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EFFECTIVENESS OF SIMULATION-BASED LEARNING IN NURSING EDUCATION: THEORETICAL AND PRACTICAL ASPECTS

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Abstract

This article examines the effectiveness of simulation-based modelling in nursing education and its application in practical training. The aim of the study was to assess the impact of simulation-based learning technologies on nursing students' acquisition of clinical skills and to compare this method with traditional clinical practice. The study was conducted during the 2023–2024 academic year at three medical education institutions in Uzbekistan, involving 120 nursing students. A mixed-method research design was employed: the experimental group underwent simulation-based sessions while the control group followed conventional clinical practice. Results showed that students trained through simulation scored 23.4% higher on the practical skills assessment than the control group; self-efficacy levels increased by 31.7%. The quality of debriefing was identified as the factor contributing most to improved outcomes. The study confirms the critical role of simulation-based modelling in modernising nursing education and presents recommendations for its integration into the Uzbekistan education system.

Keywords

simulation-based learning, nursing, clinical skills, high-fidelity manikin, debriefing, practical training, medical education innovation.

1. INTRODUCTION

The nursing profession in the modern healthcare system encompasses direct patient care, medication administration, clinical monitoring, and the provision of emergency medical assistance. Mastering this responsible profession requires students to possess not only deep theoretical knowledge but also a high level of practical skills. However, in traditional educational settings, practising directly on patients during clinical training raises a range of ethical concerns, safety risks, and resource constraints (WHO, 2016).

Simulation-based modelling is an advanced pedagogical approach that enables students to be trained safely and effectively by replicating real clinical situations in an artificial, controlled environment. The World Health Organization (WHO) and international medical education bodies recognise simulation-based learning as a vital tool for ensuring patient safety and recommend its widespread adoption.

Healthcare reforms being implemented in Uzbekistan are placing new demands on the quality of nursing workforce training. The Healthcare Development Strategy for 2019–2025 identifies the modernisation of medical education — including the introduction of simulation technologies — as a distinct priority. Nevertheless, a scientifically grounded and systematic model for simulation-based learning at the nursing college level has yet to be developed.

The primary objective of this study is to evaluate, through experimental investigation, the impact of simulation-based modelling on nursing students' clinical skills and professional self-efficacy.

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Research objectives:

1. To analyse the theoretical and methodological foundations of simulation-based modelling in nursing education;
2. To examine the current state of simulation-based learning implementation in medical education institutions in Uzbekistan;
3. To quantitatively and qualitatively assess the effectiveness of simulation-based learning through an experimental study;
4. To develop recommendations for integrating simulation-based modelling into nursing education.

2. MATERIALS AND METHODS

2.1. Research Design

A mixed-method research design was employed: the quantitative component consisted of an experimental-control group comparison, while the qualitative component involved in-depth interviews and observational analysis. The study ran from September 2023 to May 2024.

2.2. Participants

A total of 120 second-year nursing students from three medical education institutions in Uzbekistan were recruited. Participants were randomly assigned to two groups using random sampling:

– Experimental group (n=60): received simulation-based sessions in addition to conventional theoretical instruction;
– Control group (n=60): followed the standard curriculum with traditional clinical practice.

Inclusion criteria: enrolment as a second-year nursing student, no prior commencement of clinical placement, and provision of voluntary informed consent.

2.3. Instruments and Materials

The following materials were used in the study:

– Laerdal SimMan 3G (high-fidelity manikin) — for emergency scenario simulation;
– OSCE (Objective Structured Clinical Examination) assessment rubric — for clinical skills evaluation;
– Likert-scale self-efficacy questionnaire (Nursing Self-Efficacy Scale, NSES);
– Qualitative observational protocol — for behavioural analysis during simulation sessions.

2.4. Simulation Session Protocol

Weekly 3-hour simulation sessions were conducted for the experimental group over 16 weeks. Each session consisted of three phases: a preparatory stage (briefing, 15 minutes), the simulation scenario (30 minutes), and a reflective discussion (debriefing, 15 minutes). Scenarios were progressively increased in complexity.

