



Implementation of virtual reality in midwifery education: Does it really work?

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ABSTRACT

Virtual Reality (VR) technology can significantly enhance midwifery education and outcomes by offering immersive and interactive learning experiences. This paper aims to discuss the implementation and prospects of VR training in midwifery education, emphasizing the need for ongoing adoption and development of VR strategies. A literature review was conducted using keywords to identify studies published between 2020 and 2025, sourced from PubMed, BMC, and ScienceDirect. The inclusion criteria specified original research, free full-text articles in English. Seven studies met the requirements, which were analyzed into four themes: the current application of VR in midwifery education, student engagement with VR, the impact and effectiveness of VR on learning outcomes, challenges and limitations of VR, and prospects of VR in midwifery education. Integration of VR in midwifery education offers transformative potential by enhancing traditional teaching methods and improving learning outcomes. VR provides immersive experiences that help students understand complex anatomy and clinical scenarios without real-life risks, boosting engagement, retention, and confidence. Despite obstacles, effective solutions involve collaboration between educators and developers, supported by a robust pedagogical framework. VR should enhance, rather than substitute, traditional methods, and tailoring VR approaches to address changing educational demands will foster the development of more competent healthcare professionals.

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ABSTRAK

Teknologi realitas virtual (VR) dapat meningkatkan pendidikan kebidanan dan luarannya dengan menawarkan pengalaman belajar yang imersif dan interaktif. Artikel ini bertujuan untuk membahas implementasi dan prospek pelatihan menggunakan VR dalam pendidikan kebidanan, dengan menekankan perlunya adopsi dan pengembangan strategi VR secara berkelanjutan. Tinjauan literatur dilakukan menggunakan kata kunci yang relevan pada studi yang diterbitkan dari tahun 2020 hingga 2025, bersumber dari PubMed, BMC, dan Science Direct. Kriteria inklusi mencakup artikel original berbahasa Inggris dengan teks lengkap gratis. Tujuh studi memenuhi kriteria, yang dikelompokkan menjadi empat tema, yaitu penerapan VR dalam pendidikan kebidanan, keterlibatan mahasiswa dalam pembelajaran dengan VR, dampak dan efektivitas VR pada hasil pembelajaran, tantangan dan keterbatasan VR, serta prospek VR dalam pendidikan kebidanan. Integrasi VR dalam pendidikan kebidanan menawarkan potensi transformasi dengan meningkatkan metode pengajaran tradisional dan memperbaiki hasil pembelajaran. VR menyediakan pengalaman imersif yang membantu mahasiswa memahami anatomi kompleks dan skenario klinis tanpa risiko di dunia nyata, meningkatkan keterlibatan mahasiswa, retensi, dan kepercayaan diri. Meskipun terdapat hambatan, solusi efektif dengan melibatkan kolaborasi antara pendidik dan pengembang, didukung oleh kerangka pedagogis yang kuat. VR seharusnya melengkapi, bukan menggantikan, metode tradisional, dan penyesuaian pendekatan VR untuk memenuhi kebutuhan pendidikan yang berubah akan mendorong pengembangan tenaga kesehatan yang lebih kompeten.

Kata Kunci: bidan; pendidikan kebidanan; virtual reality

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INTRODUCTION

Virtual Reality (VR) technology can enhance teaching and learning in midwifery education. Its features make complex and multifaceted subjects easier to represent. Reification, in particular, facilitates the learning of abstract concepts, which are fundamental to midwifery knowledge. It allows one-dimensional representations to be transformed into visualizations, enabling students to explore the human body and observe both its structure and function, for instance. VR has demonstrated significant potential in training and education across a wide range of professional and academic areas (Ljungblad et al., 2025). It provides an immersive learning environment that enhances the understanding of three-dimensional relationships between anatomical structures. VR utilizes headsets like the Microsoft HoloLens 2 or the Meta Quest 3, which provide immersive, spatial, and interactive three-dimensional content that enables students to engage with complex material that traditional methods cannot offer (Hamilton et al., 2021).

One of the key benefits of VR-based learning is that it enables learners to repeatedly practice intricate and challenging tasks within a safe environment, particularly procedural tasks that require a certain level of competency before being performed in reality (Hamilton et al., 2021). Midwifery education encompasses both theoretical and practical elements, and midwifery students must become competent and effectively fulfill their roles in clinical settings. Their education should be theoretical, competence-based, and practical. It is expected that standards, covering both theoretical and practical aspects, including technical and non-technical skills, are met. Evidence must demonstrate that midwifery students can show their required competencies. This is crucial, as midwives' competence and effectiveness in performing these procedures ensure patients receive safe, evidence-based, and patient-centered care (Firoozehchian et al., 2022).

