

# HOW WILL METAVERSE IMPACT NURSING EDUCATION? SECOND LIFE AND VIRTUAL REALITY EXAMPLE

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## Abstract

In recent years, metaverse technologies such as Second Life and virtual reality have attracted the attention of educators and academics as an educational tool for nursing education and practices. Metaverse technologies offer important opportunities in education and provide potential advantages for nursing education and practices. This review study presents a comprehensive analysis of the relevant literature to explore how metaverse technologies such as Second Life and virtual reality can be integrated into nursing education and the potential impact of these technologies on nursing education and practices. To this end, the applications and effects of metaverse technologies such as Second Life and virtual reality (VR) in nursing education are discussed in this study. This study discusses the use of Second Life simulations and virtual clinical environments in nursing education and the development of student-teacher interactions and experiences. The study also examines the benefits of virtual reality (VR) technology in nursing education and practice, such as skill development, knowledge acquisition, and patient care. In addition, the study evaluates the advantages and disadvantages of metaverse technologies and discusses how these technologies can be integrated into nursing education and practices, and how current and future VR applications can be developed in this area. Evaluating the benefits and potential of metaverse technologies in nursing education will contribute significantly to improving learning processes and practices in this field. Nursing professionals, educators, and policymakers should evaluate the opportunities offered by metaverse technologies and promote their integration into nursing education and practices.

*Keywords:* Virtual Environment, Virtual Reality, Second Life, Metaverse, Nursing Education.

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## 1. Introduction

In today's world, the changing profile of students, the introduction of new technologies, and the changing structure of educational fields have revealed the need for innovation in traditional education methods (Koo, 2021; Damar, 2022; Tekin & Korkmaz, 2022). Several factors such as the pandemic, increase in chronic diseases, aging of the population, inequalities in nurse distribution geographically, challenges in sustaining healthcare systems, and difficulties in conducting face-to-face education highlight the importance of new technologies for education. In this context, metaverse technologies are considered to have significant potential in nursing education (Damar & Turhan Damar, 2021; Koo, 2021; Park & Park, 2022; Damar, 2022). The training of qualified nurses is of great importance for healthcare environments, where quality and safety are crucial and complex technologies are heavily used (Irwin & Coutts, 2015; Yılmaz, Mete, Fidan Türkön, & İnce, 2022; Zhao, Lu, Zhou, Mao & Fei, 2022).

Health professionals can only gain critical thinking and problem-solving skills, learn to work collaboratively, and improve their ability to cope with risky situations they may encounter in real life through competency (Damar & Turhan Damar, 2021; Zhao et al., 2022). Metaverse technologies such as Virtual Reality (VR), Augmented Reality (AR), simulation, and Second Life (SL), which can be easily integrated into theoretical education, create an experiential, immersive, and collaborative learning environment, providing attractive,

unique, and effective ways to develop critical thinking, problem-solving, leadership, clinical reasoning skills, teamwork, and self-confidence (Irwin & Coutts, 2015; Damar & Turhan Damar, 2021; Saab et al., 2022).

VR is a technology in which users immerse themselves in a completely virtual environment and interact through customizable characters called avatars, cutting off their interaction with the real world (Damar & Turhan Damar, 2021; Kye, Han, Kim, Park & Jo, 2021). AR allows one to see the virtual world in real-time through portable devices, while Mixed Reality (MR) enables digital and physical objects existing in both real and virtual worlds to coexist in real time (Logeswaran, Munsch, Chong, Ralph, & McCrossnan, 2021; Yılmaz et al., 2022). Extended Reality (XR) encompasses VR, AR, and MR, and is a combination of digital and physical environments that allows the properties of the physical world to be reflected in the virtual world (Damar & Turhan Damar, 2021; Logeswaran et al., 2021). Metaverse can be expressed as the complexity of these technologies that have emerged with the development of virtual and augmented reality (Damar, 2021; Kye et al., 2021).

