Heliyon 11 (2025) e42524

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Efficacy of high fidelity pediatric simulation on nursing students' self-awareness and empathy in a Middle Eastern County

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ARTICLE INFO

Keywords:
Empathy
High fidelity simulation training
Nursing students
Pediatric nursing
Simulation training

ABSTRACT

Background: The importance of nurses' self-awareness and empathy and the effect of high-fidelity simulation in cultivating self-awareness and empathy among students is yet to be explored.
Methods: This study determined the efficacy of high-fidelity simulation on self-awareness and empathy among undergraduate nursing students. A quasi-experimental approach with a one-group pre-posttest design was employed. Self-awareness was assessed using Self-Consciousness Revised Scale (22 items), while empathy was measured with the Kiersmae Chen Empathy Scale (15 items).
Results: Data from 67 participants were analyzed. Analysis revealed no significant difference in students' self-awareness ($t = -0.01$, $p > 0.05$) or empathy ($t = -1.92$, $p > 0.05$) pre- and post-high-fidelity simulation. However, there was a notable improvement in cognitive empathy scores. To compare High-fidelity simulation and self-awareness, a one-way ANCOVA was conducted, controlling for gender, GPA, and previous exposure to simulation. The results indicated a non-significant relationship ($F(1) = 3.59$, $p > 0.05$). Likewise, High-fidelity simulation and empathy was compared using one-way ANCOVA while controlling for gender, GPA, and previous simulation exposure. The results revealed a non-significant relationship ($F(1) = 1.64$, $p > 0.05$).
Conclusion: Though the study findings did not demonstrate significant effects, the observed enhancement in cognitive empathy post-simulation suggests a potential benefit. It is plausible that the intervention dosage was insufficient to induce substantial changes in these skills. Therefore, it is recommended to replicate the study with a larger sample and multiple simulation sessions.

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https://doi.org/10.1016/j.heliyon.2025.e42524
Received 5 September 2024; Received in revised form 3 February 2025; Accepted 6 February 2025
Available online 7 February 2025
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Key points

- Nurses' are required to possess self-awareness and empathy in enhancing patient care outcomes.
- High fidelity simulation utilizing different patient care scenarios are expected to enhance the self-awareness and empathy among nursing students.
- Notable improvement in cognitive empathy scores was observed after the pediatric high-fidelity simulation.

1. Introduction

Simulation in educational settings aims to replicate clinical practice through varying fidelity scenarios. Simulated scenarios enable the repetitive training of various clinical skills in a safe environment [1,2], allowing learners to reach an optimal level of learning and develop critical and reflective analysis skills ([3]; Raurell-Torredà et al., 2020). Advanced simulation involves high-fidelity systems that accurately replicate real clinical situations, offering learners an immersive and authentic learning experience [4,5]. High-fidelity simulation (HFS) labs help nurses develop the skills required to care for complex patients, handle emergencies, and work closely with other healthcare professionals [6].

HFS also enhances patient-centered care and improves the skills required for effective nursing practice [7]. Consequently, it creates a safe and controlled space where learners can learn from their mistakes without risking patient safety, boosting their confidence and capability. Considering these valuable learning opportunities, HFS could potentially replace up to half of the clinical training hours in a nursing program [8]. The use of HFS in nursing education offers significant advantages beyond cognitive learning, extending to the promotion of patient-centered and sensitive care in the affective domain [9,10].

Patient-centered care emphasizes a personalized approach to health care through a therapeutic relationship with the clients (Morgan, 2012). Healthcare students can foster patient-centered and sensitive care practices through their self-awareness and empathy skills [11]. Self-awareness enable nursing students to recognize their strengths and identify areas for growth, promoting mindfulness that can positively impact patient care. This element is integral to reflective thinking and is most effectively instilled through active engagement in structured interventions and practical tasks, such as high-fidelity simulation ([12]; [13]; [14]). A reflective student nurse learns to navigate past negative thoughts and experiences to focus on providing positive care for the patient (Matshaka, 2021).

