

Virtual simulation education of students from specialty of “Nursing care”

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Abstract

Introduction: Virtual reality (VR) simulation training has emerged as a promising educational tool in nursing, offering immersive and interactive learning experiences. This summary discusses the implementation and outcomes of a pilot training initiative using VR glasses at the Medical Simulation Training Center of Medical University Plovdiv.

Aim: The aim of the pilot training was to evaluate the effectiveness of VR simulation training in nursing education and its impact on student and teacher perceptions, empathy development, and preparedness for patient care.

Material and methods: Thirty-four participants, including nursing students and teachers, underwent VR simulation training following practical instruction with models. Qualitative analysis was conducted to assess participants' reactions, empathy levels, and perceptions of the training.

Results: Participants expressed strong interest in VR simulation training, noting its realism and impact. Students demonstrated heightened empathy towards virtual patients, while teachers exhibited a more professional response. Both groups emphasized the benefits of VR simulation for patient care and recommended greater autonomy and interactivity in virtual scenarios.

Conclusions: VR simulation training with VR glasses offers a valuable educational approach in nursing, fostering active learning, empathy development, and clinical competence.

Key words: virtual reality; simulation training; nursing education; empathy development; qualitative analysis

Introduction

In Bulgaria, the training regimen for nurses in specialized fields adheres to a rigorously structured protocol: initial theoretical instruction, practical training within specialized facilities, hands-on experience in authentic healthcare settings, and culminating with a pre-graduation internship.

Theoretical instruction typically comprises lecture-based sessions. Within specialized educational facilities, students, under the supervision of instructors, engage in a variety of nursing procedures, tasks, and patient care simulations using models and simulators. Subsequently, students transition to real-world healthcare environments, such as hospitals or outpatient facilities, where they apply their acquired professional competencies while under the supervision of instructors. The training program concludes with a pre-graduation internship, during which students autonomously execute tasks under the guidance of experienced mentors.

Aim

The article aims to showcase the outcomes of a pilot training initiative involving both nursing students and instructors at the Medical Simulation Training Center of the Medical University Plovdiv, utilizing virtual reality (VR) glasses as an educational technology.

Material and methods

The pilot training initiative conducted at the Medical Simulation Training Center (MSTC) of the Medical University-Plovdiv under the auspices of the Erasmus+ project *Caring violent children safely in child psychiatric and residential units (Safe4Child) 2021-1-FI01-KA220-HED-000032106* held from March 23 to April 12, 2024, featured a comprehensive methodological approach.

Participants were stratified into two distinct cohorts: third-year nursing students and academic lecturers specializing in nursing education. The training regimen encompassed various stages, including enrollment on the Moodle platform, comprehensive examination and assimilation of theoretical materials pertinent to the project's thematic scope, completion of assessments following each of the five modules within the theoretical curriculum, and individualized practical sessions employing virtual reality (VR) technology, under the supervision of project implementation team members. Upon satisfactory completion of both the theoretical coursework and practical exercises, participants were conferred with certificates denoting their successful fulfillment of the Moodle platform-based training course affiliated with the project.

After the training, a qualitative analysis incorporating reflective theme analysis techniques was applied to evaluate the outcomes and insights gleaned from the

initiative. Upon successful completion of both the theoretical coursework and practical exercises, participants were awarded certificates signifying their adept navigation of the Moodle platform-based training course associated with the project.

Results

During the pilot phase of the training, 34 participants were engaged and divided into two distinct focus groups. The first group comprised 16 individuals, consisting of teachers possessing foundational nursing education and 16 third-year nursing students. All teachers held master's degrees in "Health Care Management," with three of them additionally holding Ph.D. degrees in the same scientific discipline. In Bulgaria, the nursing care specialty entails a four-year academic curriculum, in accordance with standardized state requirements. The profession is regulated, with training encompassing both theoretical and practical components, culminating in a one-year pre-graduation internship. Upon successful completion of the training program, graduates are conferred with a bachelor's degree and the professional designation of "Nurse."

