Original Research Article

An investigation into the impact of utilizing simulation-based instruction versus the conventional approach on nursing students' self-confidence and clinical proficiency: A Quasi-Experimental Research.

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ABSTRACT

Background: Within a clinical setting, simulators offer students a safe environment in which to develop skills and gain experience under the guidance of their instructors, all without posing any risks to patients. This study aims to compare the impact of simulation-based teaching and the traditional approach on nursing students' self-efficacy skills and clinical performance.

Methodology: This research employed a quasi-experimental design with a pre-test and post-test arrangement. The study population encompassed 122 nursing students, from which a sample of 100 students was randomly selected. These students were then divided into two groups: an experimental group and a control group. A questionnaire was utilized to assess the students' self-efficacy skills and clinical performance before and after the implementation of the instructional programs. Data analysis was conducted using descriptive and inferential statistical methods with SPSS 23.

Results: Following the intervention, there was a significant increase in the participants' mean self-efficacy scores, rising from 87.57 to 142.13. Likewise, the mean clinical performance scores showed a significant increase, moving from 2.16 to 4.57. These findings underscore the substantial impact of simulation-based teaching on nursing students' self-efficacy and clinical performance.

Conclusion: The study recommends the adoption of simulation as an effective teaching methodology, especially within nursing internship settings. In essence, it is advisable for students to acquire essential skills through simulation before venturing into real-world healthcare environments.

Keywords: Simulators; Students; Nursing; Clinical Performance.

INTRODUCTION

Simulation involves replicating real-world instruments or operational scenarios to represent specific behavioural aspects of a physical system through the actions of another system. In the context of healthcare, the primary objective of simulation is to prepare students for real clinical situations, enhance patient safety, reduce errors, and enhance nurses' clinical decision-making abilities. Consequently, students can acquire proficiency in skills that may be challenging to develop in actual clinical settings.[1] Nurses require ongoing learning to keep their knowledge and skills up to date.[2] To put it differently, medical knowledge is continually expanding. Therefore, nursing education should evolve into a dynamic form of instruction, embracing innovation, progress, and the integration of modern teaching and educational techniques.[3] In the present day, information technology-based tools have profoundly infiltrated all facets of medical sciences, particularly in the realm of education.[4] Continuous education through technology implementation offers significant advantages, including the increase in knowledge and effectiveness, the enhancement of performance quality, and the elevation of nurses' skills and professional qualifications.[1]

Additionally, this approach offers flexibility, easy accessibility, and the opportunity to participate in valuable roles within nursing education at any given time.[5] Simulation-based nursing education is an increasingly popular pedagogical method. It encompasses activities that mimic real clinical settings and have been designed to illustrate processes, decision-making, and critical thinking through techniques such as role-playing, as well as the use of educational films, models, scenarios, and case studies.[6,7] The adoption of simulation in nursing education is warranted due to several factors, including the limited availability of feedback in clinical settings, patient passivity during examinations, inadequate access to a sufficient number of patients, the constantly changing patient demographics in real-world scenarios, the scarcity of available clinical situations, and the high number of students in clinical placements.[8]

Simulation has the potential to enhance students' knowledge, skills, and performance in nursing education. By practicing and acquiring new professional competencies without compromising patient safety and well-being, students can reach higher levels of critical thinking.[9] Implementation of this method can also facilitate nurses' learning and provide valuable feedback to help them become proficient in their roles. Simulation scenarios empower nursing students by enabling them to apply educational, perceptual, and psychological learning experiences, ultimately equipping them with the skills needed for effective thinking, evaluation, problem-solving, decision-making, and data analysis.[10]

Simulation-based education exhibits distinctive features such as the unique transfer of information from traditional classrooms and clinical settings to simulated environments, accurately replicating clinical scenarios and real-life situations.[11] This pedagogical approach promotes collaborative efforts and fosters a sense of cooperation and collective influence among students. Simulated environments offer students opportunities to enhance their professional skills without posing any risk to patients' well-being.[12]

