Review

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The use of virtual reality in clinical skills training for nursing students

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ABSTRACT

This review examines the contributions of virtual reality technology to clinical skills training in nursing students. Virtual reality allows students to safely develop psychomotor and cognitive skills by providing three-dimensional and interactive learning environments. The literature shows that virtual reality supported education increases learning motivation, reduces anxiety about making mistakes and improves practical skills. It is also important in terms of providing reproducible experience without compromising patient safety. In this context, the review ims to evaluate the role of virtual reality in gaining clinical skills as an innovative and effective method in nursing education.

Keywords: Nursing, clinical skills, nurse education, virtual reality

INTRODUCTION

Today's health systems are changing with technological developments. As a matter of fact, this change is also effective in the education process of health professionals.[1] Especially nursing education includes a complex and challenging learning process in which theoretical knowledge and clinical practice are integrated. In this process, the ability of students to acquire clinical skills in a safe, effective and ethical manner is directly related to the quality of educational environments.[2] However, many difficulties such as patient safety, student anxiety, lack of guidance and limitations of practice environments may prevent nursing students from gaining sufficient experience in clinical practice.[3]

In this context, innovations in information technologies have brought the use of alternative and complementary methods in nursing education. Virtual reality technology, which has been increasingly used in recent years, offers realistic and interactive learning environments that allow students to experience complex clinical situations. Virtual reality provides the user with a sense of presence in a three-dimensional environment, enabling the application of clinical skills in a risk-free and reproducible manner; thus, it both strengthens the learning process and increases student safety.[4]

In this review study, the integration of virtual reality technology into nursing education and especially its role in gaining clinical skills will be discussed. The aim was to present innovative and evidence-based recommendations to improve the quality of health education by revealing the potential of virtual reality-based educational applications for nursing students.

VIRTUAL REALITY

Virtual reality is a computer-based technology that allows users to feel as if they are physically present in a three-dimensional, interactive environment.[5] During a virtual reality experience, users are usually required to wear a half-helmet-like head-mounted display connected to a computer interface. With the incorporation of tracking software and haptic or touch control technologies, users can navigate a computer-aided three-dimensional environment designed to be responsive to head movements.[6]

In the definition of hardware-based virtual reality, two basic psychological concepts come to the fore: our mental perception and the body. While our mental perception is shaped by our cognition and senses related to the environment, the body as a part of perception takes part in the representation of the mind. It is suggested that these sensory processes, providing synchronized sensory stimulation in a three-dimensional environment and tracking body movements with sufficient degrees of freedom are based on two interconnected hardware capabilities.[7]

For a sensory stimulation to be effective in virtual reality, the virtual reality hardware should be capable of blocking visual stimuli in the physical environment. This enhances the virtual reality experience by reducing distractions and is a key differentiator that distinguishes the technology from

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television, computers or augmented reality. Virtual reality's ability to neutralize visual stimuli should work consistently and synchronously with synchronized sensory stimulation and motion support.[8,9]

In virtual reality applications, various technological components are utilized to increase the interaction and perceptual experience of users with the virtual environment. These components include interactive 360-degree content systems that allow virtual elements to be viewed in all aspect,[10] virtual reality glasses, which are imaging devices worn on the head or integrated into the helmet,[11] joysticks that enable users to move in the environment and interact with objects, body tracking systems that enable the representation of the individual's own body in the virtual environment, and virtual reality gloves that enable natural interaction by sensing hand movements precisely.[12]

When the literature is examined, it is seen that the usage areas of virtual reality technology spread over a wide range. This technology is effectively used in various fields ranging from supporting the personal skills of individuals with balance disorders and autism spectrum disorders, training military personnel, visualizing the interior and exterior designs of architectural structures, treating phobias, and supporting the development of emotion and empathy. In addition, there are many application areas such as reinforcing surgical practices in the field of medicine and training new surgeons, providing experiential learning in the tourism sector and educational environments.[13]

VIRTUAL REALITY AND EDUCATION

Unlike other learning digital learning platforms, virtual reality is a unique method in that it offers an immersion that enhances the sense of presence through realistic experiences, allows the user to interact with the environment to change location and pick up or manipulate objects, and provides multi-sensory feedback: visual, auditory and tactile.[14] Virtual reality is a particularly effective method for developing creativity. It engages users in multi-sensory experiences, tangible and three-dimensional spatial cognition, allowing them to expand their perspectives and generate new ideas.[15]