In recent times, academic nurses have been using metaverse technologies in the theoretical and practical education of student nurses. Second Life (SL) is the most well-known technology among them (Zhao et al., 2022). Second Life is one of the Metaverse universes where users can socialize with 3D avatars and organize activities involving education and collaboration in a virtual world platform (Lee et al., 2019). Second Life provides students and instructors with the opportunity to experience clinical scenarios and simulations, creating a learning environment similar to real-world experiences in a safe environment for nursing education (Lee et al., 2019; Yılmaz et al., 2022; Saab et al., 2022). Metaverse technologies have the potential to enable safe and quality patient care without physical contact from an educational perspective, while also offering the opportunity to develop social connections and communication skills (Damar & Turhan Damar, 2021; Kye et al., 2021; Garavand & Aslani, 2022). Metaverse technologies have the power to affect and transform the healthcare sector along with all other industries, are predicted to improve healthcare services, enhance healthcare performance, and provide effectiveness and efficiency in health education and practices, in short, create positive impacts in this regard. In this context, nursing education and applications can become more effective, efficient, and safe through metaverse technologies. This study examines the effects of metaverse technologies on nursing education, providing an overview of current practices and research. Additionally, it addresses the positive and negative aspects of using Metaverse technologies in nursing education.

## **2. Methods**

This review study presents a comprehensive analysis of the relevant literature to explore how metaverse technologies such as Second Life and virtual reality can be integrated into nursing education and the potential impact of these technologies on nursing education and practices.

### **2.1. Literature Review and Databases**

A literature review was conducted using various scientific databases such as Web of Science, Science Direct, and Wiley Online Library. Additionally, relevant studies were found using Google Scholar.

### **2.2. Selection and Elimination of Reviewed Studies**

Initially, a preliminary search was conducted using keywords such as "metaverse", "virtual reality", "Second Life", and "nursing education". After relevant titles and abstracts were identified, the full texts were examined and selected considering whether they included a specific application of metaverse technologies in nursing education and demonstrated a certain level of quality and interest.

### **2.3. Criteria for Evaluating and Analyzing Relevant Studies**

Several studies were analyzed to determine the effects of metaverse technologies on nursing education. This analysis focused on how these technologies were used in studies, which learning objectives were achieved by these technologies, the advantages and challenges of their use, and student and educator reactions to these technologies.

Information in these studies was synthesized to identify the applications, opportunities, and challenges of metaverse technologies in nursing education. Additionally, the results and discussions in reviewed studies were evaluated to identify gaps in knowledge in this area and future research.

### **3. Examples of Metaverse Technologies in Nursing Education**

Metaverse technologies have significant implications for the healthcare industry. Their use is widespread in several areas such as education, communication, medical imaging, intervention services, clinical outcomes and access to medical data, healthcare services, and intensive care patient monitoring (Garavand & Aslani, 2022). Metaverse applications can be used in research, education and training, counseling, clinical research, physical examination, geriatric nursing and self-care, diagnosis and treatment of diseases, medical tests, drug therapy, hospital management, quality control in medicine, patient education, remote surgery, psychiatry, therapies, health exercises, telehealth, and medical marketing (Asadzadeh, Samad-Soltani & Rezaei-Hachesub, 2021; Thomason, 2021; Yang *et al.*, 2022; Saab *et al.*, 2022). This section discusses the examples and benefits of metaverse technologies used in medical and nursing education.

#### **3.1. Applications of Second Life Technology in Medicine and Nursing Education**

SL is a metaverse platform that allows users to create unique 3D avatars and engage in social interactions, as well as perform activities in a virtual world. It is also recognized as a simulation methodology for training professionals (Irwin & Coutts, 2015; Lee *et al.*, 2019). SL provides various learning opportunities in nursing education, enabling nursing students and professionals to acquire both theoretical and practical knowledge and skills (Irwin & Coutts, 2015).

A study of graduate nursing students found that SL is a way to improve therapeutic communication between nurses and patients, facilitating communication and increasing confidence and social skills. It can serve as a forum for professional presentations, interaction, and support with patients, a site for accessing education and health materials, and effectively disseminating information. However, technological challenges were noted as a negative aspect of the study (Benham-Hutchins & Lall, 2015). Despite the challenges, the use of SL has been considered to facilitate learning, interaction, and therapeutic communication.

