nursing education. This teaching method has been utilized and widely supported for over a decade as an advanced form of aiding students' critical thinking development and preparation for the student to nurse transition. Using high fidelity simulation, this study utilized a non-experimental prospective quantitative design which compared a before experiential group with a during experiential group. The final sample (n = 180) consisted of entry-level baccalaureate nursing students. The p values of each of the questions are all, with the exception to question 11, greater than the cutoff for significance value of 0.05, indicating no statistical worth and the null hypothesis was accepted. The results of this study imply that specific times for use of HFS during an experiential experience does affect student self-confidence levels thus clinical competency. The overall findings do support previous research findings that the use of high-fidelity simulation in nursing education does in fact provide nurse educators with a modifiable teaching method to evaluate students' clinical decision-making efforts that may aid in development of self-confidence and clinical competency.

Introduction

The ability to find suitable facilities for placement of students for traditional clinical rotations is becoming more and more difficult as schools of nursing continue to open, thus leading to increased student numbers [1]. This increase in nursing student numbers leads to limited clinical opportunities and crowded traditional clinical facilities. Additionally, nurses who may be overwhelmed with daily workloads potentially are not able to provide students with quality one-on-one mentoring that is so vital for student's success.

Multiple factors have been identified as rational for usage of simulation. These include competition for clinical sites, shorter hospital stays, greater patient acuity, faculty shortage, and increasing numbers of nursing students. In the year 2000, the Institute of Medicine (IOM) published the report entitled, "To Err Is Human: Building a Safer Health System". This report highly recommended the inclusion of simulators and simulated experiences to assist in the reduction and prevention of errors in the clinical setting. The AACN, as cited in Benner, et al. [2] states "42,866 qualified applicants were turned away from baccalaureate schools of nursing in 2006 primarily because of a shortage of nursing faculty, clinical placement sites, and classroom space". A recent Health Resources and Services Administration's [3] report

concluded that approximately 68,000 new graduate registered nurses began their careers in 2001 and this number increased to more than 150,000 in 2012 and 2013.

Trending forward to 2025, close to two million new Registered Nurses (RNs) will enter the workforce (Assuming new RNs are produced at the current rate) and an estimated one million RNs will leave the workforce. This net growth of 952,000 new nurses will result in a national workforce of 3,849,000 RNs by 2025 [3]. Simulation is a method of teaching that is a modifiable clinical tool allowing students to learn to adapt and think critically in a safe environment. The use of simulation is a strategy in which educators can actively engage with students thereby enabling them to learn skills and apply theory in efforts of developing safe practices. By providing students with High-Fidelity Simulation (HFS) before clinical, they may be more apt to apply the learned skills and knowledge to the clinical site, thus provide quality and safe patient care. Additionally, the simulated no-fault environment provides students with a safe zone to make mistakes and learn from those mistakes. These learned areas of weakness often carry over to the clinical environment and can be responsible for increased student levels of self-confidence [4].

Student confidence is a huge issue when they attend their traditional clinical rotations. Research has shown that HFS aids in improving confidence and clinical competence, as well as increased perceptions of skills acquisition and knowledge gains. However, timing of this teaching strategy should be considered high importance. By implementing simulation days before going to the unit, the hope was that student confidence levels would be higher, thereby leading to higher levels of clinical competence. The researcher hypothesized that the increase in student confidence by utilizing HFS would optimistically help reduce pressure on staff nurses by making students more appreciated and valued in their clinical setting.