Nursing students play a pivotal role in providing continuous care, improving patients' health, and contributing to the future efficiency of the healthcare system. Therefore, improving the quality of healthcare delivery is a significant concern, with nurses' performance playing a vital role in influencing healthcare quality.[13] Effective nurses require problem-solving skills and the ability to make clinical decisions. Consequently, clinical performance holds great importance within nursing education.[14] Accordingly, internship courses within nursing education programs should aim to foster self-efficacy and provide the highest quality education. Bandura's Self-Efficacy Theory serves as a tool to evaluate students' confidence in their clinical skills.[15] According to Bandura's theory, individuals with high self-efficacy are more adaptable to specific situations, while those with low self-efficacy encounter challenges when performing certain tasks. Clinical experience and comprehensive education are two key factors in developing clinical confidence. Students with strong self-efficacy are efficient and self-regulating when facing future challenges.[16] In the modern world, autonomous learning is essential, and the concept of self-efficacy is pivotal in educational settings, as Bandura's theory highlights educational environments as fertile ground for cultivating and shaping self-efficacy.[17] Numerous studies have

shown that self-efficacy significantly influences knowledge acquisition, skill development, and the practical application of knowledge and professional expertise.[18] Against the backdrop of the COVID-19 pandemic and the increasing importance of simulation in nursing education, this study investigates the impact of simulation-based education versus traditional methods on nursing students' self-efficacy and clinical performance.

METHODS

Research Design and Setting

The present research employs a quasi-experimental design featuring both pre-test and post-test assessments. The study population encompasses all nursing students enrolled in the School of Nursing at a University, located in Texas.

Sampling

The students were chosen through a simple random sampling method employing random number generation software, resulting in a sample size of N = 100. Subsequently, the selected students were divided into two groups: the control group, consisting of the first 50 students, and the experimental group. Inclusion criteria for participation encompassed a willingness to engage, informed consent, and enrollment in internship and training courses. Initially, the study's objectives were thoroughly explained to all participants, who willingly and knowingly chose to take part, with full understanding that their participation would not impact their education. The initial group consisted of 122 nursing students pursuing their Bachelor's degrees. However, 22 students were excluded from the study due to their lack of interest. In the traditional class, there were a total of 50 students. The designated teacher, well-qualified and experienced, adhered to the educational objectives outlined in the lesson plan.

The Procedures of the Experimental Group

The study's participants were segregated into two distinct groups: an experimental group and a control group. The experimental group received instruction through a simulation-based approach, while questionnaires were administered to assess the participants' self-efficacy skills and clinical performance both before and after the educational interventions. At the commencement of the academic term, 7th term nursing students enrolled in the "Surgery" course at University of Medical Sciences were divided into these experimental and control groups. Initially, participants from both groups were directed to a practice room to engage in hands-on training exercises, which included tasks such as administering injections, managing pneumonia, addressing septic shock, handling hyperglycemia, and performing heart massages, all in accordance with a predefined checklist. The sessions for both groups were recorded, and this pre-test phase concluded without any immediate feedback.

Following this, the control group received their education through a combination of PowerPoint presentations and verbal lectures, with certain portions of the instruction being delivered virtually as a precaution due to the ongoing COVID-19 pandemic. On the other hand, participants in the experimental group began their learning experience by watching an instructional video and subsequently receiving feedback on their performance errors. The professor then proceeded to teach various course topics, including the administration of different types of injections, utilizing modular resources, while the instructional video was made available to the students. In the subsequent sessions, students practiced the previously covered topics using modular aids, and the professor introduced new subject matter.

One week after the conclusion of the study, both groups were invited back to the practice room. They were provided with a test manual, and the assessments were carried out by professors who were unaware of the specific characteristics of the two groups. Scores were assigned based on the previously established checklist. The entire course was taught by a single instructor over the course of 5 consecutive days, with each session lasting 2 hours.

