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A Review of the Metaverse in Nursing Education: A SCORE Model Evaluation

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Abstract. This review identifies the metaverse's key strengths which collectively enhance students' clinical preparedness and critical thinking skills. This paper also reviews opportunities for strategic partnerships with AR/VR providers and the potential for multi-institutional collaborations to pool resources. Stakeholder responses indicate that nursing students respond positively to the metaverse's engaging and realistic learning environment, while faculty exhibit mixed reactions due to concerns about training requirements and cognitive overload. The findings reveal that metaverse-based learning improves clinical competence, knowledge retention and procedural accuracy, supporting students' transition from theoretical knowledge to real-world application. This review underscores the significance of the SCORE model as a strategic planning tool for educators, administrators and policymakers seeking to integrate the metaverse into nursing curricula. The findings provide actionable guidance on how to leverage the metaverse to support personalised, experiential learning. This review offers a pathway for continuous improvement, enabling institutions to address key barriers while enhancing the effectiveness and sustainability of metaverse-based nursing education.

Keywords: metaverse; nursing education; SCORE Model; innovation

1. Introduction

The rapid advancement of immersive technologies, particularly the metaverse, is revolutionising education. The metaverse, a shared virtual space that blends augmented reality (AR), virtual reality (VR), and immersive tools, provides an interactive 3D environment where students engage in experiential learning (Azam et al., 2023; Onu et al., 2023; Rahman et al., 2024). By enabling real-time simulations that mirror real-world scenarios, the metaverse provides an engaging and immersive environment that enhances knowledge retention and skill acquisition (Sabatucci et al., 2023). AR and VR have shown significant potential in nursing education to bridge the gap between theoretical knowledge and clinical

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practice (Alshammari & Alanazi, 2023). Through VR-based simulations, students are immersed in lifelike clinical scenarios that promote critical thinking and decision-making, while AR tools enhance procedural accuracy by providing real-time visual guidance (Lee, 2023; Liu & Liu, 2023; Padilha et al., 2024). These technologies enable nursing students to develop essential clinical skills in a controlled, risk-free setting.

The increasing complexity of healthcare systems and the growing demand for skilled nursing professionals necessitate modernised educational approaches. Traditional nursing education relies on in-person clinical practice, but this approach faces several constraints, such as restricted access to clinical sites, limited patient availability and safety concerns (Balat et al., 2023; Rumsey et al., 2023). These limitations pose significant challenges for nursing programmes that prepare students for real-world healthcare environments. Immersive technologies such as AR, VR and the metaverse address these challenges by providing controlled, scalable and interactive virtual learning environments. Through these platforms, nursing students can engage in high-risk procedures such as cardiopulmonary resuscitation and intravenous insertion (IV) without jeopardising patient safety, thereby improving both competence and confidence (Hou et al., 2022; Lee, 2022). Studies have shown that students exposed to immersive simulations demonstrate higher knowledge retention and procedural accuracy levels than those relying on traditional lecture-based methods (Kouijzer et al., 2023; Lewis et al., 2024).

However, despite the potential of metaverse technology to transform nursing education, several gaps exist in its implementation. Key barriers include infrastructure challenges, limited technical expertise and the need for interoperability with existing educational platforms (Rahman et al., 2024). Existing studies primarily focus on technical functionality and short-term skill development, with limited attention to broader education outcomes, such as clinical preparedness, critical thinking and knowledge retention (Ford et al., 2023; Kim et al., 2024). This highlights the need for targeted training programmes and comprehensive evaluations of the metaverse's long-term impact on nursing education. Addressing these issues requires a structured approach to assess metaverse integration's feasibility, impact and sustainability in nursing curricula.