The standard practice initially teaches psychomotor skills to students in clinical skills laboratories to help them acquire the skills needed to prepare for the real clinical environment (Bayram & Caliskan, 2019; Stone et al., 2020). Students are further evaluated by assessing their performance in clinical settings, where they encounter diverse environments, gain direct patient access, and develop essential skills for high-quality patient care. The goal is for students to become safe and competent practitioners, enhancing their competencies. However, the healthcare environment is constantly evolving and complex. Learning opportunities are often missed, and students may not have the chance to observe or engage (Houghton et al., 2013). Due to limited clinical practice opportunities, supporting and developing students' skills is increasingly important. As a result, educators face the challenge of creating and implementing effective, innovative teaching methods.

Understanding current technologies in midwifery education, such as virtual reality simulation, is crucial. Educators worldwide will continue to adopt and develop innovative strategies for utilizing virtual reality, leveraging its immersive learning capabilities. Therefore, understanding current technologies in clinical skills for midwifery education, such as virtual reality simulation, is important (Rourke, 2020). While the advantages of VR simulation are well-documented, there is a lack of evidence regarding its effectiveness in midwifery education. To gain initial insights into the prospects of using VR for midwifery training, this paper will explore the current applications, students' engagement, potential impact and

effectiveness, challenges and limitations, and prospects for VR simulation in midwifery education. This paper aims to discuss the implementation and the prospects of VR training in midwifery education, emphasizing the need for ongoing adoption and development of VR strategies.

LITERATURE REVIEW

Virtual Reality (VR)

Virtual Reality (VR) is defined as a computer-generated simulation, such as a set of images and sounds (visual, auditory, and tactile feedback) that represents a real place or situation, that can be interacted with, in a seemingly real or physical way by a person using special electronic equipment ([Park et al., 2019](#)). VR creates realistic, interactive experiences using head-mounted displays (e.g., Meta Quest 3) and controllers, enabling users to engage with complex scenarios in a controlled setting ([Radianti et al., 2020](#)). VR has shown considerable promise in enhancing training and education across diverse professional and academic fields ([Ljungblad et al., 2025](#)).

Midwifery Education

Midwifery education encompasses both theoretical and practical components, requiring students to develop competence and effectively perform their roles in a clinical environment ([Arundell et al., 2024](#)). Their training should integrate theoretical knowledge, practical skills, and competency-based learning ([Hamilton et al., 2021](#)). It is essential to meet standards, with evidence confirming that midwifery students demonstrate the necessary competencies. This is vital, as the proficiency and effectiveness of midwives in executing these tasks ensure the delivery of safe, evidence-based, and patient-centered care ([Firoozehchian et al., 2022](#)). Thus, midwifery education requires tools to hone skills repeatedly without posing real risks, thereby enhancing confidence before engaging with and treating real patients.

VR in Midwifery Education

In midwifery education, VR technology significantly improves teaching and learning by simplifying the representation of complex and multidimensional topics. Specifically, reification supports the understanding of abstract concepts central to midwifery knowledge, transforming one-dimensional depictions into interactive visualizations that allow students to examine the human body and study its structures and functions in detail. A significant advantage of VR-based learning is that it enables students to repeatedly practice complex and demanding tasks in a secure environment, particularly procedural skills that require a specific level of proficiency before being applied in real-world settings ([Hamilton et al., 2021](#)). Midwifery education should encompass theoretical knowledge, practical skills, and competency-based training. Students must meet established standards, which include both technical and non-technical skills, as well as theoretical and practical components. Evidence is required to confirm that midwifery students have achieved the necessary competencies. This is vital, as the proficiency and effectiveness of midwives in executing these procedures guarantee safe, evidence-based, and patient-centered care for patients ([Firoozehchian et al.,](#)

2022). This literature review synthesizes the key findings, methodologies, and themes presented in the article, focusing on the current applications, student engagement, impact, challenges, and prospects of VR in midwifery training.