Irwin and Coutts (2015) aimed to examine the use of SL in nursing education and current applications in their systematic review study. The benefits of using SL in nursing education can be summarized as follows: it enhances competency and effective decision-making skills, provides student-centered, immersive, and effective education, and encourages self-learning and collaboration. Although there are negative aspects to using SL, students can receive equal and contemporary education through SL, considering its benefits for education, especially in the face of challenges such as difficulties in practical education during the pandemic, increased student numbers, and insufficient school resources.

An anatomy course at Seoul National University demonstrates how VR and AR technologies can be effective in education (Hyun, 2021). This study provides students with an immersive and interactive learning experience on human anatomy and offers a more effective and engaging learning experience than traditional teaching methods.

Qiao, Xu, Li, and Ouyang (2021) have shown that simulation and SL applications for interprofessional education in virtual environments are effective in training healthcare professionals (nurses, doctors, etc.). The advantages of these applications include;

- strengthening collaboration,
- enabling students to take on responsibilities,
- Provide effective interaction and communication,
- offering convenience and flexibility,
- developing coping skills with uncertainty,
- facilitating the expression of incorrect ideas,
- promoting teamwork and making them make the right decisions for effective patient care and treatment
- providing equal professional expression opportunities.
- emphasizing a respectful, supportive, and shared leadership approach
- achieving positive patient outcomes
- delivering an immersive learning experience

However, the study has identified some negative outcomes and problems that need to be solved related to the use of virtual environments. These include nonverbal communication issues, technical problems, and weaknesses in existing technology.

Metaverse technologies like Roblox and Zepeto enable people to come together and interact in digital environments, creating social spaces for meetings, listening, and education. During the pandemic, these platforms became even more important due to limited access to physical spaces. Zepeto is especially popular among young people and students, allowing them to attend school in virtual worlds by creating classroom environments using 3D maps.

Thus, students and teachers can continue their education while maintaining social distance (Kye *et al.*, 2021). Roblox, Zepeto, and similar metaverse platforms significantly contribute to the future of social interaction and education by allowing students and teachers to continue their education even under challenging conditions like the pandemic. These platforms can be considered important technological advancements that shape the future of education and social interaction.

More than 200 surgeons from Asian countries participated in the Outreach program held in 2021. Surgeons from Manchester University Hospital (UK) and National University Hospital in Singapore joined the program using metaverse and XR technologies and actively participated in discussions (Koo, 2021). During the program, participants listened to a lecture on lung cancer techniques and trends using a head-mounted display (HMD) and then watched a 360-degree high-resolution video of lung cancer surgery and all of its scenes using the XR platform. With the help of XR immersive sound technology, the movements of surgeons and surgical nurses were tracked in real time, and participants could observe every part of the operating room using a mouse cursor (Koo, 2021). This example shows the potential of metaverse and XR technologies for education and knowledge sharing in the healthcare sector. These technologies enable surgeons and healthcare professionals to collaborate remotely worldwide and continue their education and professional development. Additionally, these technologies can make the learning process more effective by providing realistic and immersive experiences.

AR applications like AccuVein and XR technology from companies like Veyond Metaverse contribute to significant advancements in the healthcare sector. These technologies support nursing, medical education, and healthcare workers by providing various services from visualizing vascular pathways to high-fidelity anatomical representation. Gestonurse is an example of the use of artificial intelligence and machine learning in the nursing field (Yılmaz *et al.*, 2022). These technological advancements help improve the effectiveness and quality of healthcare practices.

### 3.2. Applications of Virtual Reality Technology in Medicine and Nursing Education

VR (Virtual Reality) offers real-time, 3D, and interactive environments to its users. In nursing education, it can provide numerous benefits for both students and professionals (Damar & Turhan Damar, 2021; Kye *et al.*, 2021; Damar, 2022). Foronda, Fernandez-Burgos, Nadeau, Kelley, and Henry (2020) conducted a systematic review of virtual simulation and virtual reality in nursing education between 1996 and 2018 to examine their effects on student learning and found that virtual reality education led to improved education, skill acquisition, student satisfaction and motivation, critical thinking skills development, and increased self-confidence. Given these benefits, the importance and necessity of metaverse technologies in nursing education are apparent.

