ÉDITORIAL

Renforcer les systèmes de données pour promouvoir la santé et les droits sexuels et reproductifs en Afrique subsaharienne

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Le développement de la santé et des droits sexuels et reproductifs (SDSR) en Afrique subsaharienne est fondamentalement entravé par la « pauvreté des données de santé »[1]. Si de nombreux pays à revenu élevé ont réalisé des progrès significatifs dans le renforcement de leurs systèmes de données de santé, l'Afrique subsaharienne continue de faire face à d'importantes lacunes[1–3]. Malgré le besoin crucial de pratiques fondées sur des données probantes, le paysage régional des données est caractérisé par une méconnaissance généralisée de la valeur intrinsèque de données exactes. De nombreux pays de la région ne disposent pas de recensements de population réguliers, de dossiers de santé fiables ni de systèmes fonctionnels d'état civil et de statistiques vitales.

L'exactitude des données est souvent compromise par une réticence profondément ancrée des populations à fournir des informations personnelles. Dans de nombreux contextes africains, les tabous culturels, les croyances religieuses et la méfiance envers les « étrangers » entraînent des taux de refus élevés lors des enquêtes menées auprès des ménages et dans les établissements de santé. Par exemple, une étude menée en Afrique du Sud a mis en évidence comment des femmes peuvent refuser de parler de santé reproductive en raison d'une opposition religieuse ou par crainte d'être jugées par les chercheurs[4]. Les données sont parfois sujettes à la falsification et au biais de désirabilité sociale. Les personnes interrogées « apprennent » souvent à répondre de manière à minimiser la longueur des questionnaires, par exemple en déclarant moins de partenaires sexuels pour éviter les questions complémentaires.[5]

Plus grave encore, la crainte de répercussions juridiques ou sociales conduit à la dissimulation active d'informations sensibles par les individus et les établissements de santé. Des personnes ont déclaré avoir menti sur leur statut sérologique ou sur les violences sexistes qu'elles ont subies par crainte d'une intervention policière ou de la stigmatisation sociale.[4]

Même lorsque des données sont disponibles, on observe une minimisation et une non-utilisation systématiques des informations factuelles pertinentes pour la prise de décision et la planification stratégique. L'institutionnalisation du suivi fondé sur les données demeure faible et les plans annuels sont souvent élaborés sans tenir compte des informations sanitaires courantes.[6] Dans de nombreux cas, la planification fondée sur des données probantes est supplantée par l'ingérence politique et le népotisme, où les intérêts politiques — plutôt que les données empiriques — déterminent quels programmes de santé sont mis en œuvre et qui est nommé pour les diriger.[7] Sans s'attaquer à ces barrières culturelles et structurelles, les systèmes de données continueront de produire des informations de mauvaise qualité qui ne permettront pas d'améliorer significativement les résultats en matière de santé sexuelle et reproductive dans la région.[1,8]

Depuis la Conférence internationale sur la population et le développement (CIPD) du Caire en 1994 et jusqu'aux Objectifs de développement durable (ODD) pour 2030, la santé sexuelle et reproductive est reconnue comme un droit humain fondamental.[9–11] Ce droit est désormais inscrit dans les politiques nationales de santé et les cadres juridiques de nombreux pays.

Le droit à la santé sexuelle et reproductive comprend l'accès à la contraception, aux soins de fertilité et d'infertilité, aux services de santé maternelle et périnatale, à la prévention et au traitement des infections sexuellement transmissibles, à la protection contre les violences sexuelles et sexistes, et à l'éducation à des relations saines et sans risque.[12] comprend également le droit à l'information et la capacité de faire des choix éclairés concernant sa vie reproductive.

