

Key Positive Findings of the Effectiveness of Virtual Reality Simulation in Nursing Students' Learning Satisfaction

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ABSTRACT

Background: Even though the COVID-19 pandemic resulted in a healthcare crisis resulting in increased nurse demand, it further limited access to nursing student clinical sites. To counter this deficit, numerous nursing schools began investigating alternative learning methods. This opened the door for virtual reality (VR) simulation. VR is evolving in the 21st century with the advancement of technology. **Purpose:** The purpose of this review was to determine the effects of VR simulation based on nursing students' performance and confidence levels. **Method:** This study was a review of pertinent peer-reviewed literature published between 2021 and 2024. The patient, intervention, comparison, outcome, and time (PICOT) question is: In novice nursing students, how does VR simulation compared to no VR simulation affect the performance and confidence of nursing skills within the duration of their nursing school? Findings: The acquisition of knowledge, skill performance, self-efficacy, student satisfaction, and self-confidence were the key findings from the reviewed studies. **Conclusion:** VR simulation implied great benefits including increased knowledge, skill performance, student satisfaction, and self-confidence. However, VR simulation should not be the only form of learning environment used in nursing school. A combination best benefits the nursing student and the school of nursing.

Keywords: nursing, education, simulation, virtual reality, confidence, skill level

1. INTRODUCTION

Nursing schools incorporate simulation experiences to equip students to work independently after graduation. In a simulation integration study, Willet *et al.* [1] found that simulations create a controlled clinical setting to allow students to practice real-life skills in an artificial learning environment. The American Nurses Foundation [2] expounds that VR simulation combined with debriefing and clinical work prepares nursing students to care for patients on their own. The two types of simulations are mannikin simulation and VR simulation. Mannikin simulation uses high-fidelity mannikins that nursing instructors can control to create specific situations that a nursing student may encounter as a nurse. VR simulation uses a computerized programming system that allows the student to take on a nurse role in a controlled setting. The student uses a headset and hand controllers that replicate a real-life scenario and enables the student to practice skills on virtual patients. The combination of VR simulation and mannikin simulation can significantly improve skills in several clinical settings. The purpose of this study was to determine the effects of VR simulation based on nursing students' performance and confidence levels. The question for review was: In novice nursing students, how does VR simulation compared to no VR simulation affect the performance and confidence of nursing skills within the duration of the nursing school?

2. METHOD

The method was a review of the literature on the use of VR simulation versus mannikin simulation use in nursing school. Scientific databases were used to collect appropriate information for this review. In Figure 1, the databases used include the Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed, and EBSCOhost. All studies collected were from the timeframe of 2021 to 2024. Keywords included in the search were nursing students, education, simulation, virtual reality, confidence, and skill level. The collection of studies included meta-analyses, systemic reviews, qualitative research studies, and umbrella reviews. A total of 1,365 studies related to the research question were found in the listed databases. The studies included were written in English and had the full text. Fifteen studies that pertained to the research were used in this review. It is important to note that a control group

was used in some of the chosen studies that represent the nursing students in which mannikin simulation was their only form of simulation received during the research period.

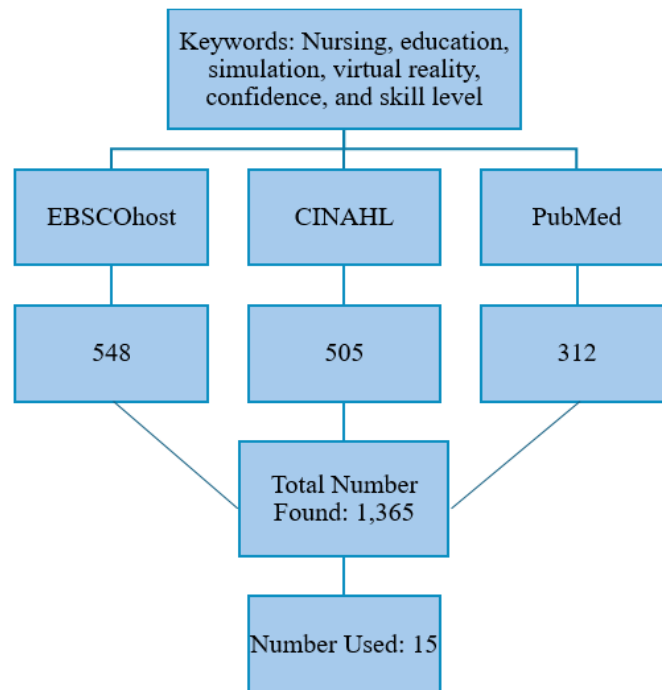


Figure No. 1 Database Search Findings

Figure 2 displays the number of studies used in this review for each corresponding level of hierarchy. The nursing level of hierarchy was used to rank the studies used in the review. Level I represents the highest and most reliable source. Level VII represents the lowest and least reliable source [3]. Studies from the top 6 tiers were used in this study.