Historical Overview

Historically, the use of simulation as an educational tool has been used in the military including examples such as war games, nuclear power industries to train for disasters, and aviation such as flight simulators. However, over the past 20 years the use of simulation in education for nurses and physicians has greatly increased as a valuable commodity [5]. "Mrs. Chase" was the earliest life-sized mannequin that debuted in 1911 for nursing education purposes. She only had movable joints at first, but with continued updates, she eventually acquired various body orifices and hairstyles. She served as a training mannequin for nursing skills such as bathing, positioning and various nursing tasks like procedures. In 1960, "Resusci" or "Rescue Annie" debuted as the first manikin built specifically for CPR [6]. "Sim-One" was the name of the first high-fidelity simulator developed by Denson and Abrahamson in the late 1960s. "Sim-One" was primarily designed for use with anesthesiology, however; due to the costly model, only one was produced. "Harvey" was the next simulator to be produced in 1974. Harvey was a partial body simulator that mimicked respiratory sounds and has since been updated and is surprisingly still being used for teaching cardiopulmonary sounds. Technology has significantly advanced over the decades hence creating improved and more innovative high-fidelity models currently used for nursing education such as: Laerdal's SimNewB, SimMom, SimJunior, SimMan, and SimMan Essential [7].

For use in education, simulation should be thought of as an educational technique that either augments or substitutes real life experiences. The increasing numbers of nursing schools have consequently led to an increased number of nursing students, competitive shortages in traditional clinical placements, and overwhelmed nurses who act as preceptors for these students [1]. After a prolonged development period and recent advancements in technology, as well as the increased need for traditional clinical placements, high-fidelity simulators are becoming more and more popular in nursing education. This popularity has made it possible to engage students with sufficient fidelity that permits nursing students to learn in a realistic and meaningful way.

Recently, the National Council of State Boards of Nursing (NCSBN) performed a national simulation study. This study, done by Hayden, et al. [8] emphasizes that since the late 1990s - early 2000s, the use of high-fidelity simulators has begun to appear regularly in nursing education. This broad historical outlook of simulation in education brings us to today where the use of high-fidelity simulation aids in student development and practice of nursing skills such as cognition, critical thinking, and motor function within an environment that provides a safe place for mistakes with no patient endangerment.

Current Findings

After a comprehensive examination of eligible literature that fit the inclusion criteria, two consistent themes emerged from the researched articles, self-confidence and clinical competence, both of which can lead to quality patient care and patient safety. As mentioned earlier, nursing programs are competitive for clinical sites and because of this, the NCSBN thought that the use of simulation in nursing curriculum was a suitable solution [8]. The Joint Commission [9] National Patient Safety Goals (NPSG) and the Institute of Medicine (IOM) report, "To Err is Human: Building a Safer Health System" generated multiple initiatives that are being implemented to improve these issues. Every research study examined and synthesized referred to quality patient care and patient safety as issues of concern and how simulation can aid in improving them.

Research Question and Hypotheses

The following research question was addressed in this study:

RQ: For pre-licensure baccalaureate nursing students, will the use of simulation affect clinical competence, self-confidence, and self-efficacy if done before clinical rotations as compared to during clinical rotations?

H₀: The findings of this study will be consistent with other published results with relation to HFS. The theory is with the difference being the timing of simulation experiences, whether being provided before traditional clinical rotations or during traditional clinical rotations.

Hₐ: The findings of this study will not be consistent with other published results with relation to HFS.

Significance of the Project

Nurse educators have a significant role in creating environments that aid students in the development of self-confidence and clinical competence thus increasing students' success both academically and clinically. The major outcome of this project was to present a potential global change in nursing programs that utilize simulation experiences, as a portion of student clinical practice, more specifically when should simulation experientials occur within the clinical curriculum. Data from this study suggest that understanding when simulation experientials are best offered within a clinical curriculum not only improve student confidence levels and overall satisfaction but will also significantly aid in patient safety as well. The study conducted addressed current nursing student perceptions of their confidence and competency levels with regards to simulation and traditional clinical rotations. What this study did not address was if simulation experiences prior to traditional clinical times improve student National Council Licensure Examination - Registered Nurse (NCLEX-RN) pass rates.