Asadzadeh, Samad-Soltani, and Rezaei-Hachesub (2021) examined how AR and VR technologies are used in the emergency management of infectious diseases and found that VR applications were more commonly used than AR applications in emergency management. However, the authors showed that both technologies had the potential to be used for mitigating infectious diseases and highlighted the importance of further research into their use. Especially during outbreaks and pandemics, effective use of VR and AR technologies in healthcare can provide significant advantages for education and skill development in healthcare professionals, as well as for patient treatment and care. With these technologies, healthcare workers can receive faster and more effective training through realistic simulations and immersive experiences, which can make them more prepared and equipped for emergencies. Additionally, VR and AR-based telehealth applications can offer opportunities for patients and healthcare providers to cope with the negative effects of pandemics through remote delivery of healthcare services. Therefore, more research and application of AR and VR technologies can play a significant role in managing and controlling infectious diseases.

Kyaw *et al.* (2021) conducted a large meta-analysis focusing on the simultaneous validity of virtual reality in health education and compared the effectiveness of virtual reality and traditional learning methods (such as 2D images, lectures, etc.). They also conducted a subgroup analysis on the effectiveness of knowledge and skill acquisition. The authors showed that virtual reality provided better knowledge and skill acquisition compared to traditional learning methods. Additionally, they observed a significant difference in skill development through the use of virtual reality. These results demonstrate that VR technology is an effective tool in health education and more successful than traditional learning methods. Virtual reality can provide students with realistic and immersive experiences, making the learning process more effective and long-lasting, and can play an important role in the education of healthcare professionals.

In a study conducted at the University of London, an immersive VR environment was created to better explain the geometry and structure of the COVID-19 virus. The study aimed to provide students and researchers with a deeper understanding of the virus using immersive and non-immersive presentations of basic molecular dynamics. Additionally, Stefan Siemann from Laurentian University used VR technology to study the enzymes and proteins of the SARS-CoV-2 virus (Asadzadeh *et al.*, 2021). Such applications help scientists and researchers better understand, analyze, and visualize complex biological structures and processes. The use of VR technology can improve the learning process in science and medicine, leading to discoveries and insights. Especially during pandemic periods, the use of such technologies can contribute to a better understanding of the characteristics and effects of the virus and the development of potential treatment methods.

A pilot study conducted by Zeng, Zeng, Zhang, and Cheng (2022) produced promising results for cognitive rehabilitation with VR for cancer patients. The study demonstrated that VR technology has significant potential in the healthcare field and can help improve the quality of life and cognitive functions of cancer patients. Cognitive rehabilitation with VR provides an interactive and immersive treatment method aimed at improving patients' cognitive skills and alleviating the challenges they face. This approach can improve patients' motivation, quality of life, and treatment adherence. Zeng *et al.* have shown that the use of VR in cognitive rehabilitation for cancer patients is beneficial. These results indicate that the broader use of VR technology in the healthcare sector can have positive effects on patient's quality of life and treatment outcomes. Therefore,

further research on cognitive rehabilitation with VR and the integration of this technology into the treatment of cancer patients will be an important development in the health sector.

### **3.3. Benefits of Virtual Reality and Second Life Technologies**

#### **3.3.1. Simulations and Scenario-Based Training**

These technologies provide practical skills for nursing students and nurses to gain in a safe environment by offering simulations and scenario-based education for situations they may encounter in real life (Yılmaz *et al.*, 2022). These simulations help to develop rapid decision-making, problem-solving, and critical thinking skills that reflect real-life scenarios, while teaching coping strategies for emergencies (Asadzadeh *et al.*, 2021; Zhao *et al.*, 2022).

#### **3.3.2. Interprofessional Education and Collaboration**

Second Life and virtual reality simulations allow students and professionals from different health disciplines to come together and provide opportunities for interprofessional education and collaboration. This allows nursing students and nurses to develop communication and collaboration skills with colleagues from different areas of expertise (Liaw *et al.*, 2020; Thomason, 2021; Qiao *et al.*, 2021).