METHODS

This study employed a literature review approach, focusing on articles published between 2020 and 2025, obtained from reputable scientific databases, such as PUBMED, BMC, and ScienceDirect, recognized for their comprehensive coverage and relevance to health-related topics. Keywords such as virtual reality, VR, midwifery, and midwifery education. Boolean operators (AND, OR) were used to refine search results. This method adhered to the PICO framework (Population, Intervention, Comparison, and Outcome) to concentrate the search on pertinent studies. The inclusion criteria for the review were papers published from 2020 to 2025, full-text papers available in English, and original articles. Articles were excluded if they were not freely available in full text, reviews, articles published in languages other than English, or articles that were not related to the research topic.

The initial search yielded a collection of publications from each database, 233 articles retrieved from the database were imported to Rayyan, an online tool that detected and removed duplicate entries across the chosen databases (16 articles). Then, reviewed the titles and abstracts to ensure they met the inclusion criteria. Articles that passed this stage underwent a detailed full-text review to confirm their eligibility. The selected articles were then analyzed to extract information on key trends, significant findings, and research gaps. The data from these publications were synthesized narratively, with conclusions organized according to the main themes identified, offering insights into the use of VR in midwifery education. Each chosen article underwent a quality assessment to verify the legitimacy and validity of its conclusions. This involved evaluating the study's methodology, sample size, relevance to the research question, and strength of findings. Only well-executed studies were included in the final review to ensure that the conclusions were grounded in credible and well-documented sources. The entire study selection process was documented and visualized, which provides a standardized method for reporting the number of studies identified, screened, deemed eligible, and included in the final synthesis.