To achieve this, the SCORE model is employed as a conceptual framework to evaluate the effectiveness of metaverse-based learning in nursing education. The SCORE model focuses on five critical dimensions: strengths, challenges, options, responses and effectiveness (Neal, 2024). Unlike traditional evaluation models like SWOT (strength, weaknesses, opportunities, threats), or SOAR (strengths, opportunities, aspirations, results), the SCORE model emphasises adaptability and actionable insights, making it especially relevant for assessing emerging technologies like the metaverse (Neal, 2023). Each SCORE dimension plays a vital role in evaluating the integration of immersive learning in nursing education. This model helps in guiding educators, organisations or teams on performance appraisal through analysing five important dimensions. Strengths highlight what one currently does well or where one could excel. Challenges identify the lacking part, including resources or improved capabilities. Options explore opportunities and risks to inform strategic choices, while response captures various

stakeholders, such as how students, educators and policymakers might react to the proposed strategies. Lastly, effectiveness assesses how the actions attain the intended goals with efficiency and reliability.

For example, the metaverse is related to the strength dimension because it easily allows for experiential learning and enhances student engagement (Nasir & Ngah, 2022). The challenges include readiness of faculty, infrastructure demands and financial constraints (Ergin et al., 2024). The options dimension explores strategies for implementation and stakeholder responses, such as feedback from students to faculty on learning experiences (Neal, 2024). Finally, effectiveness evaluates the metaverse's overall impact on educational outcomes, including clinical preparedness, knowledge retention and critical thinking (Ergin et al., 2024; Neal, 2024).

Adopting immersive technologies like the metaverse in nursing education presents opportunities for personalised and adaptive learning, essential for developing critical decision-making skills and clinical competence (Medel et al., 2024; Zhang et al., 2022). The SCORE model enables educators to design immersive learning scenarios that simulate real-world clinical environments, allowing students to practise complex healthcare procedures in a safe, controlled space. Unlike evaluations focusing solely on student satisfaction or short-term outcomes, the SCORE model facilitates a more comprehensive assessment of strengths, challenges and opportunities, providing a clear pathway for continuous improvement in instructional design (Almomani et al., 2023). This approach ensures that key factors, such as faculty training, resource allocation and technological adaptability, are addressed to support successful implementation (Kiegaldie & Shaw, 2023).

This concept paper aims to assess the potential of metaverse-based learning in nursing education through the lens of the SCORE model. By analysing the metaverse's strengths, challenges, options, responses and effectiveness, this paper provides practical insights into how immersive simulations can enhance nursing students' learning experiences. The findings offer strategic guidance for educators and policymakers on integrating metaverse technologies into nursing curricula, supporting students' preparedness for modern healthcare environments. To achieve this objective, this paper addresses the following research questions: 1) What are the key strengths, challenges, options, responses and evaluation associated with metaverse adoption in nursing education? 2) How can insights from this analysis inform the development of effective educational strategies for nursing programmes?

2. Methodology

This concept paper employs the SCORE model as a strategic planning tool to conceptually evaluate the integration of immersive technologies, particularly the metaverse, into nursing education. As a concept paper, it focuses on theoretical exploration and does not include empirical data collection or direct participant involvement. Instead, it synthesises findings from existing literature to apply the SCORE model in a structured and actionable manner. This approach provides a forward-looking framework to assess the feasibility and potential impact of metaverse integration in nursing education, going beyond traditional analysis

tools like SWOT. The model is beneficial in identifying both opportunities and risks while offering solutions for proactive strategy development (Neal, 2024). Recent studies have utilised the SCORE model to evaluate the effectiveness of targeted strategies in various educational contexts, including special education, coaching competencies, teaching practices and mathematical education (Azeman et al., 2024; Ishak et al., 2024; Ismail et al., 2024; Othman et al., 2024).

An extensive literature review was conducted to gather relevant data for this concept paper. The review exclusively utilized the SCOPUS database, widely recognised for their extensive coverage of high-quality academic publications (Pranckutė, 2021). The search was performed using key terms such as "metaverse", "immersive learning", "nursing education" and "AR/VR in healthcare". These keywords were chosen to ensure a broad yet relevant selection of literature that aligns with the study's objectives.