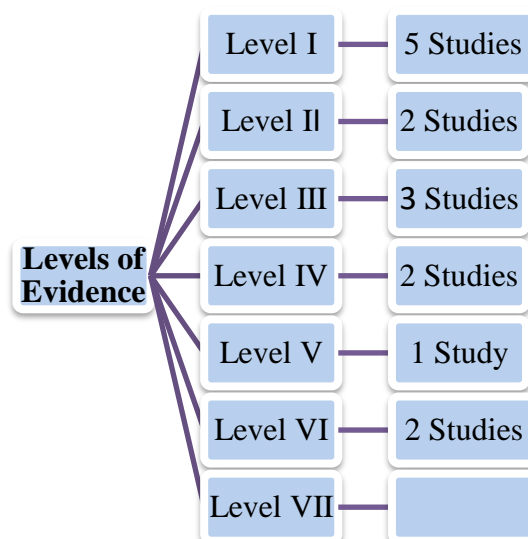


Figure No. 2: Level of Evidence and Studies Used for the Effects of VR Simulation

3. LITERATURE REVIEW

The purpose of this review was to determine the effects of VR simulation based on nursing students' performance and confidence levels. The 15 studies analyzed were published from 2021 to 2024. The analyzed studies were regarding the impact of VR simulation on nursing school curricula. The main topics of these studies were gathered and compiled into five key findings. These five key findings are based on how VR simulation influences the knowledge, skill performance, self-efficacy, student satisfaction, and self-confidence of a nursing student.

Influence on Knowledge

A nurse is expected to have a well-rounded knowledge base upon completion of nursing school and entering the nursing field as a career. A wide range of knowledge is expected ranging from textbook knowledge on diseases and treatment, to how to perform skills and care for an individual's unique needs. Uslu-Sahan *et al.* [4] stated that in skill performance with nursing students, there is a widely accepted theory-practice gap in the current nursing school curriculum. This theory explains how the textbook knowledge taught in the classroom and experiences in clinical practice do not fully prepare nursing students to take on a qualified nursing role.

Research has been going on to find ways to better prepare nursing students to undertake a nursing role. Kim *et al.* [5] emphasized that simulations provide nursing students with safe learning environments that allow the students to practice each skill until they reach competency. Allowing students to practice skills they have learned in the classroom helps bridge the gap between theory to clinical practice and further helps transfer and solidify the knowledge base by allowing repetition of practice as much as needed [4]. Lee and Baek [6] stated that VR simulation allows nursing students the opportunity to turn their learned nursing knowledge into nursing behaviors.

Growth in knowledge after completing the simulation experience is evaluated using pre-and post-test assessments of VR simulation compared to the control group. Uslu-Sahan *et al.* [4] stated that in their review of 15 studies, growth in knowledge was the main outcome throughout. Their study showed data with statistically significant increases in knowledge bases. Additionally, Qiao *et al.* [7] reviewed 13 trials and found that VR simulation showed greater increases in knowledge than mannequin-based simulation. Mistry *et al.* [8] also stated that VR simulation has been shown to accelerate nursing students' clinical skills and competency. Conversely, Kiegaldie and Shaw [9] stated that there was no significant difference in the knowledge base.

Influence on Skill Performance

Skill performance goes alongside knowledge as the nursing student must have the textbook knowledge of skills to perform skills correctly. Skill performance also plays a role in the student working together on a team to make educated clinical decisions. This skill can be practiced in VR simulation with the ability to accommodate a larger number of students in a clinical simulation [9]. A disadvantage to VR simulation is that the skills are performed via controls and are computer-based, resulting in a lack of realism during the simulation [10]. Another disadvantage is cybersickness, which can interfere with the student's ability to perform the skills to the best of their abilities [11]. Cybersickness is explained as nausea and disorientation from viewing moving digital content [12]. However, Kiegaldie and Shaw [9] maintained that VR simulations are highly innovative and allow for repetitive and interactive immersion into the simulation scenarios.