Lorsque cet accès est retardé ou refusé, les conséquences peuvent être graves, notamment le décès, un handicap permanent et des difficultés socio-économiques. Pour que ces droits se concrétisent, les systèmes de santé ont besoin de systèmes de données robustes. Des données précises, actualisées et

ORIGINAL RESEARCH ARTICLE

Midwifery students' experiences with a virtual reality simulation for newborn care: A qualitative study

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Abstract

This qualitative study explored midwifery students' experiences with a virtual reality (VR) simulation designed to teach immediate newborn care. A total of 34 students participated in an immersive VR environment where they performed essential newborn care procedures. Data were collected through semistructured interviews and analysed using thematic analysis. Three main themes emerged: VR as a realistic and safe learning environment, emotional and cognitive interaction, and the role of innovative technologies in education. Students reported increased self-confidence, motivation, and clinical readiness, while also noting initial anxiety and some technical challenges. Overall, VR was perceived as an effective and engaging educational tool that supports skill acquisition and preparation for clinical practice. These findings suggest that VR can be sustainably integrated into midwifery education. *(Afr J Reprod Health 2026; 30 [12]: 38-47).*

Keywords: Virtual reality; simulation; midwifery; newborn care; qualitative research

Résumé

Cette étude qualitative a exploré les expériences des étudiantes en maïeutique avec une simulation en réalité virtuelle (VR) conçue pour enseigner les soins immédiats du nouveau-né après la naissance. Un total de 34 étudiantes a participé à un environnement immersif de réalité virtuelle où elles ont réalisé des procédures essentielles de soins néonatals. Les données ont été collectées à l'aide d'entretiens semi-structurés et analysées par analyse thématique. Trois thèmes principaux ont émergé: la réalité virtuelle comme environnement d'apprentissage réaliste et sécurisé, l'interaction émotionnelle et cognitive, et le rôle des technologies innovantes dans l'éducation. Les étudiantes ont signalé une augmentation de la confiance en soi, de la motivation et de la préparation clinique, tout en mentionnant une anxiété initiale et certaines difficultés techniques. Dans l'ensemble, la réalité virtuelle a été perçue comme un outil pédagogique efficace et engageant qui favorise l'acquisition de compétences et la préparation à la pratique clinique. Ces résultats suggèrent que la réalité virtuelle peut être intégrée de manière durable dans l'enseignement de la maïeutique.*(Afr J Reprod Health 2026; 30 [12]:38-47).*

Mots-clés: Réalité virtuelle; simulation; maïeutique; soins du nouveau-né; étude qualitative

Introduction

In recent years, rapid technological advancements have significantly transformed educational practices, particularly in health professions education. Traditional teaching methods such as lecture-based instruction and limited hands-on practice in clinical settings often fall short in providing students with sufficient opportunities to develop practical skills in a safe and controlled environment.[1-3] These limitations have become more evident in the context of increasing concernsregarding patient safety, restricted access to clinical placements, and inconsistencies between simulated training environments and real-life clinical practice.[4-9]

The COVID-19 pandemic further intensified these challenges by disrupting clinical education and limiting students' access to hands-on training. As a result, there has been a growing need for innovative educational approaches that can effectively support skill acquisition while ensuring patient safety. In midwifery education, similar challenges have been reported, including students' fear of harming patients, lack of confidence in clinical settings, and difficulties in transferring

theoretical knowledge into practice.[10] These issues highlight the necessity of integrating technology-enhanced learning strategies into midwifery training programs.[11-13] Living in the information age, rapidly developing societies are compelled to adapt to ever-changing technologies. The use of these technologies in education is highly beneficial for addressing the limitations and challenges of traditional teaching methods. The unexpected emergence of the COVID-19 pandemic has been one of the most significant challenges worldwide. Particularly in such circumstances, educating professional healthcare personnel becomes even more difficult. Among these challenges, the most critical is enabling students to acquire practical skills. Issues such as patient safety, the scarcity of clinical settings, and the inconsistency between educational environments and real-life situations make the acquisition of practical skills increasingly challenging.[1-3]

A review of both international and national literature reveals that similar challenges are also encountered in midwifery and nursing education. [4-9] When students begin their clinical practice, discrepancies between what is taught and the realities of the clinical environment, fear of touching patients, limited support from instructors and nurses/midwives in practice settings, and the stress they experience lead to decreased academic performance and negatively affect their professional adaptation.[10] Educators play a major role in addressing the problems encountered in clinical settings. It is essential to enhance students' self-confidence, equip them with effective communication skills, and develop their problem-solving abilities. Therefore, teaching educational techniques that allow repeated practice and enabling educators to use innovative teaching methods to help students acquire skills would be appropriate. Utilizing technology in practical training enhances skills and promotes the long-term retention of learning.[11] In particular, skill training delivered through traditional methods fails to capture the attention of today's students, who were born into the digital age. Therefore, incorporating new technologies into skills education has become inevitable.[12] In recent years, the use of simulation training as an educational strategy to enhance midwifery skills has gained increasing importance. [14] Simulation enables students to gain experience through repetition and awareness of their mistakes without causing harm to real individuals. In this way, students are supported within a safe and controlled learning environment.[15]

