REVIEW ARTICLE

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The effectiveness of simulation-based learning in nursing education - A review

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ABSTRACT

Background: Simulation based learning refers to an active learning strategy that mimics the characteristics of a real-life environment. It helps healthcare professionals to practice clinical skills and apply theoretical knowledge in a safe environment without compromising the patient's safety. It provides a unique opportunity for the students to enrich their critical thinking, decision-making ability, confidence, and communication skills. **Objective:** The aim of this study was to explore the effectiveness of simulation-based learning in nursing education. **Methodology:** An integrative review was conducted to identify the importance of Simulation-Based Learning in Nursing Education. Google Scholar and PubMed databases were searched for eligible publications. The search was restricted between 2018 and 2023. The terms 'simulation', 'nursing education', and 'nursing students' were used to search the relevant databases. **Results:** Most of the prevailing findings revealed that simulation is an effective teaching-learning strategy for fostering clinical skills of nursing students. It increases the students' self-confidence as they can practice the clinical skills without apprehension. The lack of resources, poorly trained educators, and dissatisfaction among the students and teachers are some limitations in incorporating Simulation-Based Learning in curricula. **Conclusion:** The successful integration of simulation-based learning in the nursing curriculum has a positive impact on nursing students' performance. Staff readiness and student satisfaction are indispensable/crucial in implementing simulation in higher education.

Introduction

Ensuring the quality of nursing education, both in theory and practice, has been a longstanding challenge for governments, educators, healthcare administrators, and nursing students (Padilha et al., 2019).

Clinical education in nursing aims to integrate theoretical knowledge into practical skill in real-life situations and to help students

develop their professional skills (Kim et al., 2016). Today's clinical nursing environment is more complex than ever before (Ayed & Khalaf, 2018) and nursing students often experience difficulties in transferring the knowledge they acquired in laboratory and classroom environments to clinical settings (Eyikara & Gocmen Baykara, 2017).

Didactic information presented in the classroom does not always convey the complexity of clinical situations. Didactic information is the information which are intended to be taught in the classroom (Zaida Victoria Narcisa Betancourth Aragón, 2010). The distance between theory and practice complicates the learning process of the students. This will lead to lack of understanding of nursing concepts among students and it may affect their professional skills (Koukourikos et al., 2021). The theory-practice gap can be filled using an innovative teaching tool like simulation (Kapucu & Kapucu, 2017), which is an interactive method of teaching-learning where students can contribute to participate in the learning process actively (Eyikara & Gocmen Baykara, 2017).

The term 'simulation' is defined by several researchers differently (Jeffries P.R 2005, Mary et al. 2020). It's an approach that facilitates teaching-learning through which participants develop and demonstrate skills and behaviours in a controlled environment which offers opportunities for exploration and rehearsal (Humphreys, 2013).

Simulation is becoming a popular teaching pedagogy in Nursing Education (Fawaz & Hamdan-Mansour, 2016, Johnson, 2017, Reid, 2016, NLN(a), 2022). It provides realistic opportunities to practice and apply theoretical knowledge in clinical setting as simulated clinical experiences replicate the all-essential aspects of a clinical situation so that students can understand the situation and manage when it occurs in the clinical setting (Eremita, 2018; Kim & Lee, 2020) and it provides opportunity to the nursing students to practice their skills through various real life like situational experience (Al Khasawneh et al., 2021, Eyikara & Gocmen Baykara, 2017, ZarifSanaiey et al., 2016).

Simulation-based learning improve nursing students' confidence, interest, knowledge acquisition, clinical skills, critical thinking, and decision-making skill (Al Khasawneh et al., 2021; Johnson, 2017; ZarifSanaiey et al., 2016) and allow complex ideas, techniques, and concepts to be explored (Fawaz & Hamdan-Mansour, 2016). Also, it helps to enhance communication skills, the ability to cooperate with other members of the interdisciplinary team, the ability to manage complex situations, and to enhance self-efficacy and understanding of interpersonal relations (Koukourikos et al., 2021).

National League for Nursing (NLN) designed and validated three study instruments to assess the various aspects of simulation namely 'The Simulation Design Scale, Educational Practices Questionnaire and Student Satisfaction and Self-Confidence in Learning' (NLN(b), 2022).