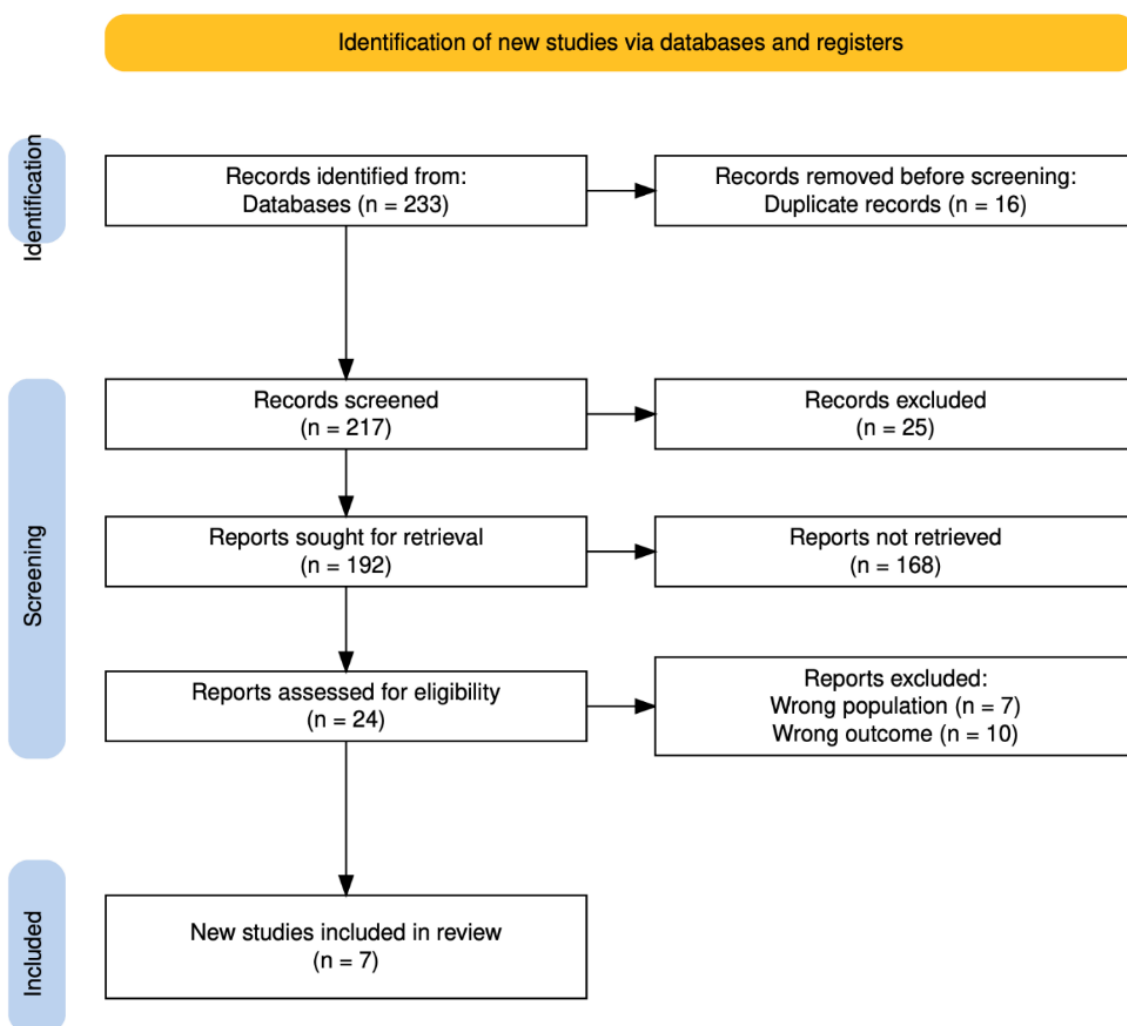


Figure 1. Flowchart: Implementation of VR in Midwifery Education
Source: Adapted from [Haddaway et al. \(2022\)](#)

Figure 1 illustrates a diagram that systematically outlines the process, starting with the identification of 233 records sourced from three databases. From these records, 16 duplicates were systematically removed using Rayyan, resulting in 217 records available for screening. From these, 25 records were excluded, and 192 reports were sought for retrieval; however, only 168 were retrieved. Subsequently, 24 retrieved reports underwent eligibility assessment, culminating in the inclusion of 7 studies in the final review.

The selected articles were collected and analyzed narratively to gain a comprehensive understanding of the topic. A thematic synthesis approach was employed to categorize the data into five key themes: the current application of virtual reality in midwifery education, student engagement with VR, the impact and effectiveness of VR on learning outcomes, challenges and limitations of VR in midwifery education, and prospects of VR in midwifery education. This approach enabled an in-depth analysis of the data, highlighting crucial findings and pinpointing gaps in the literature concerning the use of VR in midwifery education.

RESULTS AND DISCUSSION

Table 1. Result of The Finding

Author/ year/ country	Method	Finding
(Saab et al., 2023) Ireland	Mix method	Participants found VR simulation to be both educational and engaging, encouraging safe and independent learning without endangering patients. They suggested its use for practicing skills to prepare them for facing the real clinical placements, and learning about rare clinical situations.
(Aasekjær et al., 2024) Norway	Cohort study	VR is a learning tool that enhances spatial comprehension and knowledge about anatomy. By encouraging collaboration and active learning, VR facilitates students' acquisition of knowledge and understanding. Moreover, VR is seen as enjoyable and can boost students' motivation for further education.
(Hardie et al., 2020) Ireland	Cross-sectional survey and observational study	This study examines the application of immersive VR (iVR) storytelling as a pedagogical approach in Nursing and Midwifery education. It found that features such as immersion, interaction, and imagination in iVR storytelling boost students' motivation and problem-solving abilities, resulting in a meaningful and memorable learning experience. iVR storytelling helps students understand complex concepts by enabling them to visualize.
(Baidoo & Adu, 2025) Ghana	Mixed-methods study	VR can significantly improve the learning environment and practical skill acquisition in midwifery education. This study emphasizes the potential of advanced simulation technologies in healthcare education and recommends integrating virtual reality into midwifery curricula.
(Georgieva-Tsaneva et al., 2024) Bulgaria	Cross sectional	AR, VR, and MR, coupled with digital multimedia and global communication, are becoming increasingly crucial in contemporary education, especially within healthcare training. These technologies facilitate a variety of information formats and are preferred by students due to their interactive and innovative features. The study emphasizes the importance of integrating these technologies into both the theoretical and practical aspects of healthcare education. Surveys reveal that both educators and students acknowledge the need for innovative educational tools. Additionally, the study found that these technologies improve academic quality and enhance students' practical skills, particularly in learning injection techniques.
(Zhao et al., 2024) China	Quasi-experimental study.	In the midwifery course, the use of Case-Based Learning-Virtual Reality (CBL-VR) effectively overcomes the limitations of traditional teaching approaches, leading to improved academic achievement and independent learning skills among students, which also enhances their overall capabilities. This study advocates for the development of midwifery education using VR as a teaching method.

Author/ year/ country	Method	Finding
(Doğan, 2023) Turkey	Descriptive qualitative research	Students found VR valuable for learning the concept of fetal growth and applicable in the materials, indicating their adoption of technology as a valuable learning resource. The VR approach demonstrated a lasting impact and was advantageous in learning both fetal growth and midwifery care.