Scope & Limitations

To compare differences in acquisition of essential knowledge for BSN-level nurses, students were invited to participate in the self-reporting questionnaire originally developed by the National League for Nurses (NLN) (Appendix A). The NLN survey consists of 13 questions marked from strongly disagree (1) to strongly agree (5). The NLN survey questionnaire was modified to include basic demographic information such as student age, gender, highest level of education achieved, program learning modality (BSN or ABSN), and prior medical experience. This survey was given after the simulation day completed and before the students left the campus to maintain control.

Due to the measurement of learning and critical thinking skills as student's transition through their program of study, the theory that best matched the study thus providing the framework was Kolb's experiential learning theory. Kolb determined that through the experiential learning cycle, the process of learning is created or developed through experience and that these learned experiences then transfer into knowledge. Kolb asserts that these experiences are intentionally directed through observation, active participation, and reflection, all of which in turn begin the formation of abstract concepts [10].

The university setting admits four cohorts per calendar year ranging anywhere from 30 - 64 students per cohort. The estimated sample size per group was calculated at approximately 90 participants. The survey was administered to seven different cohorts. Using this approach, the researcher hoped that answers would not be skewed from previous students' exposure to the survey as well as aid in the validity of the study results due to the significant sample size. The statistical analysis portion of the study was performed using an independent t-test in hopes of evaluating the differences in mean scores and the effects of simulation on same day scores.

The limitations that impacted the credibility of the project include but are not limited to: student age differences, level of education before admission into the program, learning style differences, personal comfort levels, and student perceptions of survey questions. Regarding individualism, how students may answer the questionnaire based on their perception of how the researcher would want them to respond as opposed to their true experiences and feelings may be also be considered a limitation. Another potential limitation included the sample, which consisted exclusively of entry-level baccalaureate nursing students. Additionally, survey time frame was also considered a limitation due to the need to be distributed to students immediately following their simulation experiences. The purpose in doing that was to ensure students had immediate recall of their perceptions.

The limitations specific to the design and sampling methodology include convenience sampling and self-reporting surveys. Convenience sampling may produce bias therefore influence the results of the study. This type of sampling is not representative of an entire population; therefore, definitive conclusions cannot be drawn from the researcher's results. Self-reporting surveys are often utilized in behavioral science research. Self-reporting surveys produce ordinal data, which is then evaluated using parametric statistical techniques. These statistical techniques make assumptions about data distribution, which cannot be met when said data is ordinal. This then leads to deviations of assumptions and incorrect inferences, thus potentially leading to study conclusions that can be questioned.

Setting

The setting for this study took place in a private not-for-profit University of Health Sciences in the western United States. Because the study was based on nursing students, the focus was within the College of Nursing (CON). The study site university houses

several programs from Medical, Pharmacy, Master of Business Administration (MBA), and specific to this study, an entry-level Bachelor of Science in Nursing program (BSN). There are two types of nursing programs offered, one is a ground program which is 18 months long (BSN) and the other is a hybrid online/ground program which is 16 months long (Accelerated BSN or ABSN). Both programs are arranged in a unique block system in that students learn one content area at a time before moving on to the next. Some of the blocks have clinical portions as well as didactic portions associated with them. Those blocks that had clinicals, had prescheduled simulation days where the students would spend one of their clinical days in the simulation room. Students from both program types participated in this study.

Instrumentation

The NLN collaborated with Laerdal in 2003 to conduct a simulation research study. Survey instruments were developed as part of this study. Of the instruments developed, the Student Satisfaction and Self-Confidence in Learning Scale (SSSC) (Appendix A) was utilized for this study. The purpose of the SSSC is to assess student satisfaction and confidence during application of skills learned with relation to simulation as an educational strategy. The survey consists of 13 items with Likert-type scoring ranging from strongly agree (1) to strongly disagree (5). The tool is divided into two subscales. Subscale one has five questions relating to student satisfaction with current learning while subscale two has eight questions that relate to student self-confidence in learning. The tool is a survey consisting of a series of questions about personal attitudes, satisfaction with learning, and self-confidence regarding the simulation activity. The survey instrument was modified to include basic demographic information such as age, gender, highest level of education achieved, learning modality (BSN or ABSN), and prior healthcare experience.