Likewise, empathy is crucial for a successful patient-nurse interaction [15]. It plays a crucial role in patient care by facilitating a deeper understanding of their experiences, concerns, and viewpoints, ultimately accelerating physiological healing [11,16]. Nursing education has integrated simulation as a means to enhance empathy through various methods, including simulated suits ([17]; Mandegari-Bamakan et al., 2021), standardized patients (Colbert, 2018), high-fidelity mannequins, and virtual simulations [18]. However, there has been a significant decline in empathy training throughout clinical training and healthcare education programs, leading to inadequate communication among healthcare practitioners due to the need for more emphasis on empathy training [19].

Furthermore, the healthcare setting and educational process overly prioritize technological proficiency over addressing patients' mental well-being [20]. Optimistic findings exist on the impact of HFS on self-awareness and empathy [21]. Recent research indicated that participation in virtual simulation or text-based case studies significantly increased reported empathy among nursing students [22]. Additionally, an assessment aimed to gauge changes in nursing students' empathy before and after engaging in a clinical simulation focused on caring for patients with physiological elimination needs revealed improved levels of empathy following the exercise [23].

Despite the importance of therapeutic nurse-patient relationships, the knowledge of self-awareness and empathy in nursing still needs to be examined (Rasheed, Younas, & Sundus, 2019). Moreover, it is crucial to conduct research-involving participants from different cultural backgrounds for comprehensive understanding of the effect of high-fidelity simulation on self-awareness and empathy. This study aimed to bridge this knowledge gap by investigating the efficacy of high-fidelity simulation on self-awareness and empathy among Omani nursing students, a population representing a Middle Eastern cultural background.

2. Materials and methods

2.1. Design

This study followed a quasi-experimental research approach utilizing a one-group pretest-posttest design. This design allowed comparing students' performance before and after the intervention without a control group [24], and was used in earlier studies to examine the outcomes of high-fidelity simulation [4].

2.2. Setting

The research was carried out in the simulation laboratory of the College of Nursing at Sultan Qaboos University, located in Oman. The simulation unit has six skill practice and simulation rooms. All the laboratories are equipped with low, medium and high fidelity mannequins. The simulation unit has a debriefing room. All the clinical courses including Health Assessment, Adult health Nursing,

Maternity Nursing, Pediatric Nursing, Critical care Nursing, Psychiatric nursing, Nursing leadership, and Advanced clinical nursing utilizes simulation in their courses. A high-fidelity fully operational pediatric mannequin was used for the simulation in this study.

2.3. Population and sample

The study participants were undergraduate nursing students. All students registered for the child health nursing clinical course at College of Nursing, Sultan Qaboos University during the Fall of 2023 and spring 2024 were invited to participate in the study using a total enumeration sampling technique. All students who were enrolled in the child health-nursing course were eligible for participation if they signed the informed consent.

2.4. Study instruments

Participants completed a demographic characteristics form, including questions about their age, gender, cumulative Grade Point Average (GPA), and previous exposure to high-fidelity simulation. Self-awareness was measured using the Self-Consciousness Scaled Revised scale, while empathy was assessed using the Kiersmae Chen Empathy Scale. The study outcomes were measured at two time points: before and after the simulation sessions.

2.5. Self-awareness

The revised self-consciousness scale was used to evaluate differences in self-awareness in the pre and posttest. This is a 22-item psychometric instrument designed and has three main dimensions: private self-consciousness, public self-consciousness, and social anxiety. The scale is answered with a 4-point Likert-scale format, ranging from 0 to 3 (0 = not like me at all, 3 = a lot like me) [25]. Thus, the scale's total score may range from 0 to 66. A higher score denotes a higher level of self-awareness. Its updated version seeks to be suitable for diverse populations and is a versatile tool for research and clinical use, representing good reliability with Cronbach's alpha ranging from 0.74 to 0.90 (DaSilveira et al., 2015).

2.6. Empathy

Empathy was assessed using the Kiersmae Chen empathy scale. The scale is designed to assess empathy's affective and cognitive components, which play a critical role in providing high-quality patient care. It encompasses 15 items, answered on a seven-point Likert scale with responses ranging from 1 = strongly disagree to 7 = strongly agree. Therefore, the total score may range from 15 to 105. A higher score reflects a higher level of empathy. Reliability was demonstrated among nursing students through simulation as an intervention, with a reported Cronbach's alpha of 0.86 [26]. Construct and criterion validity were established in nursing students through factor analysis, which confirmed that 14 out of the 15 items were linked to their respective concept areas [26].