To maintain the relevance and currency of the data, only English-language articles published within the last five years were included (Houser, 2021). The inclusion and exclusion criteria used to select the articles are outlined in Table 1. Articles were screened based on their relevance to integrating immersive technologies in healthcare education. Priority was given to studies that specifically examined the impact of AR, VR, and metaverse-based learning on nursing education, ensuring alignment with the paper's focus.

The final selection of literature underwent a comprehensive analysis with each article meticulously reviewed, focusing on the findings, discussions and conclusion. Special attention was given to identifying key themes related to the SCORE model's five dimensions correlated with integrating metaverse technologies into nursing education. This approach provided a structured and critical understanding of the existing literature, highlighting evidence-based insights on how the metaverse can be effectively integrated into nursing education. Figure 1 illustrates the SCORE model, a strategic assessment tool that extends beyond the traditional SWOT model. It evaluates five essential components: Strengths (S), Challenges (C), Options (O), Responses (R), and Effectiveness (E) (Neal, 2023).

Table 1: Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Years of publication	2020 onwards	Prior to 2020
Languages	English	Non-English
Relevance	Focus on immersive technologies (AR, VR and metaverse) in nursing education	Studies on immersive technologies outside of nursing education (e.g., general education, business, engineering, etc.)
Type of study	Empirical studies, conceptual paper, systematic reviews and meta-analysis	Conference, abstract and non-reviewed publications

Although no direct participants were involved in this study, the analysis considered hypothetical contexts based on existing research. For instance, the application of the SCORE model assumed diverse student demographics,

including nursing students at varying academic levels and with differing levels of technological proficiency. These conceptual scenarios helped contextualise the findings and provide a theoretical basis for exploring the SCORE model's utility in addressing the unique challenges and opportunities in nursing education. As a concept paper, this study is limited to theoretical analysis and does not include empirical validation or direct stakeholder input.

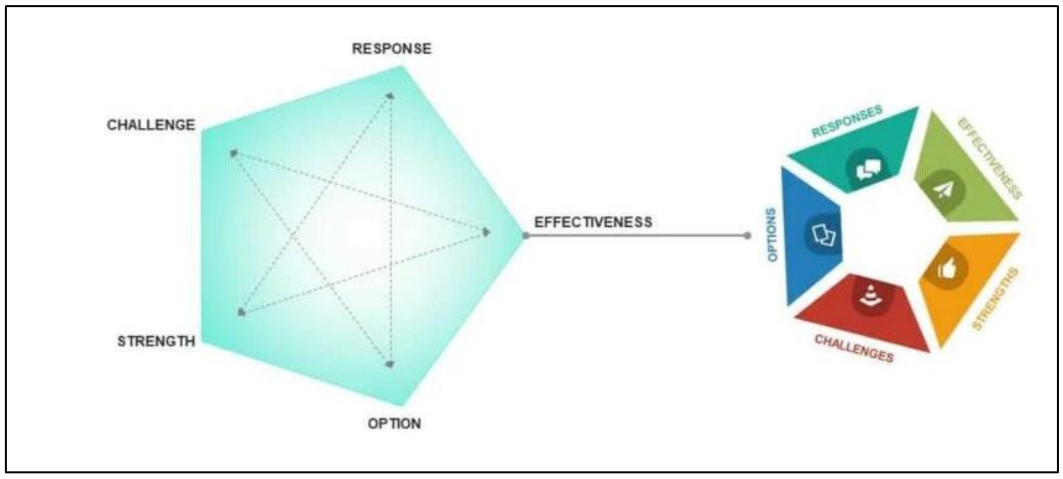

Figure 1: The SCORE model as a strategy assessment beyond SWOT (Neal, 2023)

3. Findings and Discussions

Strengths of the Metaverse in Nursing Education

The metaverse's primary strength lies in its transformative potential to redefine nursing education through immersive, highly realistic simulations. These virtual environments allow students to practise clinical skills in a controlled, risk-free setting, bypassing the limitations of physical space and patient availability (Chen et al., 2020; Guerra-Tamez, 2023). The ability of the metaverse to stimulate diverse and rare clinical scenarios ensures that the nursing students gain exposure to complex healthcare settings that are often unavailable in traditional training environments (Ahn & Lee, 2023; Ryu & Yu, 2023). This immersive experience not only enhances understanding and retention of complex concepts but also fosters a sense of confidence among students as they navigate clinical situations in a controlled setting.