Cronbach's alpha was used to test reliability for satisfaction and self-confidence. A score of 0.94 was noted for satisfaction while a score of 0.87 was noted for self-confidence [8]. The representation of attributes and outcomes of interest for this study was the rationale for utilization of this particular measurement instrument.

Methods

Statistical analysis for this study was performed by using IBM SPSS® Version 23 and SAS 9.4. A power analysis performed using G*Power with the parameters of a medium effect, 80% power, and a confidence level of 95% indicated that the estimated sample size of N = 106 (N = 53 per group) was needed however; as mentioned previously, this value was exceeded by 74 making the final sample size of n=180. Descriptive statistics, such as the mean with standard deviation and the median with range for continuous data, and frequencies with proportions for categorical data,

were utilized to describe the sample characteristics. Preliminary statistics were run to test the assumptions for using a parametric t-test. Because the assumptions were not met, the non-parametric alternative Mann Whitney U test was used to compare the two independent groups.

The research question for this study was as follows: For entry-level baccalaureate nursing students, will the use of simulation impact clinical competence, self-confidence, and self-efficacy if done before clinical rotations as compared to during clinical rotations? To place this question within the context of scientific inquiry, an extensive literature search was completed using databases such as Cumulative Index to Nursing and Allied Health Literature (CINAHL), ProQuest, and PubMed Central.

In order to determine or establish the effectiveness of the use of high-fidelity simulation prior to traditional clinical rotations, a non-experimental quantitative comparative approach yielded the best possible results. This non-experimental comparative design took place in a university setting with the target population consisting of pre-licensure baccalaureate nursing students. The data for this study was collected over a four-month period, which began in late August 2016. This allowed for students from various cohorts in all simulation blocks to participate.

Ethical Considerations

The study took place in a private not-for-profit University in the southwestern region of the United States. Because the study was based on nursing students, the focus was within the College of Nursing (CON). Institutional Review Board guidelines from the setting concerning the treatment of human subjects were followed. Participation in the study was voluntary. Full disclosure of the study's intended purposes was provided to students before agreeing or declining participation. Privacy was maintained for all participants through the de-identification process, which included the seven-digit codes that contained both letters and numbers. The study was strictly an educational intervention investigation in hopes of determining appropriate timing for simulation.

Results

The original expected sample size was n=106 however, participation in the study exceeded the expected value by 75 for a total sample size of n=181. Of this n value, one participant failed to complete the demographic information. This survey was excluded from the statistical analysis thus the final sample of n=180 were grouped. Two groups were formed, Group BC and Group DC. Group DC (During Clinical) consisted of students that had their scheduled simulation day during their traditional clinical rotation and Group BC (Before Clinical) consisted of students scheduled for simulation before their traditional clinical rotation.

Table one provides the reader with the individual results

from the survey questions. Questions one to five related specifically to satisfaction while questions six through 13 related specifically to self-confidence. Confidence levels are reported to improve with further exposure to simulation thus clinical placement [12]. The p values of each of the questions are all, with the exception to question 11, greater than the cutoff for significance value of 0.05, indicating no statistical worth and the null hypothesis was accepted. Question 11 asked students to state whether they knew to ask for help when concepts were not understood. The p value for this question was 0.0459, which is slightly less than the cutoff for significance value of 0.05 indicating minimal statistical worth between the BC and DC group.