Participation in the training course was entirely voluntary. Given that the theoretical training on the Moodle platform was conducted in English, proficiency in the English language was a prerequisite for inclusion. Following the promotion of the course among both students and teachers, a predominant motive that surfaced was a notable interest in the innovative educational technology of learning through VR glasses. All participants expressed a lack of prior experience with VR glasses training but displayed enthusiasm for the commencement of practical training.

After acquainting themselves with the theoretical materials and completing an entry questionnaire, participants underwent individual practical training with VR glasses. Subsequently, a small group comprising 5–6 individuals engaged in discussions facilitated by a moderator immediately after the practical training session.

The Table 1 presents the initial reactions of both students and teachers following the removal of VR glasses. Students expressed profound interest, describing the experience as *very interesting*, *very real* and akin to being transported to another location. They appreciated the immersive nature of the training, with comments like *it's like you're there* and *it's like it's real*. Some expressed gratitude for the opportunity to participate and praised the presentation of real-life case studies. Teachers echoed similar sentiments, emphasizing the incredible and impactful nature of the experience. They highlighted the realism of the simulation and the way it surpassed

their expectations. Overall, both groups found the VR training to be engaging, immersive, and effective in enhancing their learning experience.

Table 1. Initial reaction of the participants, immediately after removing the VR-glasses

Students	Teachers
Very interesting;	Incredible, very strong impact.
Very real;	
It's like you're there;	
It's like it's real.	
Thank you for inviting me to participate;	
interestingly presented case study from real practice;	
Very realistic;	
Real;	
It's like you're somewhere else;	
Nice experience;	
Exceeded my expectations.	

After removing the VR glasses, two of the participating students requested additional training because they *did not want it to end*. The teachers pointed out that learning with VR glasses is very suitable for students who are now starting their nursing education.

Following the VR training session, feedback from participants revealed some noteworthy observations. One teacher mentioned feeling slightly disoriented upon removing the VR glasses, while another reported feeling a mild sense of dizziness. Among the students, opinions varied: one student admitted experiencing a degree of stress and tension, whereas another expressed feeling more relaxed compared to a real-life environment. Despite these variations, all students successfully grasped and articulated the scenario presented in the virtual environment, demonstrating a clear understanding of its intended purpose. They were particularly impressed by the detailed presentation of the virtual setting, which included the participants, their surroundings, views through windows, and the presence of medical staff. In the second focus group comprising teachers, there was unanimous agreement that the case study was well-conceived and comprehensive, incorporating pertinent family history.

An aspect of paramount importance highlighted by the training was the cultivation of empathy towards patients, particularly in scenarios involving aggressive behavior. It was gratifying to observe strong emotional reactions from students encountering such situations for the first time, indicating their engagement and investment in the training process. Moreover, teachers, drawing from their practical

nursing experience and extensive teaching backgrounds, responded to these scenarios with professionalism and expertise. This collective feedback underscores the efficacy of VR training in preparing future nurses to navigate complex patient interactions with empathy and professionalism.

The Table 2 depicts the empathetic responses of both students and teachers towards the virtual patient in the simulated environment. Students expressed a strong desire to assist the child/patient and recognized the need for individualized attention from a nurse. Some students also expressed feelings of sadness and helplessness, unable to alleviate the child’s virtual suffering. Conversely, others reported feeling a sense of euphoria and a desire to engage with the patient further, indicating varying emotional responses to the scenario. Additionally, students expressed curiosity about the child’s feelings and experiences, showing a genuine interest in understanding the patient’s perspective. Teachers, on the other hand, interpreted these responses as normal expressions of empathy, noting a natural inclination to comfort and console the virtual child. Overall, the responses from both students and teachers highlight the development of empathetic attitudes crucial for effective patient care.