The Procedures of the Control Group

The control group received their education through the conventional approach, which involved the use of PowerPoint presentations and lectures, following the standard syllabus. No distinct interventions or modifications were introduced to their educational procedure. Initially, all participants in this group underwent a pre-test, which encompassed the

administration of the Self-Efficacy Questionnaire and an evaluation of their performance.

Data Collection Instrument

A questionnaire soliciting demographic information was distributed to gather data on participants' age and gender. Additionally, the Nurses' Clinical Self-Efficacy Questionnaire (Charaghi et al., 2010) was administered. This questionnaire, originally developed in Iran, comprises 37 items distributed across five domains: patient examination, nursing diagnosis, planning, implementation of healthcare programs, and evaluation of healthcare programs. Respondents rated their responses on a 5-point Likert scale, ranging from "completely disagree" to "completely agree," with total scores ranging from 37 to 185. The content and face validity of this questionnaire were established through expert evaluation by faculty members from the School of Nursing, and necessary adjustments were made. Concurrent validity between the "self-efficacy of clinical performance" and "general self-efficacy" instruments was found to be acceptable ($r = 0.73$, $p < 0.01$).[15] The finalized instrument, "self-efficacy of clinical performance," demonstrated a Cronbach-Alpha coefficient of $\alpha = 0.96$, indicating high internal consistency within the range of 0.90–0.92. Furthermore, a retest conducted after a two-week interval showed the instrument's reliability ($r = 0.94$).

Additionally, the Cronbach-Alpha coefficient for the finalized instrument, "the clinical performance of nursing," was $\alpha = 0.72$, and its stability was affirmed by a retest ($r = 0.81$).[15] Construct validity of the instrument was verified through factor analysis. To assess clinical performance, pre-established scenarios were presented to the participants. These scenarios had been designed and approved by the faculty members of the Department of Nursing and the professor overseeing the educational program. Moreover, a checklist for evaluating students' performance based on the predefined scenarios was jointly developed by the Department of Nursing and the professor.

Data Analysis

The gathered data underwent analysis through statistical methods encompassing descriptive statistics (mean and standard deviation) and inferential techniques (independent-samples and paired-samples t-tests, as well as covariance analysis) using SPSS version 23.

Ethical Considerations

The present research employs a quasi-experimental design featuring both pre-test and post-test assessments. The study population encompasses all nursing students enrolled in the School of Nursing at University of Medical Sciences.

RESULTS

In the experimental group, the average age was 21.84 with a standard deviation of ±0.570. Conversely, the control group had an average age of 22.2 and a standard deviation of ±0.704. In terms of gender distribution, 56% of the participants in the experimental group were female, while 44% were male. In contrast, the control group had 52% female participants and 48% male participants.

The results obtained (Table 1) revealed that the control group's mean scores for nurses' clinical self-efficacy were 88.3 in the pre-test and increased to 90.40 in the post-test. Additionally, a normality test conducted on the significance values for the research variables ($p < 0.05$) confirmed the normal distribution of the data. Consequently, parametric tests were deemed appropriate for analyzing the variables (0.318, 0.612).

As depicted in Table 2, prior to any interventions, the mean scores for participants' communication skills were 2.16 for the experimental group and 2.14 for the control group. In terms of personal management, the mean scores were 2.08 and 2.15 for the experimental and control groups, respectively. Furthermore, before any interventions, the mean scores for being patient-oriented were 2.22 in the experimental group and 2.24 in the control group. Similarly, the mean scores for self-description and physical examination were 2.18 for the experimental group and 2.20 for the control group. Overall, the total pre-test scores for clinical performance were 2.16 for the experimental group and 2.18 for the control group. These findings suggest that there were no significant differences between the experimental and control groups in terms of the four components of clinical performance (communication, personal management, patient-oriented care, and self-description and physical examination). The two groups exhibited nearly identical mean scores.