2.5. Data Analysis

Quantitative data were analysed using SPSS 26.0. Independent t-tests and the Mann-Whitney U-test were applied to identify inter-group differences. The threshold for statistical significance was set at $p<0.05$. Qualitative data were processed using thematic analysis.

3. RESULTS

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3.1. Clinical Skills Outcomes

OSCE assessment results indicated that the experimental group achieved a mean score of 78.6 ± 9.2, compared to 63.6 ± 11.4 for the control group. The difference between groups was statistically significant (t=7.84; p<0.001). Students trained through simulation performed 23.4% better on the practical skills assessment.

Table 1. Comparison of OSCE Results

Indicator	Experimental Group	Control Group	p-value
Mean score (0–100)	78.6 ± 9.2	63.6 ± 11.4	p<0.001
Minimum score	56	40	—
Maximum score	97	89	—
Students achieving distinction (%)	41.7%	18.3%	p=0.004

3.2. Self-Efficacy Levels

According to the NSES questionnaire, the experimental group's self-efficacy score increased by 31.7% by the end of the sessions (baseline: 52.3 ± 8.1; final: 68.9 ± 6.4). In the control group, this indicator rose by 12.4% (from 54.1 ± 7.9 to 60.8 ± 8.2). The difference between groups was statistically significant (U=892; p<0.001).

Table 2. NSES Self-Efficacy Scores

Group	Baseline	Final	Change	p-value
Experimental group	52.3 ± 8.1	68.9 ± 6.4	+31.7%	p<0.001
Control group	54.1 ± 7.9	60.8 ± 8.2	+12.4%	p=0.011

3.3. Qualitative Results

In-depth interviews and observational data revealed four core themes: (1) quality of debriefing — students rated the discussion phase as the most valuable component; (2) psychological safety — reduced fear of making errors; (3) teamwork skills — enhanced ability to collaborate during group scenarios; (4) stress resilience — improved capacity for rapid decision-making in emergency situations.

4. DISCUSSION

The findings are consistent with conclusions drawn in international research. The large-scale US study by Hayden et al. (2014) found that simulation groups achieved outcomes no lower than those of traditional clinical placement groups. Our study demonstrated a statistically

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significant superiority of simulation-based learning over conventional methods, which may be explained by features specific to the educational environment in Uzbekistan.

The central role of debriefing was also confirmed in our findings. As noted by Fanning and Gaba (2007), 70–80% of learning in simulation-based education occurs during the debriefing phase. In this study, groups whose facilitators conducted high-quality debriefing sessions achieved outcomes that were 18% higher.

However, the study has certain limitations: first, the sample size was relatively small (n=120); second, long-term (longitudinal) outcomes — such as skill retention following clinical placement — were not examined. Third, differences in material and technical provision between institutions may have partially confounded the results.

The meta-analysis by Cant and Cooper (2010) confirms simulation-based learning's high effectiveness in improving critical thinking, teamwork, and self-efficacy — findings that are directly corroborated by our qualitative results.

5. CONCLUSION

This study experimentally confirmed that simulation-based modelling is an effective pedagogical tool in nursing education. Students trained through simulation performed 23.4% better on the clinical skills assessment, and their professional self-efficacy increased by 31.7%.

Based on the study findings, the following recommendations are proposed:

- Incorporate simulation-based sessions as a mandatory component (at least 30% of total practical hours) into nursing education curricula;
- Establish modern simulation centres equipped with the necessary technology in all medical education institutions;
- Introduce a dedicated facilitator training and certification system in debriefing methodology;
- Develop national simulation-based learning standards for Uzbekistan based on INACSL international standards;
- In future research, investigate long-term outcomes, including skill retention following employment in clinical settings.

The systematic integration of simulation-based modelling into nursing education will not only improve educational quality but also make a significant contribution to ensuring patient safety and enhancing the overall effectiveness of Uzbekistan's healthcare system.

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