

AN EMPIRICAL STUDY ON VIRTUAL REALITY INTEGRATION IN NURSING EDUCATION: ITS IMPACT ON LEARNING PERFORMANCE AND CLINICAL SKILLS DEVELOPMENT

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Abstract

Introduction: The integration of Virtual Reality (VR) into nursing education has emerged as a promising strategy to enhance student learning by providing immersive, hands-on experiences in simulated clinical environments. While prior studies have suggested VR's potential to improve decision-making, skill acquisition, and knowledge retention, limited empirical data exists on the strength of these relationships within academic nursing programs.

Methods: This study employed a descriptive-correlational quantitative design to investigate the relationship between the use of VR in nursing education and key learning outcomes, including knowledge retention, confidence in clinical skills, decision-making abilities, and overall clinical preparedness. A total of 157 nursing students and educators from higher education institutions were surveyed using a structured questionnaire. Responses were analyzed using Pearson's correlation coefficient at a 0.05 and 0.01 level of significance.

Results: Findings revealed weak but statistically significant positive correlations between VR use and decision-making abilities in performing medical procedures ($r = 0.158, p = 0.049$) and handling high-pressure clinical scenarios ($r = 0.174, p = 0.029$). No significant correlations were found between VR use and knowledge retention, clinical confidence, or general preparedness. These results indicate that while VR may enhance specific cognitive and procedural competencies, it does not significantly influence broader learning outcomes without additional pedagogical support.

Conclusion: The study supports previous literature suggesting that VR is effective for targeted skill development, particularly in high-stress clinical decision-making. However, its broader impact on learning may depend on integration strategies, faculty training, and curriculum alignment. It is recommended that institutions adopt VR as a complementary learning tool alongside traditional methods, ensuring comprehensive instructor and student orientation.

Keywords: Virtual Reality (VR), Nursing Education, Skill Acquisition, Clinical Decision-Making, Learning Performance.

Introduction

The rapid evolution of technology in healthcare education has led to the integration of advanced digital tools such as Virtual Reality (VR) to simulate clinical scenarios and enhance the learning experience. VR provides immersive, interactive environments where nursing students can practice clinical procedures, decision-making, and critical thinking in a safe, controlled setting (White & Grant, 2023). This innovation addresses gaps in traditional clinical education by offering exposure to rare or high-risk situations without endangering patient safety.

Several studies have highlighted the educational benefits of VR, including improved engagement, enhanced confidence in clinical skills, and increased retention of complex knowledge (Groom et al., 2022; Hall & Morrison, 2024). However, despite its potential, barriers such as high costs, limited access to technical support, and insufficient training among faculty and students often hinder its implementation (Patel et al., 2021). Furthermore, there is limited empirical evidence on how VR correlates with specific learning outcomes such as skill acquisition, clinical preparedness, and knowledge retention in nursing education.

Given the growing interest in immersive learning technologies, this study aims to investigate the relationship between VR use in nursing education and measurable improvements in learning performance, particularly focusing on decision-making abilities, knowledge retention, and clinical skill confidence. The findings seek to inform educators and policymakers on how to effectively integrate VR into nursing curricula and optimize its educational benefits.

Methods

Research Design

This study employed a descriptive-correlational quantitative research design to examine the relationship between the use of virtual reality in nursing education and various learning outcomes such as knowledge retention, skill acquisition, and decision-making.

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Participants

A total of 157 nursing educators and students from various academic institutions participated in the study. Participants were selected using purposive sampling, targeting individuals with prior exposure to VR-based training modules within their nursing programs.

Instrumentation

Data were collected using a structured survey questionnaire, which was developed based on existing literature (e.g., Cook et al., 2012; Green & Roberts, 2023). The questionnaire consisted of four main sections: Demographic Profile, Perceived Barriers to VR Implementation, VR Utilization in Clinical Training, Self-reported Learning Outcomes (e.g., confidence, knowledge retention, preparedness)

Responses were measured using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Data Collection Procedure

The survey was distributed electronically, and participants were given one week to respond. Informed consent was obtained prior to participation, and ethical clearance was secured from the institutional ethics committee.

Data Analysis

Data were analyzed using descriptive statistics (mean, standard deviation) and Pearson Product-Moment Correlation Coefficient to determine the strength and significance of relationships among the variables. Significance levels were set at $p < 0.05$ and $p < 0.01$.

Result

The primary aim of this study was to assess whether a significant relationship exists between the use of Virtual Reality (VR) in nursing education and improvements in learning performance and skill acquisition. The statistical correlations focused on

key learning outcomes, including knowledge retention, confidence in clinical skills, decision-making abilities, and overall clinical preparedness.

The results show two statistically significant but weak positive correlations within the domain of decision-making abilities: Performing medical procedures ($r = 0.158$, $p = 0.049$), and handling high-pressure clinical scenarios ($r = 0.174$, $p = 0.029$).