Resources: Result of the finding, 2025

Table 1 summarizes findings from seven studies on the use of VR and related technologies in healthcare education, particularly in midwifery and nursing. Conducted between 2020 and 2025 across countries including Ireland, Norway, Ghana, Bulgaria, China, and Turkey, these studies employed various methodologies, such as mixed methods, cohort studies, cross-sectional studies, quasi-experimental studies, and descriptive qualitative research. Key findings highlight the effectiveness of VR in enhancing learning experiences by improving engagement, motivation, and practical skill acquisition. VR facilitates safe, independent learning, boosts spatial comprehension, and helps students understand complex concepts through immersive and interactive methods. The studies advocate integrating VR into healthcare curricula to complement traditional teaching, improve academic achievement, and prepare students for real-world clinical scenarios.

Discussion

Current Application of VR in Midwifery Education

The rapid advancement of digital technologies has revolutionized teaching methods across various fields, including healthcare education (Aasekjær et al., 2024). Virtual reality, with its immersive and interactive features, is leading this educational revolution. Midwifery requires a significant amount of procedural knowledge and hands-on skills, which means traditional teaching methods might be inadequate. These conventional approaches often focus on didactic teaching and offer limited patient interaction, potentially leaving students underprepared for the dynamic and complex nature of clinical settings (Abraha et al., 2023). Virtual reality creates simulations of real-world scenarios, enabling midwifery students to refine their skills without the risks associated with live clinical environments. A study in Ghana revealed the shortcomings of traditional manikin-based education, such as a lack of engagement and realism (Baidoo & Adu, 2025). The study highlighted the necessity for more interactive and immersive training methods, with virtual reality providing a more effective preparation by addressing the weaknesses of conventional approaches.

Students trained with virtual reality reported greater engagement and satisfaction, indicating that it not only enhanced learning outcomes but also made the educational experience more enjoyable and fulfilling. Compared to their traditionally trained counterparts, the virtual reality group showed significant improvements in knowledge retention and practical skills in both post-tests and practical assessments. Participants appreciated the realism and complexity of the clinical scenarios offered by virtual reality. Their increased readiness and confidence were attributed to the direct, hands-on practice and immediate feedback provided by virtual reality simulations. Students expressed concerns about feeling underprepared for

the unpredictability of real-life clinical situations, highlighting a significant shortcoming in traditional midwifery education and suggesting a crucial area for improvement through the integration of more interactive and realistic educational elements (Baidoo & Adu, 2025).

VR encompasses a diverse range of computer-based applications renowned for their immersive, highly visual, and three-dimensional qualities, enabling users to explore and navigate an environment that appears realistic or physical (Saab et al., 2023). VR is recognized for offering an immersive platform to facilitate the exchange of academic and practical knowledge, enhancing midwifery students' competencies and overall educational objectives, particularly in limited clinical settings (Morin, 2020). Recently, virtual reality has been effectively employed in midwifery education to instruct midwives on anatomical concepts, simulate scenarios to teach fetal development, and manage third-stage labor (Aasekjær et al., 2024; Doğan & Yazıcı, 2023; Hasyim et al., 2021).

Student Engagement with VR

A study in Ireland found that immersive VR (i-VR) storytelling provided a beneficial and impactful learning experience (Hardie et al., 2020). Students observed that the storytelling narrative maintained their attention consistently and indicated higher levels of engagement compared to conventional learning settings. This could be attributed to the unique characteristics of immersive virtual reality storytelling, where students become active participants rather than passive viewers. Students are required to actively engage with the story, as narrative and visual elements unfold in a 360-degree environment around them. They reported experiencing high levels of immersion, with the Head-Mounted Displays (HMD) effectively removing visual distractions from the simulation lab, emphasizing the story's visual components. Those using headphones experienced even greater immersion, as they blocked out surrounding noise.

The most significant advantage of immersive virtual reality (i-VR) storytelling was the boost in students' motivation to learn. Students were impressed with the use of i-VR storytelling for educational purposes and considered it a suitable medium for learning about the five senses. They reported that it inspired their future learning. Additionally, students found that i-VR storytelling offered more motivation than traditional teaching methods and reported enhanced problem-solving skills after the i-VR storytelling experience (Hardie et al., 2020). Another study conducted in Norway in 2024, which integrated VR into midwifery education, concluded that students and their peers become more engaged and collaborative (Aasekjær et al., 2024). The immersive 3D virtual construct enables midwifery students to engage directly with the surroundings and learn through active participation. This method transformed students from passive recipients into active participants in their educational journey. They could explore and discuss anatomical organs, layers, and positions with their peers from various angles and adjust the zoom.