3. Data collection procedure

3.1. High-fidelity simulation scenarios

Four emergency pediatric scenarios were used. The scenarios include diabetes ketoacidosis, blood transfusion reaction in a patient with sickle cell disease, hydrocephalus with increased intracranial pressure, and pneumonia with respiratory distress. The mother of the child was very aggressive, stressful, irritable, crying and shouting to the nurses. All the scenarios were structured in a way that help the students feel empathy for the mother of the child. Further, with such stressful scenarios, the participants got ample opportunities to know themselves better.

3.2. Simulation implementation

A pre-briefing was conducted for all the participating students. The high-fidelity simulation was conducted in four consecutive days in both semesters, discussing one scenario daily. Each day, 10–15 students participated. They were divided into 4–5 groups, so each group had only 3 students. The same scenario was used each day for all the groups. However, students were asked to wait in a room, and they were not allowed to communicate with those students who already finished the simulation to avoid contamination. Students from the first three of four groups attended the last group simulation. All simulation activities were recorded for the debriefing. The same scenarios were used in the Fall and Spring semesters. The research assistant who was the nurse played the role of mother. All of them were well trained by the principal investigator (PI) on how to perform the scenario. Each day, during the pre-briefing, the research team explained to the students about the study. All the students participated in the simulation as it is part of the coursework, yet only those who were interested were asked to sign the informed consent and were asked to complete the study questionnaires. It was an online questionnaire, so the barcode was given to those who signed the informed consent. After the debriefing, the students were also asked to complete the post-test questionnaires using the barcodes.

3.3. Ethical considerations

Ethical approval was secured from the Research and Ethics Committee of College of Nursing, SQU (Ref. No. CON/NF/2023/21). No personal identifying information was gathered. Since this is part of coursework and no actual clients were involved, no risks are associated with this study. Furthermore, there was no expected physical or psychological harm to participants in this research. Before completing the questionnaire, students provided written consent after being informed that their participation did not affect their grades. The data collected were securely stored in a password-protected file under the supervision of the project's Principal investigator.

3.4. Data analysis

Study data was entered in SPSS version 25. The data were thoroughly cleaned and checked for errors before analysis. Descriptive analysis described participants' characteristics and study outcomes, including percentages, frequencies, mean, and standard deviation. The paired samples *t*-test was utilized to validate the study hypothesis, stating that there is no statistically significant difference between self-awareness and empathy before and after the HFS. A p-value of $>$ .05level of less than 0.05 was considered statistically significant.

4. Results

4.1. Participant's characteristics

The study involved 67 participants, all of whom completed the study, resulting in no dropouts. Most participants were female students (76.1 %). The study included 23.9 % of male and 76.1 % of female nursing students. 82.1 % of study participants were previously exposed to high fidelity simulation; whereas 17.9 % of them were not exposed to high fidelity simulation. The participants were a diverse group, including students from the fourth (53.7 %) and fifth (46.3 %) years of the program with varying GPAs, as outlined in Table 1.

An initial analysis was performed to examine potential positive associations between the student related factors (age, gender, previous exposure to simulation, and study level) and the outcomes (empathy and self-awareness) using t-tests, correlation, and ANOVA. However, none of these associations were found to be statistically significant.

4.2. High-fidelity simulation and self-awareness

The mean self-awareness score before the high-fidelity simulation was 38.96 (SD = 7.80), while the mean score after the intervention was 38.97 (SD = 8.94). Details relevant to the results of scale components, which show a marginal increase in the social anxiety component, are presented in Table 2. A paired *t*-test was conducted to examine the effect of the high-fidelity simulation on students' self-awareness scores. The test showed that the increase in test scores before the intervention to after the intervention was statistically non-significant, t (66) = −.012, p $>$ 0.05. The mean score difference was −.015 points, with a 95 % confidence interval ranging from −2.47 to 2.44 (Table 3).