Moreover, these virtual spaces provide a dynamic interface where real-time feedback, automated assessment tools and advanced visualisation enhance learning (Kiegaldie & Shaw, 2023; Zi & Cong, 2024). A key feature of these simulations is the inclusion of a real-time feedback mechanism, which allows students to refine their skills iteratively, improving their confidence and performance (Ford et al., 2023). By integrating blockchain-based smart contracts for educational evaluation, metaverse platforms enable secure, adaptive and data-driven assessment, addressing such critical challenges as reliability and transparency (Zi & Cong, 2024).

Another notable strength of the metaverse is its ability to support flexible and personalised learning experiences, including asynchronous opportunities. This flexibility allows students to train at their own pace, catering to their unique

learning needs while maintaining consistency in education quality (Jeon et al., 2024). Such adaptability enhances engagement and strengthens learning retention, making the metaverse an indispensable tool for modernising nursing curricula to align with the demands of a technology-driven healthcare environment (Almarzouqi et al., 2022).

Furthermore, the metaverse significantly improves student engagement and motivation. The interactive nature of metaverse platforms encourages active participation, making learning more enjoyable and effective (Dorribo et al., 2024). In nursing education, where student engagement is critical for mastering complex material, the metaverse provides an innovative solution to traditional pedagogical challenges. For example, the gamified elements and interactive simulations inherent in metaverse environments can transform the educational experience, making it more dynamic and appealing to digital-native students (Yang & Kang, 2022).

The development of essential skills is another critical strength of the metaverse in nursing education. Collaborative activities within the metaverse allow students to work together to solve complex clinical problems, thereby fostering teamwork and communication skills that are vital in healthcare settings (Suh & Ahn, 2022). This holistic approach to skill development prepares nursing students to face the multifaceted challenges of modern healthcare environments, where collaboration and effective communication are paramount.

Finally, the metaverse enhances accessibility and flexibility in nursing education. Students can access learning materials and simulations from anywhere, which is particularly beneficial for those with varying schedules or geographical constraints (Almarzouqi et al., 2022). This flexibility can lead to increased enrolment and retention rates in nursing programmes, as it accommodates the diverse needs of students. By breaking down traditional barriers to education, the metaverse has the potential to democratise access to high-quality nursing education, ensuring that a broader range of students can benefit from innovative learning experiences (Bobko et al., 2024).

Challenges in Integrating the Metaverse into Nursing Education

The integration of the metaverse into nursing education presents a promising frontier for enhancing learning experiences; however, it is not without significant challenges that must be critically examined. Despite its numerous advantages, both internal and external obstacles hinder the effective adoption of metaverse technologies in nursing curricula. Internally, resistance to changes remains a key barrier; faculty members may hesitate to adopt immersive technologies due to limited technical expertise, concerns about increased workloads, or apprehension over deviating from traditional teaching methods (Lewis et al., 2024). Moreover, many nursing faculty may not be familiar with the intricacies of virtual environments, which can hinder their ability to design and implement effective metaverse-based curricula (Ryu & Yu, 2023). Without adequate professional development and support, educators may struggle to integrate these technologies into their teaching practices, leading to suboptimal learning experiences for students. Similarly, students may struggle to adapt to new tools and technologies without adequate guidance and support (Dwivedi et al., 2022).

Another significant challenge is the technological readiness of both educators and students. Many nursing programmes may lack the necessary infrastructure, such as high-speed internet and advanced hardware, to support immersive metaverse experiences (Jeon et al., 2024; Kye et al., 2021). This technological gap can create disparities in access to metaverse-based learning, particularly for students from underprivileged backgrounds or institutions with limited resources. As a result, the potential benefits of the metaverse may not be equitably distributed, thereby exacerbating existing inequalities in nursing education (Zaidi et al., 2024).