Virtual reality transforms the education approach to be more focused on learners and team-based. This experience aligns with other studies that demonstrate how virtual reality can increase students' enthusiasm and involvement while also enhancing analytical thinking through collaboration and interactivity (Silén et al., 2022; Sinha et al., 2022). VR offers an environment with immediate feedback, enabling students to learn from their mistakes and

adjust their approaches accordingly (Baidoo & Adu, 2025). This iterative learning process is essential for honing skills and developing the quick thinking and adaptability required in high-pressure situations, such as childbirth (Lange et al., 2020; Meese et al., 2021).

Impact and Effectiveness of VR on Learning Outcomes

To use VR applications effectively, users need prior training and preparation. Practicing skills such as picking up, moving, and placing virtual objects is essential to achieve precise movements. This is particularly important for precise tasks, such as injection techniques. Numerous VR applications utilize controllers to represent virtual hands within the simulated environment, enabling users to move, rotate, and grasp objects. Skills for navigating virtual spaces, including turning and movement control, are necessary. VR application interfaces must be intuitive and user-friendly, as they facilitate interaction with menus and the launch of simulations. Developing skills to handle virtual tools is crucial for performing corresponding actions within the virtual environment. The majority of VR healthcare applications provide feedback, enabling learners to identify and rectify errors, enhance their skills, and expand their understanding (Georgieva-Tsaneva et al., 2024).

The environment created in the virtual simulation provides realistic feedback to help midwives master proper techniques and perform nursing care, enabling them to exercise frequently without posing any harm to patients. Virtual reality healthcare applications also enhance the previous experience of midwives. Traditional lab classes often lack sufficient time to master essential skills. VR transforms conventional lab practice into immersive learning experiences, enabling students to reinforce and expand their training in more complex skills and procedures (Georgieva-Tsaneva et al., 2024). Compared to Manikin-assisted training methods, VR experience enables students to engage in prolonged practice and develop further clinical competencies they might not encounter in a clinical environment (Benham-Hutchins & Lall, 2015). This is an effective method for cultivating essential skills, such as environmental awareness, communication, decision-making, and teamwork, all of which are crucial for patient safety (Bracq et al., 2019).

Virtual reality training has been shown to significantly improve midwifery students' theoretical knowledge, practical skills, and confidence compared to traditional simulation methods (Baidoo & Adu, 2025). The immersive nature of virtual reality provided students with a realistic environment that closely resembled clinical scenarios, effectively bridging the gap between theory and practice. Its interactive features greatly enhanced student readiness for professional midwifery roles, making it a more effective educational tool that better equipped them with essential skills and confidence. The students' increased preparedness and confidence were due to the direct, hands-on practice and immediate feedback offered by virtual reality simulations (Baidoo & Adu, 2025). A recent study of fourteen trials concluded that VR simulation proved to be more effective than traditional methods in developing students' procedural competence (Woon et al., 2021). Additional advantages of VR include providing a safe and interactive environment for practice and learning, as well as serving as a platform for delivering lectures, posing questions, and fostering analytical thinking (Benham-Hutchins & Lall, 2015; Zackoff et al., 2020).

A study in Ghana created a virtual reality environment that replicated a fully functioning birthing suite, providing midwifery students with a training setting that closely resembled actual clinical practice. This realistic simulation bridges the gap between theoretical learning and real-world application, better preparing students to manage the complexities and unpredictability of labor and birth. These simulations enabled students to participate in the entire birth process, from early labor to postpartum care, including placenta inspection and completion of medical notes. This comprehensive approach allows students to grasp the entire birthing process, rather than just isolated skills. Holistic training ensures that students are well-prepared for the full scope of midwifery practice, which is crucial for building confidence and competence in clinical settings. The controlled, safe environment offered by virtual reality allows students to practice high-stakes procedures without the fear of harming patients, thereby reducing stress and boosting confidence. By enhancing the educational experience, virtual reality training attracts and retains students in midwifery courses, helping develop a skilled workforce to address profession shortages (Baidoo & Adu, 2025).