Students in VR simulation can practice scenarios, including critical patient events like a code blue, multiple times until the student feels comfortable with the steps that need to be taken for each skill [9]. Uslu-Sahan *et al.* [4] found in their meta-analysis that results on skill performance had greater significance when the control group was in a conventional classroom setting versus mannequin-based simulation. Uslu-Sahan *et al.* [4] further concluded that VR simulation helps to strengthen the student's theoretical knowledge by learning through experience and contributing to an improvement in skill performance. Piispanen *et al.* [13] affirmed that VR simulation platforms can be used to enhance interaction skills among nursing students and further improve patient safety. Overall, Uslu-Sahan *et al.* [4] confirmed that an increase in skill performance was backed by statistical significance throughout six studies analyzed.

Influence on Self-efficacy

Uslu-Sahan *et al.* [4] identified self-efficacy to be the sense of confidence of a person in his or her ability to perform a particular activity in various circumstances. Self-efficacy is compiled from experiences, mental status, verbal responses, and affective state [4]. Some studies referred to self-efficacy as self-confidence [14]. Cant *et al.* [15] found a positive influence on a student's self-efficacy of skills and knowledge when using VR simulation specifically compared to mannequin simulation. To have concrete evidence of this, there needs to be a scale to thoroughly evaluate self-efficacy. Since a scale has not been created, the studies were based on self-reported levels of self-efficacy. In summary, an increase in satisfaction and self-efficacy was self-reported by nursing students with the use of VR simulation [15].

Influence on Student Satisfaction

Lui *et al.* [16] defined self-satisfaction as a psychological state that refers to a person's subjective evaluation of the quality of a relationship. VR simulation has become more popular since the beginning of the COVID-19 pandemic. The effects of the pandemic are still prominent and require new ways to practice nursing skills. A study, involving 7600 nursing students, Cant *et al.* [16] reported satisfaction with VR simulation. The students confirmed that virtual simulation helped develop psychosocial skills such as community, time management, empathy, teamwork, and manage lateral violence. In addition to improving the development of psychosocial skills, the students reported increased self-satisfaction with administering medications, measuring vital signs, and changing wound dressings [16].

Placing students in virtual simulation equips the students with the knowledge and confidence to succeed in an in-person hospital setting. In another study involving 896 participants, Qiao *et al.* [7] analyzed the differences between VR simulation and mannequin-based simulation. Results implied a greater increase in knowledge and satisfaction in VR simulation, compared to mannequin-based simulation. These outcomes show the effectiveness of VR simulation in preparing nursing students for the clinical setting.

Influence on Self-Confidence

Self-confidence is paramount in implementing important nursing skills. When nursing students are placed in critical scenarios, self-confidence helps produce an appropriate response to the situation. Lui *et al.* [16] applied randomized controlled trials and quasi-experimental research to investigate if the use of VR improves competence and confidence, reduces stress and anxiety, and increases satisfaction rates. Nursing students and those involved in hospital internships both stated improved confidence and decreased anxiety levels. These students participated in ranking themselves on certain scales, including a self-rating anxiety scale, the Simulated Clinical Experience Satisfaction Scale, and the Clinical Learning Environment Scale [16]. These scales helped confirm the outcomes of the study.

In a descriptive study, Suryadi *et al.* [17] examined the importance of self-confidence in a virtual laboratory. Fifty-six nursing students were placed in a VR simulation to practice and learn wound care skills. The findings showed a significant increase in self-confidence and self-satisfaction. Suryadi *et al.* [17] made a hypothesis based on the results of their research that VR simulation can be used as an alternative, or in conjunction with, mannikin simulation and it supports student skills and knowledge in other nursing skills.

Yoon *et al.* [18] stated the importance of practicing clinical skills, such as enemas, nasogastric feedings, and catheterization in a VR environment since these procedures are infrequently performed in the clinical setting. During this study, 76 second-year nursing students were immersed in a three-dimensional VR environment that practiced these skills on virtual patients. The variables used in their study were confidence, proficiency, learning satisfaction, and task management before and after interventions. The findings revealed significant improvements in competence and skill in nasogastric feedings and catheterization. Improvements in skill led to slight improvements in confidence [18].

Summary of Findings

The purpose of this review was to determine the effects of VR simulation based on nursing students' performance and confidence levels. It was evident in the literature that VR simulation also impacts a nursing student's knowledge, self-efficacy, and satisfaction. The key findings are in Figure 3. These findings are interrelated to each other and directly affect each other. Uslu-Sahan *et al.* [4] expound that skill performance can be evaluated by a student's self-efficacy and self-confidence.