Externally, the financial burden of acquiring and maintaining the necessary infrastructure, such as VR headsets and software, poses a significant challenge for many institutions. Aligning these technologies with existing nursing curricula and meeting educational standards further complicates the process. Collaboration with technology vendors to customise solutions that meet institutional needs adds another layer of complexity (Padilha et al., 2024). The rapid pace of technological advancements means that educators must continuously update their skills and knowledge, which can be a daunting task amidst their existing responsibilities (Jagatheesaperumal et al., 2024).

The potential for privacy breaches and security concerns in metaverse environments also poses a significant challenge. As nursing education increasingly relies on digital platforms, the risk of exposing sensitive student and patient data becomes a pressing issue (Kye et al., 2021). Instructors must navigate these risks while ensuring that students feel safe and secure in their learning environments. The implementation of robust security measures and clear guidelines for data protection is essential to mitigate these risks, yet many institutions may lack expertise resources to do so effectively (Lewis et al., 2024).

Moreover, the immersive nature of the metaverse can lead to issues related to student engagement and motivation. While the metaverse has the potential to enhance learning experiences, it can also be overwhelming for some students, particularly those who are not accustomed to virtual environments (Dorribo et al., 2024; Yang & Kang, 2022). The novelty of the technology may initially attract students, but sustaining their interest and motivation over time can be challenging. As such, educators must carefully design metaverse experiences that are not only engaging but also pedagogically sound, ensuring that students remain focused on their learning objectives (Ahn & Lee, 2023).

Finally, the assessment of student learning in metaverse environments presents unique challenges. Traditional assessment methods may not be suitable for evaluating competencies developed in virtual settings, necessitating the development of new evaluation frameworks that accurately reflect student performance in immersive environments (Ryu & Yu, 2023; Zi & Cong, 2024). This shift requires collaboration among educators, technologies and assessments experts to create reliable and valid assessment tools that align with the learning outcomes of metaverse-based nursing education.

Options for Integrating the Metaverse in Nursing Education

The advent of metaverse technologies has the potential to revolutionise nursing education by providing immersive and interactive learning experiences that traditional methods cannot offer. As healthcare continues to evolve, nursing

programmes must adapt to prepare students for the complexities of modern practice. One prominent option for integrating the metaverse in nursing education is through the use of virtual simulations and immersive learning environments. These platforms allow students to engage in realistic clinical scenarios, enhancing their practical skills and decision-making abilities in a safe and controlled setting (Ahn & Lee, 2023; Jeon et al., 2024). For instance, VR simulations can replicate high-stakes situations, enabling students to practise critical nursing skills such as vital signs assessment and patient interaction without the risk of harming real patients. This experiential leaning approach not only boosts students' confidence but also fosters a deeper understanding of complex healthcare concepts (Ryu & Yu, 2023).

Another option for integrating the metaverse is through collaborative learning experiences, such as virtual mock trials or interprofessional education scenarios. These initiatives can facilitate teamwork and communication among nursing students and other healthcare disciplines, mirroring real-world healthcare environments where collaboration is essential (Dorribo et al., 2024). By participating in virtual mock trials, nursing students can develop critical thinking and advocacy skills while gaining insights into the legal and ethical dimensions of healthcare practice.

Integrating metaverse technologies also opens up opportunities for innovation through collaborative partnership with AR/VR technology providers (Dwivedi et al., 2022). These partnerships enable nursing programmes to create custom solutions tailored to their specific needs while alleviating the developmental and technical burdens on educators. Multi-institutional collaborations can further foster resource sharing, such as pooled VR infrastructure, which lowers costs and improves accessibility for a broader range of institutions (Neal, 2024). Access to external grants and sponsorships from healthcare organisations and educational consortia enhances the feasibility of piloting and scaling metaverse initiatives, providing nursing programmes with the necessary resources to adopt immersive technologies effectively (Lewis et al., 2024). Additionally, integrating the metaverse into nursing education necessitates a focus on inclusivity and accessibility. As the literature suggests, understanding the unique needs and preferences of diverse learners is crucial for creating an effective metaverse-based educational environment (Ahn & Lee, 2023). Institutions must ensure that all students, regardless of their backgrounds or technological proficiency, have equitable access to metaverse resources. This may involve providing additional support and training for students who may struggle with new technologies, as well as addressing potential barriers to engagement (Song et al., 2023).