A pilot study in Turkey demonstrated increased knowledge among all participating students both immediately and two weeks after an anatomy lecture. The study concluded that immersive VR could be beneficial in midwifery education by improving comprehension of the woman's pelvic anatomy and primary fetal movements (Doğan & Yazıcı, 2023). In a study in Norway, midwifery students demonstrated enhanced knowledge when using VR as an instructional tool for anatomical learning. Technology like VR can boost student interest and provide better conditions for understanding complex information, like anatomy. In this study, the anatomical knowledge of the students not only increased but was also retained after using VR, because VR prompted learners to consider and assimilate the insights gained in the virtual environment. The study also noted an improvement in spatial understanding among the students, addressing the familiar challenge that healthcare students face in comprehending the relationships between anatomical structures (Cheung et al., 2021). The improved spatial awareness observed within midwifery students in this study might be attributed to the VR environment, which creates a realistic learning setting. This setting facilitates the identification, visualization, and comprehension of the relationships between various anatomical structures.

Other studies have indicated that conventional education resources, such as printed books and lecture sessions, make it challenging to visualize and conceptualize three-dimensional anatomical structures (Cheung et al., 2021). Studies have shown that using three-dimensional methods enhances both anatomical knowledge and spatial understanding compared to two-dimensional approaches. Midwifery students reported that using VR as an educational resource aided in visualizing and understanding the elaborate connection between the woman's pelvis and the developing baby inside the womb. The VR experience emphasized actual childbirth and blended clinical scenarios with anatomy topics that could enhance students' understanding of the importance of anatomical knowledge for becoming competent practitioners. Digital tools in teaching offer variety and create learning environments that are not possible with conventional anatomy instruction. By simulating the fetus's position, students had to use their head and body to simulate fetal rotation inside the female pelvis. Higher education is essential for translating knowledge and enhancing students' competencies and clinical skills, as well as equipping them for timely decision-

making. To achieve this, healthcare education must provide diverse and authentic learning experiences (Aasekjær et al., 2024).

The simulation technology, utilizing the Case-Based Learning method with Virtual Reality (CBL-VR), effectively improved students' individual and team operational skills. Infant delivery training for midwifery students is often unavailable in school due to high risks. VR simulation technology resolves this issue by creating a risk-free, immersive atmosphere for midwifery training. This approach increases their opportunities for training in delivery procedures. Moreover, CBL-VR software is accessible through the campus network, allowing students to develop their operational skills beyond the classroom. The real-time feedback feature enables students to correct any errors in their operations promptly. Consequently, the CBL-VR method enhances students' operational abilities by providing more training opportunities and real-time corrections (Zhao et al., 2024).

In a midwifery case study assessment, students are required to diagnose by evaluating maternal physical and psychological adaptation, formulate treatment plans by organizing midwifery responsibilities and delegating them to team members, and communicate their analysis results through group discussions and clear expression of their viewpoints. This process encompasses critical thinking principles in midwifery practice, including assessment, effective implementation, problem-solving, assessment of care, cooperation, and mediation, promoting collaborative choices, interaction, and information transformation (Carter et al., 2022). The study concluded that the collaborative midwifery case study assessment may boost students' cognitive skills and interest in learning. The CBL-VR method effectively enhanced students' independent learning by improving their skills in autonomy, information analysis, and teamwork (Zhao et al., 2024).

Challenges and Limitations of VR in Midwifery Education

Despite the promising applications of VR, several challenges persist. Barriers to wider adoption in midwifery education include high costs, language barriers for non-English-speaking students, health side effects from prolonged VR use, and technical issues during VR experiences. Barriers to the broader adoption of VR in midwifery education include the high costs of VR hardware, despite some reductions making it less accessible to educational institutions. Furthermore, developing educational software demands substantial investment. The potential solutions include financing educational initiative proposals, employing more affordable VR devices, and leveraging cost-free applications. Nonetheless, developing resources specifically designed for particular issues remains expensive (Georgieva-Tsaneva et al., 2024).

English is currently used in most VR applications, creating a communication obstacle for students with limited language skills. To manage the risks associated with implementing innovations, educational leaders must exhibit qualities such as courage, experience, entrepreneurship, and a resolute commitment to the successful integration of new technologies (Georgieva-Tsaneva et al., 2024). Further limitations of using VR include side effects such as dizziness, nausea, visual fatigue, and disorientation, as well as symptoms resembling motion sickness and visually induced motion sickness (Chang et al., 2020; Keshavarz et al., 2015). These symptoms can be alleviated through adaptation techniques,

including initiating limited VR sessions and gradually increasing the time. Educators should carefully assess and study the duration of VR educational app use (Georgieva-Tsaneva et al., 2024).