#### **3.3.3. Cultural and Ethical Aspects**

Metaverse is a world where virtual and real interactions create value and social, cultural, and economic activities can be carried out (Kye *et al.*, 2021). Second Life and simulation technologies help nursing students and nurses develop awareness and understanding of cultural and ethical aspects. Digital ethics and culture are no different in these platforms. Nursing students and nurses interact with people from different cultures and life experiences, enabling them to be more sensitive and effective in nursing practices (Thomason, 2021; Zeng, Zeng, Zhang & Cheng, 2022; Zhao *et al.*, 2022).

#### **3.3.4. Simulations and Clinical Skills Development**

Virtual reality provides students and nurses with realistic and interactive simulations to develop their clinical skills. These simulations allow nursing students and nurses to practice their skills in a safe environment, such as patient care, communication, and emergency management (Foronda, Fernandez-Burgos, Nadeau, Kelley & Henry, 2020; Saab *et al.*, 2022; Zhao *et al.*, 2022).

#### **3.3.5. Empathy, Self-Confidence, and Communication Skills**

Virtual reality also helps nursing students and nurses develop empathy and communication skills. VR simulations enable nursing students and nurses to better understand the emotions and needs of patients by working with different patient profiles and situations (Benham-Hutchins & Lall, 2015; Foronda *et al.*, 2020; Damar & Turhan Damar, 2021; Saab *et al.*, 2022; Damar, 2022).

### 3.3.6. Education and Learning Motivation

Virtual reality provides a fun, immersive, and interactive learning environment for nursing students and nurses, increasing their participation and motivation in education while supporting better learning retention and understanding (Foronda *et al.*, 2020; Damar, 2021; Zhao *et al.*, 2022).

### 3.3.7. Distance Education and Accessibility

Virtual reality offers distance education opportunities to nursing students and professionals by eliminating geographical barriers (Koo, 2021; Saab *et al.*, 2022). In this way, nursing students and nurses can access worldwide educational resources and experts, increasing the accessibility and quality of nursing education (Benham-Hutchins & Lall, 2015; Yilmaz *et al.*, 2022; Zeng *et al.*, 2022).

## 4. Positive and Negative Aspects of Metaverse Technologies in Nursing Education

In this section, we examined the positive and negative aspects of metaverse technologies in nursing education. While utilizing the potential benefits of these technologies, it is important to consider their downsides and challenges.

### *Positive Aspects:*

**Collaborative, experiential, interactive, and immersive learning experiences:** Metaverse technologies allow nursing students to have more interactive and immersive learning experiences by practicing with realistic scenarios. They also provide an alternative solution to several problems encountered in health education (such as pandemics and internship problems) (Koo, 2021; Kye *et al.*, 2021; Yang *et al.*, 2022; Saab *et al.*, 2022; Damar, 2022).

**Development of critical thinking, decision-making, and problem-solving skills:** Metaverse environments provide opportunities for nursing students to develop critical thinking, decision-making, and problem-solving skills that will help them cope with challenges they may face in real life (Kye *et al.*, 2021; Yilmaz *et al.*, 2022).

**Safe implementation of risky practices:** Metaverse technologies provide nursing students with the opportunity to perform risky practices in a safe environment, free from the dangers they may encounter in real life. They also reduce stress related to nursing practices and promote self-confidence development (Damar & Turhan Damar, 2021; Yilmaz *et al.*, 2022).

**Patient safety and quality care:** Metaverse technologies facilitate making correct decisions in surgical procedures, radiology, and medical imaging while strengthening team communication and collaboration to achieve safe and high-quality patient care outcomes. They also help nursing students and nurses establish empathy with patients and improve therapeutic communication (Damar & Turhan Damar, 2021; Damar, 2022; Yilmaz *et al.*, 2022; Yang *et al.*, 2022; Saab *et al.*, 2022).

### *Negative Aspects:*

**Technological access and skill deficiency:** Not all students may have access to metaverse technologies or possess the skills to use these technologies, which can lead to inequalities (Irwin & Coutts, 2015; Yilmaz *et al.*, 2022; Yang *et al.*, 2022).

**Cost:** The use of metaverse technologies in nursing education can be costly, especially in terms of licensing and hardware expenses (Saab *et al.*, 2022; Yilmaz *et al.*, 2022).