Table 2. Demonstrates feelings of empathy for the virtual patient in a simulated environment

Students	Teachers
I felt the need to help the child/patient;	Normal feelings, but you want to hug the child and comfort him.
The child needs individual work with a nurse;	
The child needs to play with other children under the supervision of a nurse;	
I felt a strange feeling of sadness for this child;	
I got very emotional, I felt sad that I couldn’t do anything in such a virtual situation;	
A feeling of euphoria came over me, I want to talk to the patient;	
I want to know how the child feels;	
I want to understand the child’s experiences.	

The Table 3 outlines the perceived benefits of simulation training with VR glasses for both students and teachers. Students highlighted the importance of thorough preparation at the Medical Simulation Training Center (MSTC) to effectively handle real-life patient encounters. They emphasized the immersive nature of the training, which allows them to actively participate and gain practical insights, surpassing the passive learning experience of traditional instruction. Additionally, students noted that problem situations within the virtual environment are swiftly

resolved, fostering an understanding of correct professional behavior, and contributing to enhanced education quality. Furthermore, they acknowledged that such training reduces the stress associated with direct patient interaction during learning. Teachers echoed these sentiments, emphasizing the value of simulation training in providing students with exposure to diverse practice scenarios that may not always be feasible in real-life environments. They recognized the potential of simulation training to complement overall nursing education and improve the quality of learning while minimizing student stress. Overall, both students and teachers underscored the significant educational benefits offered by simulation training with VR glasses, enhancing student preparedness and fostering a supportive learning environment.

Table 3. Benefits of simulation training with VR-glasses for the patient

Students	Teachers
To prepare well at the MSTC, so that when we meet such a patient in a real environment, we can react and know how to approach;	It is not always during nursing education in a real environment that students can see everything. It is good to have such simulation training scenarios for different practice situations to complement the overall training of nursing students.
I actually become a participant and it is better than being told about a situation from practice;	
it is understandable, the problem situation is quickly resolved.	
after training in a virtual environment, an algorithm for correct professional behavior will be created for the students;	
the quality of education will increase; the students will not be trained directly on a patient and in this way the stress in the learning process will be avoided.	

Discussion

The integration of virtual reality (VR) simulation training with VR glasses into nursing education represents a significant advancement with profound implications for patient care. Our study contributes to the growing body of literature supporting the efficacy of this innovative educational approach. By incorporating VR simulation training immediately following practical training with models or phantoms, our findings suggest that students can benefit from a seamless transition between theoretical and practical learning modalities. This sequential approach allows students

to consolidate theoretical knowledge and immediately apply it in a realistic virtual environment, thereby enhancing their preparedness for direct patient interaction.

Our results resonate with previous research, such as the study by Wolf et al. [1], which demonstrated the positive outcomes of case-based simulation scenarios in university-level practical courses. Similarly, findings from Pence et al. [2] and Tiang et al. [3] highlight the perceived supportiveness of VR simulation training and its potential to facilitate knowledge application in clinical settings. These studies collectively underscore the value of VR simulation as a supplementary learning tool for improving procedural knowledge and clinical decision-making abilities among nursing students.

Moreover, our study aligns with research by Eunju et al. [4], which identified the effectiveness of VR simulation nursing education programs in enhancing students' performance confidence and clinical reasoning skills. The successful integration of a virtual psychotherapy course into advanced nursing education, as demonstrated by Vives et al. [5], further illustrates the versatility and applicability of VR-based training across diverse healthcare contexts.

Additionally, the positive impact of a virtual exchange and clinical simulation program on nursing students' cultural intelligence, as reported by Galan-Lominchar et al. [6], highlights the broader educational benefits of VR simulation beyond clinical skills development.

Our pilot training with VR glasses unveiled several noteworthy conclusions. Firstly, the novelty and immersive nature of VR technology elicited strong interest and perceived realism among participants, indicating its potential to engage learners effectively. Secondly, while both students and teachers recognized the benefits of VR simulation for patient care, students exhibited a more pronounced emotional response, suggesting a deeper level of empathy and engagement with virtual patient scenarios. Finally, the consensus among participants regarding the benefits of VR simulation training for patient care underscores its potential to enhance nursing education and ultimately improve healthcare outcomes.