Despite the promising options for integrating the metaverse into nursing education, several challenges must be critically addressed. Resistance to change among faculty and students can hinder the adoption of immersive technologies, as many may be apprehensive about deviating from traditional teaching methods (Lewis et al., 2024). To overcome this barrier, institutions should implement targeted faculty development programmes that equip educators with the necessary skills to effectively use metaverse tools in their teaching practices (Dwivedi et al., 2022). Additionally, the financial burden of acquiring and maintaining the required infrastructure poses a significant challenge for many

institutions, necessitating careful planning and resource allocation to ensure successful implementation (Padilha et al., 2024).

Stakeholder Responses to Metaverse Integration in Nursing Education

Stakeholder responses are instrumental in determining the success and feasibility of metaverse integration into nursing education. Nursing students often respond positively to immersive environments, citing increased engagement, motivation and realism as key benefits. These features enhance their confidence and improve skill retention, effectively bridging the gap between theoretical knowledge and practical application (Liu & Liu, 2023). The gamified elements of the metaverse further enrich the learning experience, making complex clinical scenarios both enjoyable and impactful (Volejnikova-Wenger et al., 2021).

Educators, however, exhibit mixed responses to the integration of metaverse technologies. Those with prior experience in simulation-based learning tend to express enthusiasm for the metaverse's potential to transform nursing education. They recognise that immersive learning experiences can significantly enhance students' practical skills and confidence, particularly in high-stakes clinical scenarios (Ahn & Lee, 2023; Jeon et al., 2024). However, other educators remain apprehensive due to concerns about curriculum integration and the time required for training (Dwivedi et al., 2022). Some faculty members experience cognitive overload when navigating virtual environments and require additional technical support for successful implementation (Khateeb & Alotaibi, 2024). This gap in readiness can lead to resistance among faculty who may prefer traditional teaching methods, underscoring the need for comprehensive training and support.

Healthcare professionals and employers recognise the potential for metaverse technologies to produce graduates who are better prepared for the complexities of modern healthcare environments (Ryu & Yu, 2023). They appreciate the ability to practise in simulated settings, which can enhance critical thinking and the decision-making skills essential for effective nursing practice. However, concerns persist regarding the adequacy of metaverse training in preparing students for real-world challenges. Some stakeholders argue that, while virtual simulations are beneficial, they cannot fully replicate the nuances of patient interactions and the unpredictability of clinical settings (Said, 2023). This perspective emphasises the need for a balanced approach that combines metaverse training with traditional clinical experiences to ensure comprehensive skill development.

Policymakers play a crucial role in shaping the landscape of nursing education and have responded to the integration of metaverse technologies with a mix of support and caution. There is recognition of the need to modernise nursing education to keep pace with technological advancements in healthcare (Barut et al., 2024) and policymakers advocate for the incorporation of innovative teaching methods, including the metaverse, to enhance the quality of nursing education. However, they also express concerns about the financial implications of such integration. The costs associated with acquiring and maintaining the necessary infrastructure can be significant, particularly for institutions with limited resources (Padilha et al., 2024). Policymakers must therefore consider funding

mechanisms and support systems to facilitate the transition to metaverse-enhanced education while ensuring that all institutions can participate equitably.

To address the concerns of various stakeholders, administrators must foster collaboration across departments and incorporate stakeholder feedback into the implementation process. Establishing feedback loops and maintaining open communication channels ensure that all stakeholders feel supported and invested in the transition to immersive technologies (Neal, 2024). This collaborative approach enhances stakeholder buy-in and supports the effective integration of metaverse-based learning in nursing education.