Based on the degree of credibility, simulation can be described ranging from low-fidelity simulation (LFS) to high-fidelity simulation (Kim et al., 2016). Fidelity is an inherent property of simulation and is defined as "the degree of accuracy to which a simulation, whether it is physical, mental, or both, represents a given frame of reality in terms of cues and stimuli, and permissible interactions" (Reid, 2016). LFS mannequins provide anatomical representations only. It does not offer realistic physiological or vocal feedback (Mary et al., 2020). It uses task trainers such as catheterization models and low or no-technology manikins or environment to practice specific psychomotor skills (Reid, 2016). Medium-fidelity simulation means patient-care scenario that uses a full-body simulator with installed human qualities such as breath sounds without chest rise (Hayden, 2010).

High-fidelity, clinically human simulation exercise that employ technologically sophisticated equipment in a realistic physical and psychological environment (Honkavuo, 2021; Reid, 2016).

The simulation-based learning involves a variety of learning methods, including manikin-based, standardized/simulated patients or

computer-based programs, virtual reality, or hybrid simulation to achieve realistic learning environments (Smith et al., 2018; Eremita, 2018, Ayed & Khalaf, 2018, Zarif Sanaiey et al., 2016)

A study conducted among the first-year junior baccalaureate students revealed that, self-reported anxiety scores of students who experienced the preclinical simulation is lower than the students who did not have the preclinical simulation experience (Gore et al., 2011). The feedback that educators provide during a simulation session helps to improve their practice, strengths and helps to recognize the areas for further improvement (Karunathilake, 2018).

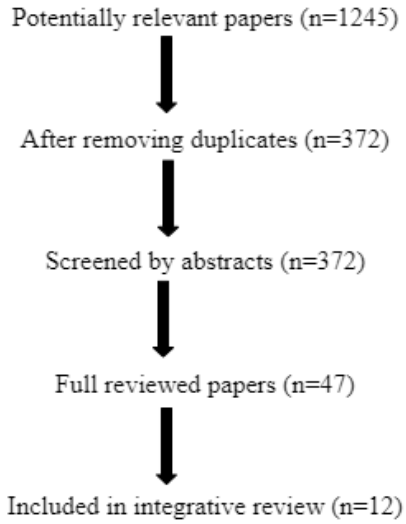
Hence, there was evidence to support the effectiveness of Simulation-Based Learning in Nursing Education; based on the above facts, a systematic review of simulation-based learning and its effectiveness would be more useful in order to build up a foundation for further studies in this area and to enhance the competency of nurses in clinical nursing.

Methodology

An integrative review was conducted to find the effectiveness of Simulation-Based Learning in Nursing Education. Google Scholar and PubMed databases were searched for eligible publications. The terms 'simulation', 'nursing education', and 'nursing students' were used to search the relevant articles. Articles which were published between 2018 and 2023 were filtered to extract the recent findings. The search was limited to studies written in English, and conducted in a Nursing Education setting. Review papers, editorials, short communications, and conference abstracts were excluded from the search.

Total of 1245 articles were identified from both databases. After evaluating the titles and removing duplicates 372 were identified as relevant for this study. Then the abstracts of the articles were screened, and 47 articles were retrieved. Subsequently, full-text articles were reviewed for relevancy. Finally, 12 articles were identified to include in the review (Figure 1). The data from the articles were extracted by one investigator and checked by others. The data was synthesized to express a comprehensive overview regarding the effectiveness of simulation-based teaching in nursing education.

Figure 1: Flow diagram of studies identified, screened, assessed for eligibility, and included



Results

Twelve relevant articles were reviewed for this study purpose. From each article, the study purpose, design, sample, and findings data have been extracted (Table 1). Among these twelve articles, seven articles have used quasi-experimental method, three used randomised control trial, one used cross-sectional descriptive method and one used mixed method design. All studies were conducted in nursing schools with nursing students.

The studies' findings revealed that simulation is an effective teaching-learning strategy for fostering the clinical skills of nursing students. It allows the students to rehearse and gain skills in the safest environment. Further, it increases the self-confidence of the students as they can practice the clinical skills without worry.

Among these twelve studies, three studies were conducted to evaluate the effectiveness of simulation-based learning methods in providing End-Of-Life care to patients. The studies' findings revealed that the End-Of-Life

care simulation method helped the students enhance their attitude toward delivering care. This learning method provides an opportunity for the students to deal with their own emotions (Id et al., 2021; Rattani et al., 2020; Tamaki et al., 2019).