Recommendations

Based on the feedback provided by both students and teachers during the pilot training with VR glasses, several recommendations emerge to enhance the effectiveness of VR simulation training in nursing education:

1. **Increase Autonomy:** Both students and teachers expressed a desire for greater autonomy in the actions of the virtual nurse. This suggests a need to develop VR scenarios that allow learners to make decisions independently and respond

flexibly to dynamic patient situations. By empowering learners to take control of their virtual interactions, they can develop critical thinking skills and gain confidence in their clinical judgment.

2. **Promote Active Learning:** Participants highlighted the importance of active participation and decision-making in virtual scenarios. To address this, educators can design VR simulations that encourage learners to engage actively with the virtual environment, rather than passively following predetermined steps. Incorporating interactive elements, such as branching scenarios or decision points, can foster deeper engagement and facilitate learning through hands-on experience.
3. **Enhance Realism:** Both focus groups emphasized the need for realistic virtual scenarios that accurately reflect the complexities of clinical practice. To achieve this, developers should prioritize the incorporation of realistic patient interactions, lifelike simulations of clinical environments, and dynamic scenarios that challenge learners to adapt and problem-solve in real-time. By immersing learners in lifelike situations, VR simulations can effectively bridge the gap between classroom learning and real-world practice.
4. **Provide Feedback and Reflection:** Participants highlighted the importance of feedback and reflection in the learning process. Educators should incorporate mechanisms for providing timely feedback within VR simulations, such as debriefing sessions or virtual mentors. Additionally, learners should be encouraged to reflect on their experiences and decision-making processes, both during and after VR training sessions. This reflective practice can deepen learning, enhance self-awareness, and promote continuous improvement.
5. **Tailor Content to Learner Needs:** Recognizing the diverse learning needs and preferences of students, VR simulations should be designed to accommodate individual learning styles and skill levels. Educators should offer a range of scenarios and difficulty levels to cater to the varying needs of learners, ensuring that each student receives a personalized learning experience. Additionally, VR content should be aligned with curriculum objectives and clinical competencies to maximize educational outcomes.

By implementing these recommendations, educators can optimize the effectiveness of VR simulation training in nursing education, fostering a dynamic and engaging learning environment that prepares students for the complexities of clinical practice. By empowering learners with greater autonomy, promoting active learning, enhancing realism, providing feedback and reflection opportunities, and tailoring content to learner needs, VR simulation training can serve as a powerful tool for developing clinical competence and improving patient care outcomes.

Conclusions

The conducted pilot training with VR glasses at the Medical Simulation Training Center of Medical University Plovdiv, under the Erasmus+ project “Caring violent children safely in child psychiatric and residential units (Safe4Child) 2021-1-FI01-KA220-HED-000032106,” showed that the innovative educational technology of learning with VR glasses is very suitable for students who are now starting their nursing education.

Our study provides compelling evidence supporting the integration of VR simulation training into nursing curricula as a valuable and effective educational tool. By leveraging the immersive capabilities of VR technology, educators can enhance students’ learning experiences, foster empathy, and clinical competence, and ultimately prepare future nurses to deliver high-quality patient care in diverse clinical settings. Further research is warranted to explore the long-term effects and broader implications of VR simulation training in nursing education and practice.

The participants in the training course, both students and teachers, expressed a strong interest in the innovative educational technology of learning with VR glasses. The results of the pilot training show that the manifestation of a feeling of empathy is significantly more pronounced in the focus group of students, who react strongly emotionally, and not so strongly expressed in the focus group of teachers, whose reaction is rather professional. The fact that both groups of subjects emphasize the benefit of stimulation training with VR-glasses for the patient is satisfactory.

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