Virtual reality can be particularly useful for individuals who can mentally visualize objects, shapes, and relationships in space[16] or for those who learn more effectively through hands-on activities.[17] From a broader perspective, it is argued that the discovery-based and curiosity-inducing structure of virtual reality makes significant contributions to the learning process and allows individuals to feel freer in processes such as generating ideas, research and evaluation.[18]

Compared to traditional training methods, virtual simulation-based training offers significant advantages such as time savings, safety, cost-effectiveness and efficiency in training, as they can be completed in less time.[19] Recent developments in motivation theory suggest that understanding how to harness the affective effectiveness of e-learning tools such as virtual reality is a central issue for learning and teaching.[20] The cognitive and affective theory of learning with media emphasizes that learning is not only a cognitive but also an affective process.[21] A student's emotional response to the learning process can have a great impact on academic achievement. Two key features are important in instructional design. One is to give students a sense of autonomy and the other is to evoke a sense of intrinsic value for the learning task and content.[22] Integrating these two features into instructional design can help reduce negative emotions such as anger and frustration in students, while increasing motivation and enjoyment of the learning process. In particular, virtual reality is suitable for creating educational models in accordance with cognitive and affective theory.[23]

IMPORTANCE OF NURSING EDUCATION

Nursing is one of the most versatile professions in the health care workforce. Since Florence Nightingale developed and put into practice the concept of educated nursing, the nursing profession has continuously restructured itself with the transformations in the health system.[24] Nursing education is of strategic importance not only to support individual professional development but also to protect public health, ensure patient safety and contribute to the sustainability of the health system. A qualified nursing education ensures the acquisition of basic professional competencies such as critical thinking, clinical decision making, ethical sensitivity and communication skills.[25] The International Council of Nurses emphasizes that nursing education plays a critical role in providing up-to-date knowledge, leadership skills and the ability to deal with emergencies.[26] Similarly, Jefferies et al.[27] draw attention to the decisive role of higher education standards in nursing education by revealing that academic literacy, critical thinking and clinical competence are directly related to professional practices. In this context, nursing education directly affects the quality and effectiveness of health services not only at the individual but also at the societal level.

CLINICAL SKILLS TRAINING IN NURSING EDUCATION

Clinical skills are difficult to be acquired by students as they consist of components of psychomotor, cognitive and affective learning domains.[28] Therefore, clinical skills acquisition is a complex process that requires students to integrate knowledge and critical thinking skills with practical performance. In addition to practicing in both hospitals and home care facilities, clinical skills laboratories are one of the most commonly used settings for developing nursing students' clinical skills.[29]

Nursing education requires comprehensive preparation and training for nursing students to gain proficiency in specific clinical skills in clinical settings. Although lecture and demonstration methods are traditionally used to teach clinical nursing skills, these methods do not always meet learning needs and therefore may be inadequate.[30] With the development of multimedia technology, technological developments such as computer-assisted learning,[31] video-assisted learning,[32] simulation,[33] augmented[34] support the efficiency and effectiveness of clinical skills training.

Clinical practice is a fundamental and indispensable component of nursing education. However, especially in the first clinical experiences, factors such as the intensity of the practice areas, students' sense of inadequacy, fear of making mistakes or harming the patient, and the imbalance in the student/faculty ratio increase the level of anxiety in students. This anxiety may cause students to be unable to adequately reflect their knowledge and skills to real patient care.[35] In addition, the direct application of some interventions that violate bodily integrity on the patient carries serious risks in terms of patient privacy and safety. Therefore, making sure that students act by respecting patient rights and values during clinical practice is of great importance in terms of providing safe care. In line with all these reasons, the use of skills laboratories in the development of clinical skills of nursing students is becoming increasingly important. Inadequate planning of clinical education in clinical skills training, organizational problems, inappropriate assessment methods, unsupportive learning environment, inadequate clinical guidance and difficulties in transferring theoretical knowledge to practice are among the main obstacles that negatively affect the clinical learning process.[36]

CLINICAL SKILLS TRAINING IN NURSING AND VIRTUAL REALITY

Rapid developments in information technologies, especially with innovations such as virtual reality, bring a different pedagogical perspective to nursing education. This technology provides nursing students with hands-on learning opportunities by offering interactive and realistic clinical scenarios, while eliminating the need for direct patient participation. Thus, it not only allows clinical nurses to use their time efficiently, but also reduces the challenges associated with traditional patient-based education.[37]

This technology allows students to practice their clinical skills, improve their decision-making in simulated patient care scenarios, and explore different medical conditions. Virtual reality encourages the active participation of nursing students in realistic and interactive learning processes, enabling them to better grasp theoretical knowledge and receive hands-on training in a safe, controlled environment. Moreover, the interactive nature of virtual reality enriches students' intuitive and experience-based learning processes by supporting traditional didactic methods.[38]