**Legal, ethical, and security issues:** The lack of legal regulations and infrastructure in metaverse environments can lead to legal, ethical, and security issues. Particularly in medical and nursing education, the use of these technologies can raise ethical and legal concerns. Safeguarding the privacy and confidentiality of students and educators in nursing education and ensuring data security are important and sensitive issues. Policies and regulations regarding the use of metaverse technologies in nursing education should be created fairly, protecting intellectual property rights and ensuring users' respect for these rights, while also establishing appropriate rules and regulations to meet ethical and professional conduct expectations among users (Kye *et al.*, 2021; Yilmaz *et al.*, 2022; Zeng *et al.*, 2022; Damar, 2022).

**Other issues:** There are several other issues related to metaverse technologies, including identity confusion, the potential for integration with avatars and psychological issues, accessibility issues for individuals with sensory and physical impairments, and technology-related physical problems (eye strain, nausea, dizziness, etc.) (Kye *et al.*, 2021; Yilmaz *et al.*, 2022; Saab *et al.*, 2022; Frith, 2022).

## 5. Potential Contributions of Metaverse Technologies to Nursing Education

The potential contributions of metaverse technologies to nursing education will increase in parallel with the continuous development of educational methods and healthcare services. In this section, we will discuss some potential contributions that metaverse technologies can provide to nursing education in the future.

- **Personalized education:** Metaverse technologies can offer personalized education opportunities to students based on their learning pace and needs (Irwin & Coutts, 2015; Kye *et al.*, 2015; Yang *et al.*, 2022; Yilmaz *et al.*, 2022).
- **Interdisciplinary collaboration:** In metaverse environments, nursing students can collaborate with students and professionals from other disciplines, providing them with the chance to acquire knowledge and skills from different fields (Qiao *et al.*, 2021; Garavand & Aslani, 2022).
- **Remote education and global access:** Through metaverse technologies, nursing education can be provided to more students and professional nurses worldwide. This allows education to reach a broader audience beyond geographical boundaries (Koo, 2021; Damar, 2021; Park & Park, 2022; Yilmaz *et al.*, 2022).
- **Continuous professional development:** Metaverse technologies support nurses' access to continuous professional development opportunities throughout their careers, ensuring they have up-to-date knowledge and skills (Qiao *et al.*, 2021; Damar & Turhan Damar, 2021; Damar, 2022).
- **Innovative teaching techniques:** The use of metaverse technologies in nursing education can assist educators in developing innovative teaching and assessment methods (Damar, 2021; Yang *et al.*, 2022; Park & Park, 2022).

The potential contributions of metaverse technologies to nursing education in the future will contribute to the development of more effective and interactive learning experiences for students, leading to the emergence of more qualified professionals in the field of nursing. The utilization of these technologies will continue to increase in conjunction with the continuous development of education and healthcare services.



## 6. Conclusions

This review study examined the impact of metaverse technologies, particularly Second Life and virtual reality applications, on nursing education. Through a literature review, it has been observed that these technologies offer significant benefits in nursing education and practices. Second Life and virtual reality provide nursing students and professionals with more immersive, interactive, and experiential learning environments, helping them enhance critical thinking, problem-solving, communication, and collaboration skills. Additionally, these technologies contribute to the simulation of risky and complex situations in nursing education and practices, thereby facilitating patient safety and the delivery of quality care.

However, alongside the benefits provided by these technologies in nursing education, there are also some disadvantages and challenges. For instance, the preparation and use of virtual environments can be time-consuming and costly. Accessibility issues may arise for some students and professionals due to technical skill deficiencies and the learning curve. Therefore, addressing these challenges and developing relevant solutions is necessary for the effective utilization of metaverse technologies in nursing education. Further studies should assess the use of metaverse technologies in nursing education on a broader scale and explore how these technologies can be more effectively employed in different nursing domains and interdisciplinary collaboration contexts. Additionally, addressing legal, ethical, and security concerns related to the use of these technologies and establishing appropriate regulations is crucial in this regard.

In conclusion, evaluating the benefits and potential contributions of metaverse technologies in nursing education will significantly improve learning and practice processes in this field. This study aimed to raise awareness about the use of metaverse technologies in nursing education and practices and serves as a basis for future studies. Nursing professionals, educators, and policymakers should assess the opportunities offered by metaverse technologies and promote their integration into nursing education and practices.

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