Another challenge and limitation of VR involves technological inefficiencies, such as technical difficulties during the VR experience that interrupt scenarios and disrupt immersion. Additionally, the VR device and the application may encounter issues, such as headsets unexpectedly stopping, which can interfere with task completion. Complications due to limited internet connectivity, VR controls such as joysticks, and unsatisfactory text and sound rendering also impair usability. Initially, learners faced challenges adapting to simulated environments due to limited guidance, although this adaptation may improve over time. The significant expense of VR was identified as a limitation, leading some educators to reallocate funds to acquire the technology. Furthermore, the physical environments utilized for VR and related safety issues were emphasized, as the immersive experience impacted awareness of external stimuli (Odame-Amoabeng et al., 2025).

Future Prospects of VR in Midwifery Education

The educator and developer must collaborate to develop effective VR-based learning material for future midwifery education. To enhance midwife education through innovative technologies, efforts should address challenges such as: utilizing VR to design dynamic simulation settings that provide realistic experiences through visual, auditory, and tactile response, connecting virtual and physical realms; and creating interactive training scenarios using VR that mimic actual clinical settings; to select VR development frameworks and programs for designing interactive virtual environments; to choose suitable technological tools for VR training applications, including high-quality VR headsets, helmets, accessories, and high-performance computers able to process intricate simulations instantaneously; and to establish efficient feedback systems by incorporating VR healthcare applications into training programs, with the primary goals to improve the skills of future healthcare professionals in a monitored and interactive environment (Georgieva-Tsaneva et al., 2024).

The substantial improvements in knowledge retention and practical skills among students trained with virtual reality strongly suggest that it is more effective than traditional methods. These findings have significant implications for curriculum development, indicating that virtual reality should be an integral part of midwifery education to ensure graduates are well-prepared for clinical practice. Ongoing evaluation and refinement of virtual reality educational strategies are crucial to ensure that midwifery education keeps pace with technological advancements and meets the evolving needs of healthcare (Baidoo & Adu, 2025). While VR offers considerable benefits for midwifery education, its full integration encounters practical challenges and raises concerns about health and well-being. Successful implementation requires committed support from educators, active student participation in content development, clear guidelines, enhanced institutional investment, and a balanced integration with traditional simulations (Odame-Amoabeng et al., 2025). VR simulation should be supported by strong pedagogical principles and aligned with learning objectives. Training in virtual reality simulation is necessary for both educators and learners before it is integrated into the curriculum (Hasannah et al., 2024; Saab et al., 2023).

Virtual Reality Learning Environments (VRLEs) are a valuable resource for enhancing student learning experiences and increasing students' engagement, satisfaction, and self-confidence in the material (Ryan et al., 2022). VR is most beneficial when used before clinical placements. Overall, VR should be considered as a means to enhance knowledge and complement other simulation strategies, thereby improving the quality and safety of clinical practice (Saab et al., 2023). It is regarded as an addition to traditional methods, rather than a substitute. Learners emphasized the importance of comprehensive instructions provided both before and during use to support their learning process (Odame-Amoabeng et al., 2025). Given these substantial benefits, educational policymakers and academic institutions must consider integrating VR technologies into curricula to better prepare future healthcare professionals (Baidoo & Adu, 2025).

CONCLUSION

The integration of VR in midwifery education highlights its transformative potential to enhance traditional teaching methods and improve learning outcomes. VR offers immersive and interactive experiences that enhance understanding of complex anatomical structures and clinical scenarios, eliminating real-life risks. This approach leads to improved student engagement, knowledge retention, and confidence in practical skills compared to traditional methods. Despite its advantages, implementing VR in education presents several challenges, including high costs, language barriers for non-English-speaking students due to the predominance of English in applications, and potential physical side effects from prolonged use. To address these challenges, ongoing collaboration between educators and technology developers is crucial for creating effective, tailored VR resources. A robust pedagogical framework is also necessary to support these advancements. In the future of midwifery education, VR presents a significant opportunity to enhance midwifery education by improving student engagement and competence. For VR to reach its full potential, educational institutions must overcome existing barriers, encourage collaboration among stakeholders, and continuously adapt VR strategies in the curricula to align with the evolving needs of healthcare education. VR can serve as a complement rather than a replacement for the existing method. By doing so, VR can contribute to the development of a more competent and confident generation of healthcare professionals.

AUTHOR'S NOTE

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