In a study of the use of virtual reality training among 200 nursing students, Chan *et al.* [19] found high levels of satisfaction and self-confidence in learning. Significant achievement in skills was perceived by the students. The levels of satisfaction and self-confidence in learning and the involvement and sensory fidelity domains in the sense of presence were positive predictors of virtual reality training. In contrast, Classen [20] sustained that distractions in simulation affect the quality of comprehension and learning. However, virtual reality-based simulations can provide greater impact on clinical learning which can provide better outcomes for the nursing student.

In relation to the research question: In novice nursing students, how does VR simulation compared to no VR simulation affect the performance and confidence of nursing skills within the duration of the nursing school? The major focus was on performance and confidence as these recurring ideas were found most often in the reviewed studies. Skill performance and confidence can greatly improve in VR simulation over mannikin-based simulation in some cases [7]. However, some studies showed no greater impact on knowledge and confidence between the two simulations [9]. In the analysis of the selected studies, there was no negative impact noted on student's knowledge or confidence with the use of VR simulation; therefore, with increased improvement in VR simulation systems, there could be a positive impact on one's skills that can better prepare the students to work as a nurse.

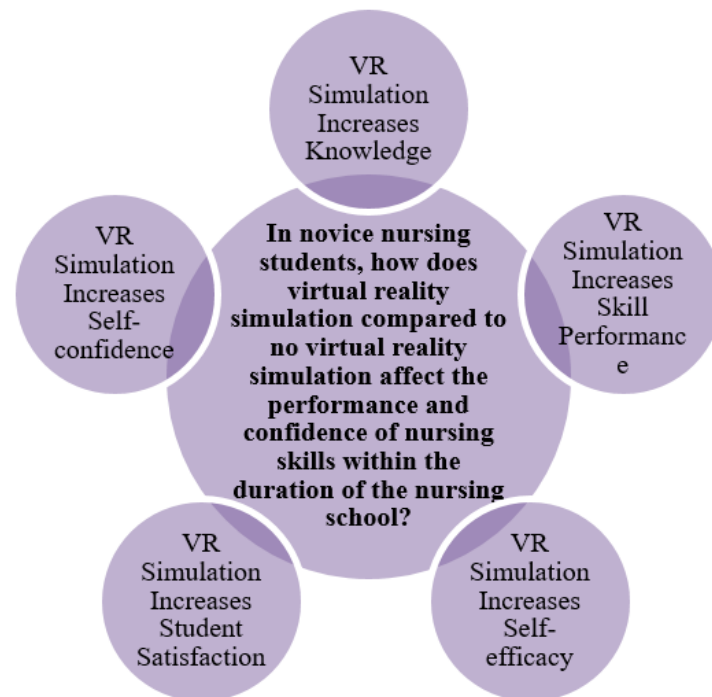


Figure No. 3: Key Positive Findings of the Effectiveness of Virtual Reality Simulation

4. DISCUSSION

Most of the reviewed studies indicated VR simulation to be beneficial to nursing students based on reports of increased confidence, satisfaction, self-efficacy, knowledge, and skills performance. Of the 15 studies, several focused on the improvement of nursing skills. These skills not only involve physical care of patients but also provide enhanced practice in communication skills [1]. The more the nursing students practiced individual care with VR patients, the more confidence the students gained in practicing these skills on real patients.

VR simulation may be added to most nursing curricula. An increasing number of nursing programs are pairing VR simulation with high-fidelity mannequins to improve confidence and nursing skills [16]. Besides improving skills, several studies revealed that VR simulation can be more cost-efficient. Suryadi *et al.* [17] asserted that physical laboratories require expensive costs and do not have enough space to effectively improve learning outcomes. However, Kiegaldie and Shaw [9] warned of limited research on the economic viability because of a large upfront cost for the program software and headset itself. There are also software maintenance update costs and periodic equipment replacement costs. Thoughts of VR simulation as being more cost-effective stem from the idea that there are significant upfront costs, but the nursing school will not have to keep paying for more supplies and resources each time a simulation is done. Long-term studies on the comparison of costs showed that VR simulation was significantly less expensive than mannikin simulation [9].

Weaknesses of VR simulation included technical difficulties, initial costs for the headsets, or limited participation; however, these weaknesses were non-significant compared to the benefits. The strengths of improved skills, knowledge, confidence, satisfaction, and self-efficacy trumped any weaknesses presented. No student should be forced to use VR simulation over high-fidelity mannequins, but the option for both could be presented.