These findings suggest that exposure to VR-based simulations can enhance clinical decision-making, particularly in high-pressure or complex situations. These results align with the work of White and Grant (2023), who found that VR immersion enhances critical thinking by allowing learners to practice decision-making in safe, controlled environments. Similarly, Hall and Morrison (2024) emphasized that scenario-based learning using VR can build the cognitive and procedural flexibility required in real-world clinical settings.

However, no significant correlations were observed between VR use and knowledge retention, confidence in clinical skills, or overall learning performance. Variables such as patient assessment, adaptability to diverse environments, and readiness for real-life interactions demonstrated near-zero correlation values and p -values greater than 0.05. These results suggest that VR alone may not significantly influence general educational outcomes without additional support mechanisms.

As Cook et al. (2012) noted in a meta-analysis of technology-enhanced simulation in health professions education, while simulations can improve specific skills, their efficacy depends greatly on instructional design, feedback integration, and learner engagement. Therefore, the absence of strong correlations in other domains may be attributed to the lack of comprehensive training support, structured debriefing, and integration with existing curricula.

Variables	Knowledge Retention			Confidence in Clinical Skills			Decision-Making Abilities			Learning Performance (Overall)		
	r	p	Interpretation	r	p	Interpretation	r	p	Interpretation	r	p	Interpretation
Performing medical procedures	-0.022	0.781	Not Significant	-0.050	0.537	Not Significant	0.158	0.049	Weak Positive Correlation			
Patient assessment	-0.052	0.516	Not Significant	-0.011	0.895	Not Significant	-0.037	0.642	Not Significant			

Handling emergency scenarios Barriers to VR	- 0.079	0.328	Not Significant	- 0.071	0.374	Not Significant	- 0.004	0.964	Not Significant			
Skills Acquisition (Overall)										- 0.044	0.585	Not Significant
Handling high-pressure clinical scenarios	0.018	0.819	Not Significant	- 0.127	0.112	Not Significant	0.174*	0.029	Weak Positive Correlation			
Readiness for real-life patient interactions	0.125	0.118	Not Significant	0.046	0.566	Not Significant	- 0.002	0.980	Not Significant			
Adaptability to diverse clinical environments	- 0.012	0.878	Not Significant	- 0.060	0.458	Not Significant	- 0.103	0.198	Not Significant			
Clinical Preparedness (Overall)										- 0.047	0.558	Not Significant

Implications

The data suggest that VR has targeted benefits - particularly in developing decision-making skills - but may not substantially impact broader learning outcomes unless implemented within a well-structured pedagogical framework. Educators should view VR not as a standalone solution but as a supplementary tool that enhances skill-specific learning when combined with traditional teaching methods and reflective learning practices (Groom et al., 2022).

To maximize its educational potential, institutions must ensure that VR tools are embedded into instructionally sound learning environments, equipped with adequate faculty training, technical support, and student orientation programs. This holistic approach may help transform VR from a novel technology into a sustainable, evidence-based strategy in nursing education.

Conclusion

This study examined the relationship between the use of Virtual Reality (VR) in nursing education and key indicators of learning performance and skill acquisition, including knowledge retention, confidence in clinical skills, decision-making

abilities, and overall clinical preparedness. While most variables did not demonstrate statistically significant relationships, the results identified two weak but significant positive correlations between VR-based training and improved clinical decision-making - particularly in performing medical procedures and handling high-pressure clinical scenarios.

These findings suggest that VR's strongest educational value lies in enhancing cognitive and procedural decision-making rather than broadly improving all domains of learning performance. The lack of significant correlation with knowledge retention and confidence may reflect limitations in the current integration of VR technology, including inadequate instructional design, insufficient training support, or lack of alignment with broader learning objectives.

Thus, while VR holds promise as an immersive, skill-enhancing tool, it must be strategically integrated into nursing curricula and complemented with other evidence-based educational methods to achieve its full potential in professional preparation.

Recommendations

Based on the findings, the following recommendations are proposed:

Integrate VR as a Supplementary Tool: VR should be used to enhance specific clinical competencies, especially in decision-making and scenario-based training, rather than as a standalone educational strategy.

Invest in Instructor and Student Training Comprehensive training programs should be developed to ensure both educators and students are adequately prepared to use VR technology effectively, thereby maximizing learning outcomes.

Enhance Curriculum Design: VR experiences should be integrated within well-structured instructional frameworks that include pre-briefing, guided simulation, and post-simulation debriefing to promote reflective learning.

Strengthen Technical Infrastructure: Institutions should invest in reliable hardware, regular maintenance, and dedicated IT support to reduce technical disruptions that hinder the effectiveness of VR in education.

Conduct Longitudinal Research Future studies should explore the long-term impact of VR on clinical competence and patient outcomes, using larger samples and more diverse educational contexts to validate and extend current findings.

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Conflicts of Interest

The author declares that there is no significant competing financial, professional, or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

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