One of the competency domains defined by the International Confederation of Midwives (ICM) for midwives is the immediate postpartum care necessary to ensure healthy continuation of the newborn's life.[16] Touching the newborn one of the most delicate aspects of midwifery is particularly challenging for students. The effort of newborns to adapt to extrauterine life immediately after birth makes this process even more difficult. Therefore, the necessity of virtual simulation training has become inevitable to help students further develop their practical skills. It has also been reported that simulation-based education has a positive effect on students' learning outcomes.[17,18] One of the areas positively influenced by simulation training is self-efficacy. Simulation-based education positively affects students' levels of self-efficacy as well.[19] A strong sense of self-efficacy leads to success.[20] Simulation training is an important learning strategy for enhancing clinical skills and eliminating students' negative experiences.[21,22] If students have high levels of satisfaction and self-confidence, their adaptation to the clinical environment will be easier, and consequently, their skills are expected to improve. In training programs, selecting an appropriate simulator is crucial for the quality of education, but equally important is that the instructor possesses up-to-date clinical knowledge and skills.[15,17] The World Health Organisation (WHO) has published gold standards for healthcare professionals and, according to these standards, recommends the use of e-learning and simulation-based training in educational programs for teaching and learning.[23,24]

High-fidelity simulators are beneficial in preparing students for situations they may encounter in clinical practice and in enhancing their self-confidence.[25,26] One of these simulators is the virtual reality simulator. VR is utilized in various fields, including learning environments, to create situations that closely resemble real-life conditions.[25]

Virtual reality simulations have numerous advantages, such as creating real-life experiences, demonstrating procedures that are impossible or dangerous to show in a classroom environment, being reusable, enabling active participation, increasing motivation, allowing observation from

remote locations, improving clinical skills, ensuring patient safety, and enhancing students' self-confidence.

While randomised controlled trials are considered the gold standard in health education research, we believe it is appropriate to first conduct a qualitative investigation to determine whether students find a new educational technology intervention accessible, acceptable, and intuitively usable by following an existing study as a reference before quantitatively measuring its effectiveness. This was, therefore, the main purpose of the present study.[28-30]

Methods

Study design

This qualitative study aimed to explore midwifery students' experiences with a virtual reality (VR) simulation designed to teach immediate newborn care after birth. A qualitative approach consisting of three phases was adopted.

In the first phase, the participants completed a short form in which they reported their sociodemographic characteristics and various levels of technological proficiency. Sociodemographic data included age, academic level, prior experience with virtual reality, and self-reported level of technological proficiency. These data were collected using a short structured form and were used to describe the sample characteristics. The purpose of this phase was to determine whether there were any participants with abnormal deficiencies in technological experience or extreme age values. Then, suitable participants were invited to the simulation session by scheduling individual appointments.

In the second phase of the study, participants who attended individual sessions were introduced to the simulation environment, and the simulation exercise was conducted. During this stage, participants wore virtual reality headsets and control gloves to perform immediate newborn care after birth. This care included placing the newborn under a radiant warmer, assessing the Apgar score, performing umbilical cord care, administering vaccinations, measuring height, weight, head and chest circumference, taking a footprint, measuring temperature, applying eye drops, dressing the newborn, and finally handing the baby to the mother for breastfeeding. In addition, the completion of the birth registry to record all these procedures was also carried out within the simulation environment. During this phase, appropriate content and infrastructure were prepared for all participants, ensuring that they experienced a safe, interactive, collaborative, experiential, and learner-centred simulation session in a suitable setting. Furthermore, the entire process was guided by the International Nursing Association for Clinical Simulation and Learning (INACSL) Standards of Best Practice.[30] Each simulation session lasted approximately 30 minutes.