As outlined in (Table 3), the mean pre-test scores for students with respect to patient examination were 16.18 in the experimental group and 16.47 in the control group. In terms of nursing diagnoses,

the mean pre-test scores were 18.32 for the experimental group and 18.60 for the control group. Furthermore, for planning, the mean pre-test scores were 16.05 in the experimental group and 16.19 in the control group. Evaluating the healthcare program yielded mean pre-test scores of 17.29 and 17.48 in the experimental and control groups, respectively. Additionally, the mean pre-test scores for performing the healthcare program were 19.74 in the experimental group and 19.5 in the control group. These findings indicate that there were no statistically significant differences between the two groups in terms of their mean scores across the five components of self-efficacy skills (patient examination, nursing diagnoses, planning, performing healthcare programs, and evaluating healthcare programs). Both groups exhibited nearly identical mean scores.

Furthermore, the mean post-test scores for clinical performance in the experimental group (educated through simulation) and the control group were 4.57 and 2.24, respectively. The standard deviations (SD) for the experimental and control groups were 1.96 and 1.37, respectively. Additionally, the standard error of the mean (SEM) for the experimental and control groups was 0.3285 and 0.6814, respectively. The test's significance level revealed a notable difference between the two groups regarding their post-test scores.

Moreover, there was a substantial post-test score difference ($p = 0.0001$) between the two groups in terms of clinical performance (the experimental group scoring 4.57 and the control group scoring 2.24). However, no significant distinction was found in their pre-test scores, with both groups exhibiting nearly identical mean scores ($p = 0.211$) (the experimental group scoring 2.16 and the control group scoring 2.18).

The results of the covariance analysis, as depicted in Table 4, demonstrated a significant difference in the mean clinical performance scores between the experimental group (receiving simulation-based education) and the control group ($P < 0.01$, F (89.27)). The coefficient of determination (R-squared) was 0.55, indicating that 55% of the variance in clinical performance could be attributed to simulation-based education. In essence, this suggests that simulation-based techniques had a discernible impact on nurses' clinical performance.

DISCUSSION

The results demonstrated a notable increase in nursing students' mean scores for self-efficacy skills following the intervention (142.13) when compared to their pre-test scores (87.57). Furthermore, it was evident that simulation-based education had a positive impact on enhancing the students' self-efficacy skills. Additionally, the mean clinical performance scores of the students improved significantly after the intervention (4.57), compared to their pre-test scores (2.16), highlighting the influential role of the simulation-based technique in enhancing nursing students' clinical performance.

To rationalize these findings, it can be argued that the implementation of simulation-based techniques in medical education allows students to confront rare and challenging scenarios, thereby fostering teamwork and related skills among future healthcare professionals while bolstering their self-confidence.[19] These findings align with previous studies by Sajjadi et al., Kargar et al., and Rahmani et al. [11, 18, 20] For instance, Sajjadi et al. revealed that participants educated through an online simulation-based approach reported higher satisfaction scores post-intervention, and their performance scores ten days later surpassed those of the speech-based group. Furthermore, it was observed that ten days post-intervention, the online simulation-based group executed a specific scenario significantly faster than the speech-based group.[11] Similarly, Kargar et al. conducted a study titled "Effects of Simulation on Nurses' Performance in Neonatal Resuscitation at Behbahani Hospital" and found that both the control and experimental groups exhibited a knowledge level increase of 9 and 10 points, respectively. There was no significant difference between the two groups in terms of pre-test performance. However, a significant discrepancy emerged one month after the educational program, with the experimental group outperforming the control group. This outcome suggested that simulation coupled with simultaneous filming for educational purposes was more effective for learning.[18]