4.3. High-fidelity simulation and empathy

Before the high-fidelity simulation, the average empathy score was 69.66 (SD = 11.86), increasing to 73.58 (SD = 13.28) after the intervention. The results of scale components can be found in Table 2, detailing the observed influence on the cognitive scale. A paired *t*-test was carried out to assess the impact of the high-fidelity simulation on students' empathy scores, which revealed no statistically

Table 1
Participants characteristics (N = 67).

Gender	Frequency	%
Male	16	23.9
Female	51	76.1
Level of Program		
Fourth Year	36	53.7
Fifth Year	31	46.3
Previous exposure to high-fidelity simulation		
Yes	55	82.1
No	12	17.9
GPA		
<2.0	1	1.5
2.0–2.4	2	3.0
2.5–2.9	23	34.3
3.0–3.5	32	47.8
>3.5	9	13.0

Table 2
Pre and Post-High-Fidelity Simulation levels of Self-awareness and Empathy.

	Min	Max	Mean	Std. Deviation
Total self-awareness pre-intervention	23.00	58.00	38.96	7.80
Private self-consciousness	10.00	25.00	16.64	3.54
Public self-consciousness	3.00	21.00	12.90	3.58
Social Anxiety	0.00	18.00	9.42	3.64
Total self-awareness post-intervention	23.00	60.00	38.97	8.94
Private self-consciousness	10.00	24.00	16.52	3.92
Public self-consciousness	3.00	21.00	12.90	4.05
Social Anxiety	1.00	18.00	9.55	3.25
Total Empathy pre-intervention	36.00	92.00	69.66	11.86
Cognitive scale	21.00	56.00	42.51	7.68
Affective scale	11.00	38.00	27.15	4.98
Total Empathy post-intervention	25.00	95.00	73.58	13.28
Cognitive scale	14.00	63.00	44.75	8.98
Affective scale	11.00	38.00	27.15	4.98

Table 3
Effect of high-fidelity simulation on students' self-awareness and empathy.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	S. D	Std. Error Mean	95 % Confidence Interval of the Difference				
				Lower	Upper			
Self-awareness pre-intervention Self-awareness post-intervention	−.015	10.06	1.23	−2.47	2.44	−.012	66	.990
Empathy pre-intervention Empathy post-intervention	−3.93	16.76	2.05	−8.01	.16	−1.92	66	.060

significant increase in scores following the intervention, $t(66) = -1.92$, $p > 0.05$. The mean score difference was −3.93 points with a confidence interval of −8.01 to .16 (Table 3).

4.4. *High-fidelity simulation and self-awareness*

A one-way ANCOVA was conducted, controlling for gender, GPA, and previous exposure to simulation. The results indicated a nonsignificant relationship ($F(1) = 3.59$, $p > 0.05$).

4.5. *High-fidelity simulation and empathy*

A one-way ANCOVA was conducted while controlling for gender, GPA, and previous simulation exposure. The results revealed a nonsignificant relationship ($F(1) = 1.64$, $p > 0.05$).

5. Discussion

High fidelity simulation is increasingly used in nursing education. It provides opportunity to the students to practice variety of real-life situational simulations before entering to the actual clinical practice. Therefore, many nursing educators and institutions embraced HFS to enhance the clinical competence of nursing students [27]. In addition, HFS enhances the knowledge acquisition, professional skills and clinical judgement. Thus, it guides the nurse educators to use HFS for transitioning students from the learning environment to the clinical practice [27]. Furthermore, the International Nursing Association for Clinical Simulation and Learning (INACSL) advocate the use of simulation using real-world situations [28]. Additionally, the Health and Care Professions Council (HCPC) endorses the use of simulation using patient-safe experiences to enhance the clinical practice [29].

Effects of HFS using life threatening clinical scenarios have shown to improve the learning outcomes of undergraduate nursing students. In particular, the knowledge and clinical competence have improved after participating in HFS [30]. As cited in this study, emergency simulation scenarios including diabetes ketoacidosis, blood transfusion reaction in a patient with sickle cell disease, hydrocephalus with increased intracranial pressure, and pneumonia with respiratory distress were used in the current study. Even though, significant improvements could not be observed in self-awareness and empathy scores of the participants, improvements could be noted in cognitive empathy score after the high fidelity emergency simulation. This could be due to small sample size and exposure to the simulation scenario once during the study. Recent systematic review conducted by Ref. [31]) on the effectiveness of simulation-based interventions on empathy enhancement among nursing students suggests conducting simulation –based education to improve the nursing student's overall empathy skills.