In the third phase, semistructured interview questions were asked to participants who had completed the simulation session. All interviews were conducted face-to-face in a quiet and private setting within the university. During this stage, both the positive and negative aspects of the simulation were evaluated. The interview data were analysed via thematic analysis.

Setting

The participants (n=35) were students enrolled in the midwifery program of a university located in eastern Türkiye who had successfully completed the newborn care course. The programme lasts four years and consists of 50% clinical practice and 50% theoretical coursework.

Participants

Participants were recruited using a purposive sampling strategy. Eligible students were those who had successfully completed the newborn care course and volunteered to participate in the study. Inclusion criteria included being a fourth-year midwifery student, having completed the relevant course, and providing informed consent. Students who had prior extensive experience with virtual reality or who were unable to complete the simulation due to physical discomfort were excluded. All the students who met the inclusion criteria were invited to participate (N=62), and on the basis of the principle of data saturation, a sample size of 35 participants was deemed sufficient. All participants were female, and most were from the Eastern Anatolia region of Türkiye. Approximately 92% of them were between 21 and 23 years old, which is consistent with the typical age range of fourth-year

midwifery students in Türkiye. Thirty-three participants had never previously experienced a virtual reality environment using a headset and handheld or glove-based controllers, while two participants had limited prior experience. With respect to other digital screen technologies (smartphones, tablets, computers), 81% of the participants described themselves as "experienced but not highly confident."

Simulation procedure

The participants arrived individually on their scheduled appointment day. They were fitted with a virtual reality headset and control gloves. Upon putting on the headset, the participants observed a simulation environment that included a woman lying on a delivery table (A), a newborn (B), a radiant warmer (C), a registration desk (D), a refrigerator for vaccine storage (E), a weighing scale (F), and a sink for handwashing (G). The participants were instructed that, after washing their hands, they could proceed to perform immediate newborn care.

They washed their hands, removed the newborn from the mother, and placed the baby under the radiant warmer. They then began the care process by drying the newborn. During the simulation, they administered vaccinations, measured the baby's height and weight, took the temperature, measured the head and chest circumference, performed umbilical cord care by clamping the cord, took a footprint, placed identification wristbands on the mother and baby, applied eye drops, and dressed the baby with a diaper, clothes, and a cap. All medical waste was disposed of in the appropriate medical waste container, and the entire procedure was recorded, completing the immediate postnatal care process.

Only one student reported experiencing dizziness during the simulation and was requested to withdraw from the study. Therefore, the final analysis was conducted on n=34 participants. All the participants completed the questionnaire, and the study proceeded to the third phase, during which semistructured interview questions were used to evaluate the virtual environment.

Qualitative interviews

Following the VR simulation, individual interviews were conducted with the participants via semistructured questions to evaluate the virtual environment. To eliminate potential educator–student bias, the interviews were conducted by an independent researcher. All interviews were audio-recorded with participants' consent. The interviews took place at the university in an environment that allowed participants to respond freely and share their opinions openly. A semistructured interview guide (Table1) was used, and questions were asked in detail with prompts to encourage comprehensive responses.

Data collection and analysis

The qualitative data were developed and analysed via thematic analysis, as described by Virginia Braun and Victoria Clarke [32,33]. The process of data generation and analysis consisted of five stages. In the first stage, all the data were transcribed from audio recordings. Initially, all the recordings were listened to carefully, and the transcribed texts were reviewed and corrected to ensure accuracy and clarity. This process provided a deeper understanding of the content and context of the data.

In the second stage, before identifying the initial codes to be used as key data points, a list of ideas was created to capture the general content of the source material. A table was prepared, with the left column indicating where the data excerpts could be found in the transcripts, and the initial codes were written in the right column.

In the third stage, the coding table was written and divided into preliminary categories. Qualitative similarities and differences within the data were explored, and some codes were revised during this process. Subsequently, twelve categories were created, which were later refined and condensed into three overarching themes.

In the fourth stage, the categories were reviewed to identify emerging themes. Within each category, component codes were reread to find coherent patterns organised around topics and emotions, ensuring internal consistency. As a result, nine categories were reduced, merged, or eliminated.