Heydarzadeh et al. conducted a study titled "Exploring the Impact of Computerized Simulation and Model Implementation on Nursing Students' Confidence in Cardiopulmonary Resuscitation." They observed significant differences in mean scores and standard deviations (SD) of nursing students' self-efficacy perceptions before and after the intervention in both groups. In the model-based group, the self-efficacy perception mean score increased from 15.4 to 23.5, while in the computerized simulation group, it increased from 15.4 to 23.5. These findings demonstrated that both techniques effectively enhanced self-efficacy perceptions related to cardiopulmonary resuscitation. Thus, educational institutions can choose either technique based on their specific circumstances and resources to better equip nurses with higher qualifications for patient care.[21]

The utilization of modern educational tools such as simulators and educational films has been shown to significantly enhance students' cognitive, communication, and practical skills,[22] which aligns with the results of the present study. Khalaila's research also supported the efficacy of simulation-based techniques in increasing nurses' self-efficacy scores after an intervention program.[23] In Liaw et al.'s study, the simulation-based technique was implemented in both control and experimental groups. The experimental group, consisting of 15 participants, engaged in a 6-hour simulation program that presented four clinical scenarios involving critical patients with conditions such as pneumonia, shock, hyperglycemia, and septic shock, followed by a question-and-answer session. A performance assessment was conducted using videotapes and an independent panel of assessors who were unaware of the study's objectives. Although there were no significant differences in pre-test mean scores between the two groups, a notable disparity emerged in the post-test performance of the experimental group.[24] Rodrigues et al.'s research further emphasized the usefulness of simulation-based educational software as a valuable strategy to support nurses' professional development and skill training.[25]

Limitations

This study exclusively focused on nursing students, which implies that extrapolating the results to other branches of medical sciences could present some challenges.

CONCLUSION

Simulation in the realm of education encompasses a wide range of activities that replicate real clinical settings, aiming to illustrate various processes, decision-making, and critical thinking through methods such as role-playing and the use of educational films and models. Through simulation-based education, it becomes feasible to convey the knowledge and skills essential for nursing practice, facilitating students' self-assessment of their abilities.

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Table 1: A comparison of the mean and SD of the pre-test and post-test scores obtained by the two groups in terms of the nurses' clinical self-efficacy

Variable	group	Pretest		Posttest	
		Mean	SD	Mean	SD
Clinical Self-Efficacy	Control	88.3	3.078	90.40	3.96
	Experimental	87.58	4.152	142.13	4.37

Table 2: The mean scores of the participants' clinical performance before performing interventions in the two groups.

		Mean	SD	Difference	t	*p*-value	test
Communication	Experimental	2.16	±0.82	0.4	1.94	0.128	T Test
	Control	2.14	±0.91				
Individual management	Experimental	2.08	±0.63	0.7	2.26	0.211	
	Control	2.15	±0.74				
Patient-centered	Experimental	2.22	±0.66	0.02	1.14	0.134	
	Control	2.24	±0.84				
History and physical examination	Experimental	2.18	±0.59	0.02	1.29	0.251	
	Control	2.20	±0.62				

Table 3: The mean scores of the nursing students' self-efficacy skills before any intervention in the two groups.

		Mean	SD	Difference	t	*p*-value	test
Patient examination	Experimental	16.18	±0.54	0.8	1.18	0.125	T Test
	Control	16.47	±0.39				
Nursing diagnoses	Experimental	18.32	±0.39	0.11	1.30	0.224	
	Control	18.60	±0.41				
planning	Experimental	16.05	±0.68	0.14	2.07	0.183	
	Control	16.19	±0.59				
Implement a care program	Experimental	19.74	±0.34	0.2	1.55	0.506	
	Control	19.56	±0.40				
Care plan evaluation	Experimental	17.29	±0.37	0.2	1.13	0.319	
	Control	17.48	±0.42				

Table 4: The results of the COVARIANCE analysis of the two groups in terms of their clinical performance.

Performance clinical	T.S	df	M.s	F	sig	Effect level	*p*-value
Pretest	89.27	98	98.27	13.76	0.001	0.55	0.05
Posttest	158.13	1	51.59	29.29	0.01	0.06	
Error	345.24	38	9.16				