Jang & Song (2021) conducted a mixed-method study. The effect of the simulation programme on students' knowledge was assessed quantitatively and their learning experience was measured quantitatively by using self-reflective journal writing. After the implementation of the simulation program, investigator found significant effects on the students' theoretical knowledge and clinical performance. In addition to that self-reflective journals' analysis showed that the simulation helped the students to become self-directed learners and it increased their clinical reasoning ability. Also, it helped them to connect both theoretical knowledge and clinical practice. Participants expressed that simulation would be an effective tool to increase knowledge and clinical performance compared to the lecture-based teaching method (Jang & Song, 2021).

A quasi-experimental revealed that HFS is an effective teaching tool that helps to enhance the clinical judgment of students and that it is an effective and safe teaching-learning environment to the students (Ayed et al., 2022). Meanwhile, Vural & Zengin (2020) compared the influence of high-fidelity simulation and traditional teaching methods on nursing students' knowledge and skill performance by conducting a randomized control trial. The finding of this trial showed that HFS was more effective in increasing students' knowledge and skills compared to the traditional methods. Also, it was found that students who were trained under HFS showed less fear and anxiety compared to the students in the control group (Vural Doğru & Zengin Aydın, 2020).

Another quasi-experimental study was conducted by Rabori et al. (2021) revealed that the simulation-based learning method is an effective learning strategy in the acquisition of clinical skills among nursing students (Rabori et al., 2021). Similarly, a Saudi Arabian study proved that Simulation-based learning also is an efficient tool to enhance the knowledge acquisition of nursing students (Aljohani et al., 2019).

Among these reviewed articles two articles evaluated the effectiveness of Standardized Patient simulation design. (Basak et al., 2019) compared the effectiveness of standard patients (SPs) and theoretical lectures on enhancing the patient teaching skills of nursing students. This randomized control study revealed that the patient teaching skills score of the group receiving the simulation scenario was higher than the theoretical lecture group. Also, this study found that SPs group students expressed more confidence while teaching the patient than the other group (Basak et al., 2019). Similarly, (Cabañero- et al., 2023) analyzed the effectiveness of a standardized patient simulation programme among nursing students up to six months after the implementation of the simulation activity. It was found that the self-efficacy and communication skills were maintained by the students after six months (Cabañero- et al., 2023).

Simulation-based education helps students to increase their self-satisfaction and self-confidence by giving them a meaningful learning experience. It also supports the students to face the real clinical environment without fear (Al Khasawneh et al., 2021). Nevertheless, Kang (2022) couldn't find any significant difference between the pre-test and post-test scores to assess the nursing students' anxiety, confidence in clinical decision-making and communication competence.

Discussion

The findings of this review contribute to the assessment of the effectiveness of simulation-based learning in different ways. this review showed that simulation-based learning is an effective tool for nursing education and it helps to enhance nursing students' knowledge, clinical skills, decision-making, clinical reasoning abilities and communication skills (Koukourikos et al., 2021).

Table 1: Summary of studies included in the review

Study	Design	Sample	Finding
Aljohani et al. 2019	A quasi-experimental study	Undergraduate nursing students	There were statistically significant differences between the mean scores of pre-test and post-test, indicating that simulation has an effect on increasing the knowledge of nursing students.
Al Khasawneh et al. (2021)	Cross-sectional descriptive study	Undergraduate nursing students	Students were satisfied with the simulation technique & they felt self-confident after the simulation activity and self-confidence were correlated with educational practices and simulation design.
Ayed et al. (2022)	A quasi-experimental study	Undergraduate nursing students	High-fidelity simulation experience has improved pediatric nursing students' clinical judgment.
Basak et al. (2019)	Randomized control trial	Undergraduate nursing students	Simulation was found to be a more effective tool on patient teaching skill in nursing students.
Cabañero- et al. (2023)	A quasi-experimental study	Undergraduate nursing students	Simulation helped the students to maintain self-efficacy and communication skill
(30))	A quasi-experimental study	Undergraduate nursing students	The experimental group obtained a slightly higher average SPS score than the control group, but the difference was not statistically significant.
Jang & Song (2021)	Mixed-method approach	Undergraduate nursing students	Three themes were identified: (i) transformation into a self-directed learner for understanding the clinical situation, (ii) increased awareness of clinical reasoning ability, and (iii) embodiment of the clinical reasoning process.
Kang (2022)	A quasi-experimental study	Undergraduate nursing students	There are no significant improvements after the application of the simulation, the result of the simulation effectiveness scores and open-ended questions revealed that the simulation had a positive impact on nursing students.