In the fifth stage, the identified themes were reviewed to clarify their definitions, scopes, and meanings. At this stage, the extent to which each theme represented the data were evaluated; for each theme, a concise definition, a comprehensive explanation, and an appropriate title reflecting the

essence of the theme were developed. Relationships among the themes were also examined to ensure that the findings formed a coherent and comprehensive narrative. During this process, the researcher identified direct participant quotations supporting each theme and integrated them into the analysis text, thereby enhancing the credibility and transferability of the findings. The final themes were interpreted in relation to the study's purpose and research questions. This final stage constituted the interpretation and reporting phase of thematic analysis, enabling the transformation of data into a meaningful and structured framework. To ensure the rigour of the qualitative analysis, credibility was enhanced through careful transcription and repeated reading of the data. Dependability was supported by a systematic coding process, and reflexivity was maintained by continuously reflecting on the researcher's role in data interpretation.

Ethical considerations

Ethical approval for the study was obtained from the Noninterventional Research Ethics Committee of Fırat University (2025/14-33). Institutional permission was also granted by the relevant institution where the research was conducted. Informed voluntary consent was obtained from all participants, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Results

The three main themes and their representative codes are presented in Table 2. Detailed descriptions of the subthemes are provided below.

Virtual reality as a realistic and safe learning environment

This theme reflects students' perception of virtual reality (VR) as a realistic and safe learning environment in which they can practice newborn care without making mistakes or facing risks. The subthemes belonging to this category are *realism and immersion, error-free learning, self-confidence, and clinical readiness.*

Realism and immersion: Most participants described the virtual reality simulation as a highly

Table 1: Semistructured interview questions

1.How did you feel while performing immediate newborn care in the virtual reality environment?
2.To what extent did this virtual setting remind you of a real clinical or delivery room experience?
3.Compared with practicing on a real baby, what were the advantages or disadvantages of working in the VR environment?
4.In what ways did this simulation contribute to your preparedness for clinical or delivery room practice?
5.What emotions did you experience when you first started the VR simulation (e.g., excitement, curiosity, anxiety)?
6.How did this experience influence your willingness and motivation to learn?
7.Were there moments during the simulation when you recognised your mistakes or reflected on your own performance?
8.What are your general opinions about the use of this technology in midwifery education?
9.Did you experience any technical or physical difficulties during or after the simulation?
10.How do you think such applications could contribute to midwifery education and your professional practice in the future?

Table 2: Midwifery students' experiences with virtual reality simulation for newborn care: themes, codes, and sample participant quotations

Theme	Subthemes	Sample Participant Quotations
Virtual Reality as a Realistic and Safe Learning Environment	• Realism and immersion • Error-free learning • Self-confidence and clinical readiness	"I felt as if I were in the delivery room." "Being able to make mistakes and learn without the risk of harming a real baby made me feel at ease." "After this simulation, I felt more prepared to go into the clinic."
Emotional and Cognitive Interaction in the Learning Process	• Initial experience anxiety and adaptation to technology • Learning motivation • Self-reflection and awareness	"At first, I was a little nervous, but then I truly enjoyed it." "This simulation helped me realise what I didn't know." "I felt proud of myself when I provided the correct care for the baby."
The Role and Sustainability of Innovative Technologies in Midwifery Education	Positive attitude toward innovation • Technical limitations • Sustainability and professional contribution	"It would be great if this method were used in all practical courses." "Sometimes the device didn't work properly, which interrupted the lesson." "When using VR, I felt like a future-ready midwife."

realistic and immersive experience. The students reported that when performing newborn care procedures in a three-dimensional environment, they felt as if they were "actually in the clinic." Some participants emphasised the sensory integrity of the VR environment by expressing statements such as "*The sound and lighting made me feel like I was in the delivery room."*

Error-free learning: Participants emphasised that one of the most significant advantages of the virtual reality application was the opportunity to learn without the fear of making mistakes. They stated that experiencing newborn care in a VR environment without any risk made them feel more comfortable and facilitated learning. One participant expressed this by saying, *"I would have been very nervous if it were a real baby, but here, when I made a mistake, we just restarted. That way, I could see what I did wrong and try again."* Another student noted, *"I acted more confidently because I was learning in an environment where no one could get hurt."* The participants also mentioned that the simulation's ability to provide instant feedback on mistakes supported learning through repetition.