5. RECOMMENDATIONS

Recommendations for VR simulation, as seen in Figure 4 include advice for clinical practice, education, and future research. Clinical practice aids in the increased practice of nursing skills to better equip nursing students for clinical scenarios. Recommendations for education include being more accessible to students throughout the day. Lastly, future research suggests monitoring the effects of VR on previous students whose nursing curriculums included VR simulation.

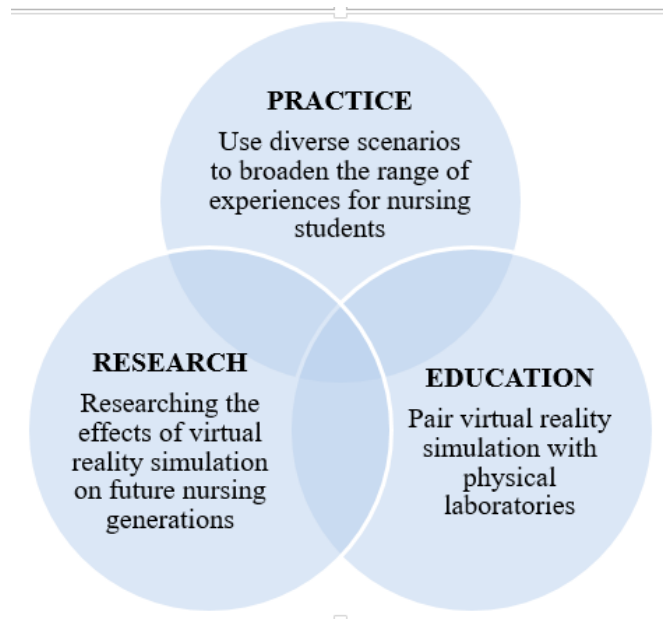


Figure No. 4: Recommendations for Practice, Research, and Education with VR Simulation

Recommendations for Practice

The more scenarios the nursing students experience in simulation, the more they will be prepared in the clinical setting. Several studies investigated students who would practice wound care, enemas, nasogastric feeds, and catheter insertion in VR simulations. Since these skills are not often seen in the clinical setting, practicing these skills was beneficial to the students. Through this additional practice, they are inclined to gain more knowledge about each clinical scenario, improving confidence and self-satisfaction.

Recommendations for Education

VR simulation has been a recent development in nursing schools and should continue to be added to nursing schools around the country. We do not believe nursing schools have to pick one over the other, but our recommendation is to implement both into the nursing curriculum. This can significantly benefit nursing students and allow them to practice skills that are not regularly seen in the clinical setting. VR simulation also could be more accessible to students because the students can go into the nursing lab and use the VR system whenever they are free. Knowing that simulations are accessible to students throughout the day would be helpful in time management.

Recommendations for Research

VR simulation has recently been added to some nursing sets of courses. Most studies are focused on the younger nursing generation. Recommendations for the future include researching these younger nurses once they have been practicing in their field for a year or two. Doing so will help assess and determine the impact VR simulation had on this nursing generation.

6. CONCLUSION

There are no right or wrong ways to integrate nursing simulation into nursing school. Often in nursing school, it is most beneficial to do skills in different settings to become the most proficient among the skills and knowledge taught throughout nursing school. Technology in the simulation realm is ever-evolving and nursing schools are continually looking into the newest technology and research that will best prepare students for future nursing careers. In the current review, solely relying on VR simulation has not shown significant positive nursing student outcomes. Mannikin simulation is still necessary for creating hands-on scenarios in which students can learn skills. However, a combination of in-person and VR simulation has added benefits such as allowing the student to practice skills repeatedly.