Rabori et al. (2021)	A quasi-experimental study	Undergraduate nursing students	Simulation was more effective in achieving clinical skills than the traditional method
Rattani et al. (2020)	A quasi-experimental study	Undergraduate nursing students	High-fidelity simulation had improved the attitudes of students toward providing care and helped to deal with their own emotions.
Tamaki et al. (2019)	Randomized control trial	Undergraduate nursing students	The simulation group improved significantly in knowledge, skill performance in physical assessment and psychological care, and self-confidence related to end-of-life care.
Vural & Zengin (2020)	Randomized control trial	Undergraduate nursing students	High-fidelity simulator method was more effective than the traditional teaching method to increase the students' knowledge. Also, it reduces the anxiety level of the students.

Simulation-based learning has increasingly become an effective tool of nursing education, offering a dynamic approach to developing clinical skills, critical thinking, and decision-making. Simulation provides a controlled environment where nursing students can practice and refine their skills without causing any harms to the patients. Simulation-based learning addresses the complexity and variability of real-world clinical scenarios (Kim & Lee, 2020).

Studies have expressed that incorporating simulation into nursing education is an effective way to prepare a competent nurse. The mere classroom knowledge is not adequate for a competent nurse. They have to apply their theoretical knowledge in the clinical settings. Simulation based learning helps the nursing students to apply their theoretical knowledge in a safe environment by mimicking the real clinical setting. This finding is supported by a study that says combining the theoretical knowledge and simulation training helps to increase nursing students' clinical skills and knowledge and make them competent in their profession (Demirtas et al., 2021).

This review demonstrates that simulation provides self-confidence to the students as they can be able to practice clinical skills in a safe environment. Students will not involve with real patients in a simulation setting and they don't have fear of causing harm to the students. This led the students to practice a particular skill or procedure repeatedly. By this repeated practice will help to foster their clinical skills and it will improve their self-confidence. This finding correlates with the study conducted by Vural Doğru & Zengin Aydın (2020) simulation provides an opportunity for a planned and repetitive application of clinical skills.

Similar results were found in another study, repetitive practice increases their confidence and experiences and also, it helps to recognize and rectify errors without harming the patient and more importantly, it gives room to provide feedback to students about their performance. Simulation-based learning improves students' self-confidence and satisfaction and they can be able to provide better care to the patient. Students feel comfortable, relaxed, brave, calm, less anxious, stress-free and happy while participating in the simulation activity (Demirtas et al., 2021).

The outcome of simulation on clinical competency and communication skills are important aspects. A study done by Alinier (2011) investigated the effects of intermediate fidelity simulation training on clinical skills and competency of nursing students. The results showed that participants who underwent simulation training expressed enhanced clinical competency than the participants who were in the control group (Alinier, 2011).

The results highlight the importance of integrating simulation-based learning into the nursing curriculum as it helps to overcome the lack of clinical competency among nursing professionals and it ensures safe and effective care for patients by minimising errors in clinical settings. Adequate resources, well-trained educators, and satisfaction among the students and staff are the important factors for the successful implementation of Simulation-Based Learning in nursing education. Study conducted by (Frotjold & Sydney, n.d.) investigated the lived experiences of nursing academics in implementing simulation. The finding revealed that there was a challenge in implementing simulation because of lack of technical support and lack of readiness and resources (Frotjold & Sydney, n.d.).

There are a few significant limitations to our study that should be mentioned. The studies included in the review may have been conducted in specific settings, with certain populations or educational contexts. So, it cannot be generalized in other settings. The search was limited between 2018 and 2023. It could be limited the findings. Therefore, this study recommends the researchers to conducted a in depth review.

This review found some challenges in implementing simulation-based learning. Future studies can be conducted to identify the factors which are affecting simulation and it can be analyzed how can these challenges be overcome.

Conclusion

This review was aimed to identify the effectiveness of simulation-based learning in nursing education by analyzing the related literature. The review article demonstrated that simulation provides a wide range of advantages to nursing students. It was observed that implementing simulation-based learning in nursing education has a positive impact on nursing students' knowledge acquisition and clinical competency.

Overall, the current research supports incorporating simulation-based learning into nursing curricula as it helps to produce competent and skillful nurses. These various simulation techniques help the nursing students to improve their clinical skills, critical thinking ability, clinical reasoning, self-confidence, self-satisfaction and communication skills. Also, it reduces the students' anxiety and increases their self-efficacy level.

Adequate resources, well-trained educators, and satisfaction among the students are to be considered for incorporating Simulation-Based Learning in curricula. Staff readiness, technical support and student satisfaction are important factors in implementing simulation in higher education. Regular assessment of the simulation techniques, staff readiness, and student satisfaction need to be done to ensure the effectiveness of Simulation-Based Learning.

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