Self-confidence and clinical readiness: Participants stated that the virtual reality application helped them gain professional confidence and better

prepare for the clinical environment. After completing the simulation, the students reported feeling more competent and ready to provide newborn care. One participant emphasised this by saying, *"I wouldn't have felt this comfortable in a real setting, but in VR, I practised several times. Now I know exactly what to do when holding a baby*." Another student stated, *"This experience mentally prepared me to work in the delivery room. Now I believe I can do it."*

Participants also noted that the VR simulation provided more lasting learning than traditional laboratory practices, allowing them to observe correct procedures before making mistakes and helping them feel prepared before encountering real cases.

Emotional and cognitive interaction in the learning process

This theme expresses the emotional and cognitive responses of students during the simulation, such as excitement, motivation, anxiety, and self-evaluation.

Initial experience anxiety and adaptation to technology: Some participants stated that since it was their first time experiencing a virtual reality simulation, they initially felt anxious, tense, and had difficulty adapting to the technology. One participant expressed this by saying, *"When I first put on the headset, I panicked a little because I did not know what to expect.*" Another student stated, "*I didn't know how to use the controls at first, I made a few mistakes, but then I got used to it.*" Several students also reported that this initial anxiety was later replaced by curiosity and interest in the simulation. One participant remarked, "*At first, it was a mix of excitement and fear, but after a while I truly started to enjoy it."*

Learning motivation: The vast majority of participants stated that virtual reality simulation increased their interest in and motivation for learning. Compared with traditional teaching methods, students emphasised that the interactive environment strengthened their engagement with the course and made the practice more enjoyable. One participant stated, "*I usually have trouble focusing during lessons, but while practicing with the VR headset, I did not even realise how much time had passed.*" Another student said, "*Seeing the result of every action I took instantly pushed me to learn more."*The participants also reported that the experience helped them reinforce their learning. One student stated, "*It's impossible for me to forget what I learned this way because I actually lived it."*

Self-reflection and awareness: Participants stated that the virtual reality application helped them recognise their mistakes and reflect on their performance. One participant explained this by saying, *"After completing the simulation, I realised where I went wrong. In a real setting, I wouldn't have had such an opportunity."* Another student noted, "*I realised that I was rushing while giving the baby a vaccine, so in the second attempt, I tried to stay calmer."*Participants also mentioned that the VR environment encouraged independent learning. One student stated, *"I felt that I truly learned because I could observe myself."*

The role and sustainability of innovative technologies in midwifery education

This theme encompasses students' views on the integration of innovative technologies such as virtual reality (VR) into midwifery education.

Positive attitude toward innovation: Participants evaluated virtual reality simulation as an innovative and engaging method in midwifery education. One participant stated, *"It was my first time experiencing this method, but it definitely makes lessons more enjoyable and memorable*." Another student said, "*Midwifery should no longer be limited to traditional practices; we need to evolve with technology*." Some participants also expressed that they would like to see this method used more frequently.

Technical limitations: Some participants reported technical problems during the simulation, such as system freezing or physical discomfort. One participant stated, "*When the system froze in the middle of the simulation, I had to start over, which disrupted my focus*." Another student noted, "*The headset was a bit heavy, and wearing it for a long time gave me a headache."*

Sustainability and professional contribution: Participants emphasised that the virtual reality application should be integrated into education on a

long-term basis. One participant stated, "*This system shouldn't be used just once; it should be implemented regularly*." Another student expressed, *"The practices I did with VR gave me a professional perspective."*

Summary of the thematic structure

Midwifery students described virtual reality simulation as a realistic and supportive learning environment. Participants reported emotional responses such as initial anxiety and increased motivation, as well as opportunities for self-reflection. They also expressed positive attitudes toward the use of innovative technologies while identifying certain technical limitations.