Further, Ayed et al. [21] highlighted that a high-fidelity simulation significantly improves self-awareness, patient-centered care and empathy among pediatric nursing students. In addition, virtual reality simulations are found to enhance the empathy in healthcare students [32]. Besides, the researchers believe that the self-awareness and empathy could be enhanced by repeating the simulation scenarios with varying levels of complexity requiring empathetic communication in the simulation. Evidences states that repeated simulation experience fosters the retention of knowledge and skills [33]. In addition, repeated simulation augments the self-confidence, critical thinking, competence and satisfaction among nursing students [34,35]. In addition, simulation based interventions leads to increased levels of empathy among nursing students [31].

Additionally, increasing the psychological fidelity during the HFS evoking an emotional and exemplified experience appear to have a positive impact on empathy levels of nursing students [36]. Therefore, theoretical integration of emotions and stress help broaden the concept of empathetic communication to the patients. Moreover, the nursing simulation educators should encourage the students to reflect on the emotions and the reason for having a positive and negative empathetic experience with their simulated participants [37]. Likewise, encouraging empathetic communications in the simulation laboratory improves the active listening skills and reduces the perceived anxiety levels among nursing students [38].

In consistent to our study findings, Riess, D. L. (2018) observed no significant difference in the empathy, self-confidence and satisfaction levels of nursing student's pre and post simulation. It is therefore suggested to change and improve the empathetic communication with the patient and family members by conducting HFS in different simulated clinical environment. In addition, varying levels and complexity of simulations requiring empathetic communication are recommended. Moreover, the concepts of communication, empathy, meditation, and cultural competence could be taught using simulation and immersion methods with the patients, and high fidelity mannequins, which is believed to increase the empathy among nursing students [39]. Embedding empathy-based education in the medical, nursing and allied health programs can help healthcare professional students to understand their patient's perspective and promote positive patient outcomes (Peisachovich et al., 2023).

In a recent study, Hamaideh et al. [40] reported low self-awareness levels, adequate empathy level and moderate perceived stress level among nursing students. However, Arrogante et al. [41] stated that HFS based training allows the undergraduate nursing students to increase their empathy levels and positive attitude towards caring for older people. In addition, Ayed et al. [21] indicated that pediatric HFS enhances the empathy, self-awareness and patient-centered care. Interestingly, mixed learning using high fidelity simulation and virtual simulation are becoming increasingly common to provide learning opportunities to experience real-life clinical scenarios as these experiences improves the thought process and clinical competence [42]. It is very evident from the findings that having these skills benefit the patients, as the nursing students are able to provide high quality care to their patients.

6. Conclusion

Interventional programs embedding complex clinical situations requiring empathetic communications using high fidelity simulation have the potential to enhance the self-awareness, empathy of nursing students. Self-awareness enhances the nurse's confidence in providing culturally competent care and managing challenging clinical situations. Empathy and communication skills training are recommended to enhance the empathetic communication among nurses.

7. Limitations

Several limitations were encountered during in this study. Firstly, the sample size was relatively small, suggesting a need for larger sample sizes in future studies to show a statistically significant trend. Additionally, students were exposed to only one simulation, which may not be sufficient to detect changes in empathy and self-awareness. Therefore, future studies should consider multiple exposures before evaluating these variables.

CRediT authorship contribution statement

Basma Al Yazeedi: Writing – original draft, Conceptualization. **Zeinab Al Azri:** Writing – original draft, Methodology, Conceptualization. **Harshita Prabhakaran:** Project administration. **Sheeba Elizabeth John:** Project administration. **Lina Mohammed Wali Shakman:** Investigation. **Divya Raghavan:** Investigation. **Erna Judith Roach:** Resources, Project administration. **Samiya Al Sabari:** Project administration. **Judie Arulappan:** Writing – review & editing, Conceptualization.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they do not have any conflict of interest in publishing this manuscript.

Acknowledgement

The authors acknowledge the study participants.

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