Evaluating the Effectiveness of Metaverse Integration in Nursing Education

As nursing education evolves to meet the demands of modern healthcare, the effectiveness of these immersive environments warrants thorough evaluation. Various studies highlight the potential benefits of metaverse integration, including increased engagement, improved skill retention, and enhanced confidence among nursing students (Liu & Liu, 2023; Suh & Ahn, 2022). However, the effectiveness of such technologies is not universally accepted, and a critical review of the literature reveals both the advantages and limitations of metaverse-based education.

The effectiveness of the metaverse in nursing education can be evaluated using five key dimensions: efficiency, reliability, elegance, appropriateness and integration. Efficiency refers to optimising resources such as time, finances and infrastructure. For instance, asynchronous VR tools enhance time management by allowing students to access training modules conveniently, reducing scheduling conflicts and maximising learning outcomes (Kim et al., 2023). Reliability emphasises consistent system performance; integrating metaverse platforms with existing learning management systems enhances stability and minimises technical disruptions, ensuring a seamless experience for students and educators (Chen et al., 2020). Elegance focuses on user-friendly design and adaptability, making the metaverse accessible to diverse learners without requiring extensive training. Appropriateness evaluates the metaverse's alignment with nursing education objectives, ensuring that it enhances clinical and theoretical competencies while complementing traditional methods. Finally, integration measures how effectively metaverse tools blend with institutional technologies to create a cohesive and scalable ecosystem (Padilha et al., 2024).

One of the primary advantages of metaverse integration is its ability to create immersive learning environments that simulate real-world clinical scenarios. This immersive experience allows students to practise essential nursing skills in a safe and controlled setting, bridging the gap between theoretical knowledge and practical application (Ryu & Yu, 2023). Studies have shown that students who engage in metaverse-based training demonstrate significant improvements in their clinical competencies, particularly in areas such as vital signs measurement and subcutaneous injections (Ahn & Lee, 2023). The gamified elements of the metaverse further enrich the learning experience, making complex clinical scenarios both enjoyable and impactful (Volejnikova-Wenger et al., 2021). This engagement is crucial in nursing education, where motivation and active participation are key to effective learning.

Despite these advantages, the effectiveness of metaverse integration is tempered by several challenges. Educators exhibit mixed responses to the adoption of these technologies, with some expressing enthusiasm based on prior experience in simulation-based learning, while others remain apprehensive about curriculum integration and the time required for training (Dwivedi et al., 2022). This divide highlights a critical barrier to the widespread adoption of metaverse technologies in nursing education. Faculty members who experience cognitive overload when navigating virtual environments may struggle to implement these tools effectively, necessitating additional technical support and training (Khateeb & Alotaibi, 2024). Without adequate preparation, the potential benefits of metaverse integration may not be fully realised, leading to inconsistent educational outcomes.

Furthermore, the reliance on technology raises concerns about accessibility and equity in nursing education. While metaverse environments can diminish disparities related to physical attributes, such as race and gender, they may inadvertently create new barriers for students lacking access to the necessary technology or internet connectivity (Hwang et al., 2023). This issue is particularly pertinent in diverse educational settings, where students come from varying socioeconomic backgrounds. Ensuring that all students have equal access to metaverse resources is essential for fostering an inclusive learning environment that maximises the effectiveness of these innovative educational tools.

The evaluation of metaverse integration in nursing education must also consider the long-term implications for student preparedness in real-world clinical settings. While virtual simulations provide valuable practice opportunities, some stakeholders argue that they cannot fully replicate the complexities and unpredictability of patient interactions (Yang & Kang, 2022). This perspective emphasises the need for a balanced approach that combines metaverse training with traditional clinical experiences to ensure comprehensive skill development. The effectiveness of metaverse integration should be assessed not only in terms of immediate learning outcomes but also in relation to students' readiness to navigate the challenges of actual healthcare environments.