Question	Class	Mean	StdDev	Overall Z test based on Mann-Whitney U test statistic	Overall P-value (Two-sided)
Q1	BC	4.4868	0.7745	-1.1095	0.2672
	DC	4.6095	0.6123		
Q2	BC	4.3421	0.8877	-1.1862	0.2355
	DC	4.5392	0.5916		
Q3	BC	4.4868	0.8245	-1.2321	0.2179
	DC	4.6664	0.5661		
Q4	BC	4.3947	0.8498	-0.929	0.3529
	DC	4.5333	0.666		
Q5	BC	4.3553	0.9049	-1.2956	0.1951
	DC	4.5096	0.7882		
Q6	BC	4.0789	0.9203	-0.3854	0.6999
	DC	4.1635	0.7896		
Q7	BC	4.2368	1.0049	0.1195	0.9049
	DC	4.3039	0.768		
Q8	BC	4.3158	0.8826	0.0176	0.9859
	DC	4.3269	0.8078		
Q9	BC	4.3947	0.8339	-0.7693	0.4417
	DC	4.5288	0.6067		
Q10	BC	4.4211	0.8681	-1.2175	0.2234
	DC	4.5962	0.6312		
Q11	BC	4.3289	0.8228	-1.996	0.0459
	DC	4.5962	0.5124		
Q12	BC	4.3158	0.7521	-0.8807	0.3785
	DC	4.4231	0.649		
Q13	BC	3.8684	1.1236	-1.2469	0.2124
	DC	4.0865	1.0059		

Table 1: Satisfaction and Self-Confidence.

Question	Z-test based on Mann-Whitney U test statistic	P-value (Two-sided)
Satisfaction	-1.6622	0.0965
Self-confidence	-1.147	0.2514
Total Score	-1.2016	0.2295

Table 2: Overall Combined BC and DC Findings.

Discussion

Overcrowded clinical facilities, increasing numbers of student nurses, and overwhelmed staff nurses demand the attention of higher educational standards. Providing safe quality patient care also demands consideration using a clairvoyant approach as changes in healthcare continue to evolve. Review of the predicted HRSA trend of 952,000 new nurses by the year 2025, a speedy approach to standardization and curricular timing with the use of HFS in higher education needs to occur.

Research has proven that the use of high-fidelity simulation has been utilized and widely supported in nursing education for over a decade as an advanced form of aiding students' critical thinking development and preparation for the student-to-nurse transition [8]. As technology continues to evolve and become more and more sophisticated, nurse educators must become familiar with the potential impact on students' learning. Nurse educators must also acquire the skill and proficiency that will best prepare their nursing students for future practice.

The use of HFS has been proven through numerous studies to increase student self-confidence levels as well as clinical competency levels however; the question remains as to when the most valuable time to provide these activities within a curriculum should occur. After performing an extensive search to find similar studies in relation to timing associated with simulation experiences, one study, a method study conducted by Bremmer, et al. [11] aimed to determine if confidence levels had any relation to the use of HFS. These authors concluded that 61% of students gained confidence in their assessment skills as well as their willingness to touch patients after receiving simulation before their clinical rotations. Based on this observation and date of study, similar future research is highly recommended in order to develop the best approach for timing of the use of HFS within a nursing program. In view of accepting the null hypothesis of this study similar studies are recommended with a focus on clearly defined timing as to when HFS is offered within an entry-level nursing program. Suggestions to this would include a "Before experiential simulation day group compared to an exact number of experiential shifts completed group" with the defining number of three out of a six-day experiential for example. The key would be to provide exact days for each during experiential group.

This researcher also suggests using a paralleled pre-post test to determine increases in student knowledge gains for each of the groups and further comparing those results. From a nurse educator perspective, further research is needed to assist educators in identifying areas of weakness with their students regarding self-confidence and clinical competency levels. This particular area of further research should focus on how varying amounts of simulation time effects student knowledge gains and self-confidence levels. This study utilized a quantitative comparative approach to research, which resulted in a clear indication for further research. Concerning one particular educational truism; as Benjamin Franklin said, "Tell me and I forget, teach me and I remember, involve me and I learn" (n.d., n.p.), experiential education, as with simulation is based upon the purpose of this educational truism; involve me and I learn.

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Conflict of Interest

This author has indicated they have no potential conflicts of interest to disclose.

Ethical Approval

This study did not involve harm to human participants, therefore IRB approval was granted.

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