REFERENCES

1. Willett, J., Adelman-Mullally, T., Ng, H., & Chung, S. (2024). Virtual reality simulation integration in a prelicensure nursing program lessons learned. *Nurse Educator*, 49(4), 217-221. <https://doi.org/10.1097/NNE.0000000000001586>
2. American Nurses Foundation. (2022, April 27). *Big 10 practice-ready nursing initiative*. American Nurses Association. <https://www.nursingworld.org/foundation/rinitiative/practice-ready-nurse-graduates/big-10-practice-ready-nursing-initiative/>
3. Schmidt, N. A., & Brown, J. M. (2025). *Evidence-based practice for nurses: Appraisal and application of research* (6th Ed.). Jones & Bartlett Learning.
4. Uslu-Sahan, F., Biligin, A., & Ozdemir, L. (2023). Effectiveness of virtual reality simulation among BSN students: A meta-analysis of randomized controlled trials. *Wolter Kluwer Health*, 41(11), 921-929. <https://doi.org/10.1097/cin.0000000000001059>
5. Kim, G., Lim, J., Kim, E., & Yeom, M. (2024). Impact of virtual reality mental health nursing simulation on nursing students' competence. *Journal of Multidisciplinary Healthcare*, 17, 191-202. <https://doi.org/10.2147/JMDH.S435986>
6. Lee, E. & Baek, G. (2024). Development and effects of adult nursing education programs using virtual reality simulations. *Healthcare* 2024, 12(13), 1-13. <https://doi.org/10.3390/healthcare12131313>
7. Qiao, J., Huang, C., Liu, Q., Li, S., Xu, J., Li, L., Redding, S., Ouyang, Y. (2023). Effectiveness of non-immersive virtual reality simulation in learning knowledge and skills for nursing students: Meta-analysis. *Clinical Simulation in Nursing*, 76(26), 26-38. <https://doi.org/10.1016/j.ecns.2022.12.003>
8. Mistry, D., Brock, C., & Lindsey, T. (2023). The present and future of virtual reality in medical education: A narrative review. *Cureus*, 15(12), 1-6. <https://doi.org/10.7759/cureus.51124>
9. Kiegaldie, D., & Shaw, L. (2023). Virtual reality simulation for nursing education: Effectiveness and feasibility. *BMC Nursing*, 22(1), 1-13. <https://doi.org/10.1186/s12912-023-01639-5>
10. Shorey, S., & Ng, E. D. (2021). The use of virtual reality simulation among nursing students and registered nurses: A systematic review. *Nurse Education Today*, 98, 1-10. <https://doi.org/10.1016/j.nedt.2020.104662>
11. Flood, S. (2024). Use of virtual reality simulations to embody a patient exploring the impact on nursing students' confidence, feelings, and perceptions. *Nurse Educator*, 49(1), 36-40. <https://doi.org/10.1097/NNE.0000000000001442>
12. Oh, H., & Son, W. (2022). Cybersickness and its severity arising from virtual reality content: A comprehensive study. *Sensors*, 22(4), 1-26 <https://doi.org/10.3390/s22041314>
13. Piispanen, N., Haavisto, E., Hublin, L., Ikonen, R., & Koivisto, J.-M. (2024). Nursing students' perceptions of interaction in a multiplayer virtual reality simulation: A qualitative descriptive study. *Nursing Open*, 11(8), 1-9. <https://doi.org/10.1002/nop2.2245>
14. Wood, J., Ebert, L., & Duff, J. (2022). Implementation methods of virtual reality simulation and the impact on confidence and stress when learning patient resuscitation: An integrative review. *Clinical Simulation in Nursing*, 66(5), 1-13. <https://doi.org/10.1016/j.ecns.2022.02.006>
15. Cant, R., Ryan, C., & Kelly, M. A. (2022). Use and effectiveness of virtual simulations in nursing student education. *Computers, Informatics, Nursing*, 41(1), 31-38. <https://doi.org/10.1097/cin.0000000000000932>
16. Liu, P., Dong, X., Liu, F., & Fu, H. (2024). Effects of virtual reality OSCE on nursing students' education: A study protocol for systematic review and meta-analysis. *BMJ Open*, 14(5), 1-5. <https://doi.org/10.1136/bmjopen-2023-082847>
17. Suryadi, Y., Komariah, M., & Eriyani, T. (2024). Level of satisfaction and confidence after using virtual reality simulation of wound care skills in nursing students. *Journal of Nursing Care*, 7(1), 17-24. 10.24198/jnc.v7i1.44891
18. Yoon, H., Lee, E., Kim, C., & Shin, Y. (2024). Virtual reality simulation-based clinical procedure skills training for nursing college students: A quasi-experimental study. *Healthcare* 2024, 12(11), 1-12. <https://doi.org/10.3390/healthcare12111109>
19. Chan, K., Kor, P., Liu, J., Cheung, K., Lai, T., & Kwan, R. (2024). The Use of Immersive Virtual Reality Training for Developing Nontechnical Skills Among Nursing Students: Multimethods Study. *Asian/Pacific Island Nursing Journal*, 8 e58818 URL: <https://apinj.jmir.org/2024/1/e58818> DOI: 10.2196/58818
20. Classen, J. E. (2012). Student behaviors in a virtual reality-based clinical simulation: Lessons learned. Conference: 2012 Western Institute of Nursing Annual Communicating Nursing Research Conference

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