Figure 2 represents the SCORE model applied to nursing education enhanced by metaverse technology. This framework identifies critical areas for improvement through a strategic and action-oriented approach. It emphasises key dimensions such as immersive learning, faculty training, student engagement and the seamless integration of advanced technologies. By leveraging this model, educators and administrators can systematically evaluate and enhance the effectiveness of metaverse-based education, ensuring they address the evolving needs of nursing students and overcome challenges in adapting immersive technologies in education.

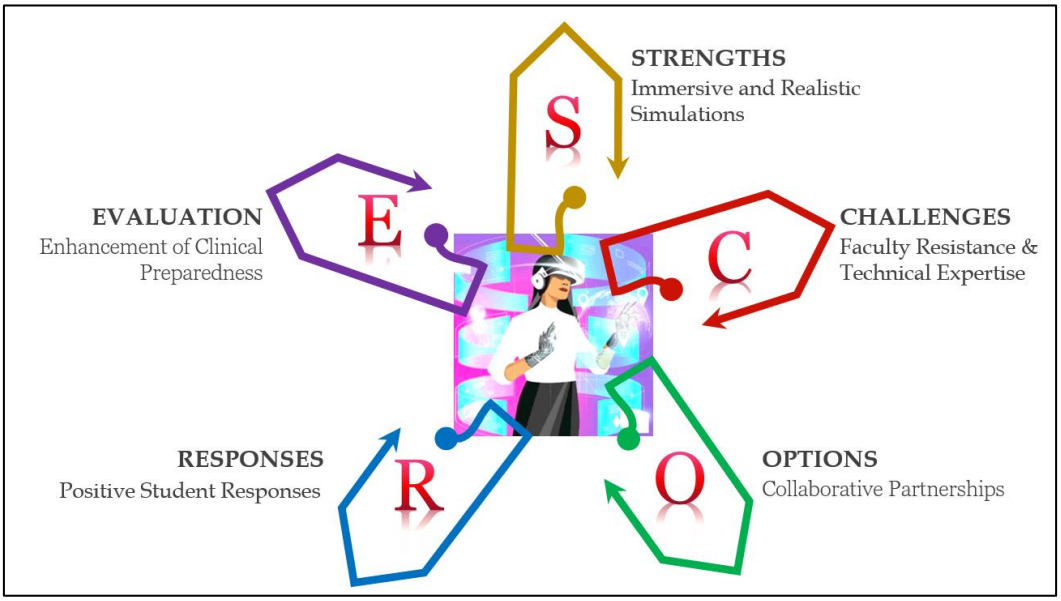

Figure 2: SCORE Model Framework for Metaverse Integration in Nursing Education

4. Conclusion

This study highlights the transformative potential of the metaverse in nursing education through the SCORE model, which evaluates strengths, challenges, options, responses and effectiveness. The metaverse offers immersive and interactive environments where nursing students can develop critical clinical skills in a controlled, risk-free setting. By bridging the gap between theoretical knowledge and real-world applications, the metaverse surpasses traditional methods, enhancing skill acquisition, critical thinking and decision-making. However, challenges such as faculty resistance, financial constraints and infrastructure limitations need to be addressed to maximise its potential. Tailored support systems – such as improved infrastructure and technical guidance – can facilitate smoother transitions to virtual learning environments, ensuring the metaverse's sustainability in nursing education.

Limitations

This study is limited by its conceptual focus and reliance on selected aspects of the SCORE model. The absence of empirical data restricts its ability to draw definitive conclusions about the long-term impacts of metaverse-based learning. Additionally, debates about the cost-effectiveness of immersive technologies remain unaddressed, necessitating further research.

Implications

Future research should prioritise empirical studies to assess the long-term effects of the metaverse on student performance and clinical preparedness. Comparative analyses of the SCORE model with other frameworks, such as SWOT analysis, could refine strategies for integration. Cost-benefit analyses are essential to evaluate financial sustainability, and institutions should explore external funding opportunities. Collaboration with technology providers and shared resource initiatives can reduce costs and enhance accessibility. By addressing these

recommendations, institutions can effectively adopt the metaverse, transforming nursing education and preparing students for the demands of modern healthcare.

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