A good learning process requires a sense of security.[39] Providing feedback on a completed clinical practice is not only a technical process but also an advanced competence that requires an understanding of the complexity behind the practice and skill. Showed that the feedback process enhances learning in both givers and receivers. Effective feedback allows for critical evaluation and integration of theory and practice.[40]

Research shows that virtual simulation in nursing education and clinical practice can be similarly effective to traditional simulation methods, and in some cases even superior.[41-43] This technology allows participants to practice repeatedly in a safe and supervised environment by realistically simulating complex medical procedures and nursing scenarios, thus contributing to the development of their clinical skills, decision-making abilities and critical thinking capacities.[44] Among the positive functions of virtual reality is the development of clinical reasoning. Levett-Jones et al.[45] conceptualized clinical reasoning as a process in which a person collects clues, processes information, identifies the problem, plans and performs actions, evaluates the results, and reflects on and learns from the processThe nursing process includes clinical reasoning stages. This cognitive and meta-cognitive process, which involves synthesizing information and patient data related to specific clinical situations, plays a critical role for nurses to respond appropriately to clinical changes and make effective care management decisions. Therefore, it is of great importance to improve the clinical reasoning skills of both nursing students and clinical practitioner nurses so that they can make evidence-based decisions by making correct inferences and provide safe, quality care.[46] Virtual simulation is an application-based teaching method that aims to improve learners' clinical decision-making skills to diagnose patient problems and their performance in outcome-oriented care management through clinical scenarios that are structured based on explicit learning objectives, reproducible and adaptable to individual needs. Virtual reality supports repetitive and deliberate practice in a safe environment with scenarios that can be adapted according to the level of complexity.[47] These scenarios offer expert rationales and feedback that facilitate the development of clinical reasoning. The structure of the virtual simulation is in line with best practices for healthcare simulation and experiential learning theory. Learners gain experience through active participation, make sense of these experiences through feedback, and integrate the acquired knowledge into their cognitive structures for use in real clinical settings.[48] In a meta-analysis of twelve randomized controlled trials (RCTs), virtual reality applications were found to be effective in improving clinical reasoning skills in nursing. It has been stated that the design features of virtual reality simulations include structured content for patient management, systematic implementation of various clinical scenarios, experience durations of more than 30 minutes, and structured feedback processes after the scenario is completed. It is emphasized that these design elements can significantly increase the effectiveness of virtual reality-based simulations in education.[49] In one of the studies on virtual reality-supported nursing education, it was determined that the simulation-based training program conducted with the participation of 90 nurses had a significant effect on nursing competence in isolation services.[50] In a systematic review of eight RCTs, it was revealed that virtual reality-based education provided significant improvement in nursing students' clinical skills, knowledge level, and perceptions of psychological and emotional safety.[51] In a meta-analysis and meta-regression study in which 11 RCTs focusing on virtual reality training were examined, it was found that virtual reality applications significantly increased the clinical skills performance of nursing students with a medium-high level effect.[52] In a systematic review and meta-analysis of 22 studies examining virtual reality simulations for nursing students, it was determined that virtual reality-based training significantly

increased nursing competence.[53] In a study conducted with a quasi-experimental design and involving 76 second-year nursing students, students performed basic clinical skills such as intravenous catheter application, nasogastric feeding and nelaton catheterization on a virtual reality-based platform; a significant performance increase was observed especially in nasogastric feeding and nelaton catheterization applications.[54] In a randomized controlled study examining the effect of virtual reality-based learning tool on nursing students' thorax and lung physical examination knowledge and skills with 80 student participation, virtual reality was found to be effective in skill development.[55]

CONCLUSION

It shows that virtual reality supported education programs are effective in improving the clinical skills of nursing students. The realistic and interactive environment provided by this technology enables students to safely practice complex health processes. In addition, virtual simulations strengthen the learning process by providing repetition and immediate feedback, thus increasing students' confidence in practice and decision-making competence. These results suggest that virtual reality technology has significant potential as a complementary and remedial tool to traditional methods in nursing education and contributes to the training of graduates who are more prepared for clinical practice. It is necessary to investigate the effect of hybrid approaches in which virtual reality is integrated with applied education. Therefore, it is important to consider the strengths and limitations of each technology and utilize best practices when integrating virtual reality with traditional educational methods. It should investigate how virtual reality can be integrated more effectively into the educational process and how innovation and progress can be achieved in nursing education.

ETHICAL DECLARATIONS

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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