Discussion

This qualitative study examined the experiences of midwifery students at a university located in eastern Türkiye regarding a virtual reality (VR) simulation designed for immediate newborn care after birth. The three main themes identified VR as a realistic and safe learning environment, emotional and cognitive interaction in the learning process, and the role and sustainability of innovative technologies reveal both the educational contributions and the limitations of this method.

Realism, safety, and learning environment

The participants' perceptions of the VR environment as a space closely resembling a real clinical setting that enables learning without the risk of making mistakes align with findings in the literature. Saab *et al.* (2023) reported that VR simulation contributes to students' ability to learn safely without errors and helps build self-confidence.[34] Similarly, Liu et al. (2023), in their meta-analysis, reported that VR education enhances cognitive learning and leads to improvements in skill transfer and self-confidence. [35] Previous studies have also reported that although VR applications may increase knowledge levels, their impact on clinical performance may be limited. [36] Therefore, the increase in "self-confidence and clinical readiness" observed in this study highlights the need for future research incorporating objective performance measures.

Emotional and cognitive interaction

Students experienced anxiety during their first VR encounter; however, as the experience progressed, their motivation and willingness to learn increased. This finding is consistent with the results reported by Pérez de los Cobos Cintas et al. (2025)[37], who noted that XR/VR-based applications reduce student anxiety and increase learning motivation. The participants' statements, such as "I realised where I went wrong," illustrate the development of self-reflection and awareness. Similarly, Kiegaldie and Shaw (2023) [38] demonstrated that VR simulations support students' self-assessment and critical thinking skills. Liu et al. (2023) also emphasised the positive effects of VR applications on experiential learning and intrinsic motivation.

The role and sustainability of innovative technologies

Students' development of positive attitudes toward innovative teaching methods (e.g., "this method should be used in all practical courses") is consistent with previous research findings. Webster and Taylor (2023) reported that mixed reality technologies provide midwifery students with a new learning perspective and make the learning process more participatory.[39] However, as also observed in this study, technical limitations (e.g., system freezing, device weight) are important factors affecting the sustainability of VR applications. Similarly, Demir-Kaymak et al. (2024) and Zhao et al. (2024) reported that technical problems and inadequate infrastructure can limit the learning experience.[40,41]

Moreover, the INACSL Standards Committee (2021) emphasised the importance of technical infrastructure, prebriefing, and debriefing standards for the effective implementation of virtual simulations.[42] Therefore, for VR-based learning environments to be sustainably integrated into midwifery curricula, it is essential to plan technical infrastructure, faculty training, and student accessibility strategies in a coordinated manner.

Limitations and future research

This study offers a unique contribution by providing an in-depth exploration of the VR experience related to newborn care. However, its generalizability is limited because it was conducted within a single institution and has a relatively small sample size. Future research could evaluate the effects of VR applications on cognitive, psychomotor, and affective outcomes across

different regions, academic levels, and comparative study designs. Additionally, multidisciplinary studies guided by the INACSL (2021) standards are recommended to reduce technical limitations and ensure long-term sustainability.

Conclusion

This study demonstrated that virtual reality (VR) technology has significant potential in enhancing midwifery students' learning experiences related to immediate newborn care after birth. Students evaluated the VR simulation as a realistic, safe, interactive, and supportive educational tool that enhances learning. The participants' statements revealed that this method reduced their fear of making mistakes, increased their self-confidence, strengthened their intrinsic motivation toward learning, and provided cognitive and emotional preparedness for clinical practice. However, certain technical limitations such as system freezes, equipment weights, and inadequate infrastructure can negatively affect the learning process. Therefore, to ensure the effective use of VR simulations in midwifery education, institutional-level technical support, faculty training, and a sustainable infrastructure are needed.Overall, this study demonstrates that virtual reality represents an innovative approach in midwifery education that strengthens experiential learning, provides opportunities for error-free practice, and enhances the sense of professional self-efficacy. VR-based applications can contribute to midwifery students' confidence in performing critical clinical skills, such as post-partum care, and support their professional identity development.Future research should include comparative designs across different educational levels (e.g., between first- and fourth-year students) and examine the long-term effects of VR applications, their transferability to clinical performance, and their reflections on patient care outcomes.

Contribution of authors

SO was responsible for the conception and design of the study, data collection, data analysis, and manuscript preparation.

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