Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

An Andragogical Evaluation of Immersive Virtual Reality for Nursing and Midwifery Education: A Descriptive Pilot Mixed-Methods Study in Uganda.

Steve Ronald Mwanje[1], Abbey Ssekalem[3], Ambrose Felix Okello[2], Lilian Ritah Barungi[2], Martin Okoed[2], Agnes Asiimwe[4]*

[1]*United Nations Regional Service Centre, Entebbe, Uganda*
[2]*Enabel, Belgian agency for international cooperation, Kampala, Uganda*
[3]*Cyberprints Limited, Kampala, Uganda*
[4]*Guardian Health Services, Kampala, Uganda*

ABSTRACT

Background:

Nursing and midwifery education in low-resource settings often has limited access to simulation facilities and opportunities for repeated practice. This study examined how immersive Virtual Reality (VR) supports learning among healthcare professionals in Uganda.

Methods:

This pilot mixed-methods study involved forty healthcare professionals (nurses, midwives, emergency care providers, and instructors). Participants completed a two-day VR training using four locally developed modules: postpartum hemorrhage (EMOTIVE), cardiopulmonary resuscitation, ABCDE (Airway, Breathing, Circulation, Disability, Exposure) emergency assessment, and eclampsia management. A retrospective pre-post questionnaire assessed perceived knowledge, engagement, relevance, usability, and adoption. Cronbach's alpha for learning and adoption domains was 0.853 (95% CI 0.776-0.913). Qualitative responses were thematically analyzed to capture participant perspectives.

Results:

Self-rated knowledge increased across all groups, with the largest gains among those with less than one year of experience. Engagement (M = 4.88), motivation (M = 4.60), and theory-practice connection (M = 4.42) received consistently high ratings across professional groups. Module use matched professional roles: midwives preferred the EMOTIVE and Eclampsia modules, whereas emergency care providers preferred the ABCDE and Resuscitation modules. Usability challenges included motion discomfort (23/40; 58%), controller use (23/40; 58%), limited practice time (21/40; 53%), and navigation difficulties (20/40; 50%). Despite these, 97.5% of participants supported recommending VR and integrating it into curricula. Qualitative findings reinforced quantitative results, highlighting stronger theory-practice links, active participation, confidence building, and learning through repetition.

Conclusion:

Immersive VR was feasible and acceptable for continuing professional development in nursing and midwifery education in Uganda. These findings suggest that VR can complement existing training in resource-constrained settings.

Recommendation:

Future studies should assess long-term learning outcomes, cost-effectiveness, and implementation across larger, more diverse cohorts.

Keywords: *Virtual Reality Training; Nursing and Midwifery Education; Immersive Learning; Adult Education; Simulation-Based Learning; Healthcare Workforce Development; Educational Technology; Low-Resource Settings*
Submitted: *June 27, 2026* ***Accepted:*** *July 01, 2026* ***Published:*** *June 30, 2026*

Corresponding Author: *Steve Ronald Mwanje*
Email: *mwanjesteve2@gmail.com*
United Nations Regional Service Centre, Entebbe, Uganda

Introduction

Preparing nursing and midwifery trainees for clinical practice requires more than classroom teaching. Learners need opportunities to build confidence, make clinical decisions, and practice procedures before working with real patients. In many low-resource settings, however, training institutions continue to face challenges such as limited access to simulation facilities, shortages of clinical placement opportunities, and insufficient time for repeated skills practice (Epuitai et al., 2025; J. Najjuma et al., 2025).

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

As a result, students may complete training with fewer opportunities to apply what they have learned in realistic clinical situations.

To respond to these challenges, educators are testing approaches that can expand practical learning opportunities. One approach is immersive Virtual Reality (VR). Immersive VR creates simulated clinical environments where learners can practice procedures, make decisions, and receive feedback in a safe setting without affecting patient care. For nursing and midwifery education, this matters because competence requires clinical judgment and response to changing situations, not only theoretical knowledge. Observation alone does not develop these skills (Birkheim et al., 2023; Huh et al., 2026).

Most international studies on VR in healthcare education report technical performance, user satisfaction, and clinical outcomes. Less is known about how VR supports adult learning processes in low-resource settings. This gap matters because nursing and midwifery trainees are adult learners. They enter training with prior experience, workplace responsibilities, and expectations that learning be practical and directly applicable (Cheng et al., 2025; Spies et al., 2015).

This study draws on Knowles' Andragogy Theory, which explains that adults learn more effectively when learning connects to their work, builds on prior experience, encourages active participation, and can be applied immediately. These ideas fit well with immersive VR environments, where learners engage directly with realistic scenarios and learn through experience (Abeni, 2020; Merriam, 2001).

Against this background, this study examined how immersive Virtual Reality supports adult learning among nursing and midwifery trainees in Uganda. The study explored participants' perceptions of knowledge gain after training, their learning engagement and motivation, the extent to which the training felt relevant to their professional work, how the experience supported connections between theory and practice, and their willingness to accept and continue using VR in future learning activities (Fealy et al., 2019). By focusing on learner experience in addition to skill outcomes, this study contributes evidence on how immersive approaches can support adult learning in resource-constrained healthcare education. The findings can inform nursing and midwifery curriculum design in Uganda and similar contexts.

Methods

Design

This study used a descriptive cross-sectional pilot mixed-methods design guided by Knowles' Andragogy Theory (Knowles, 1984). Quantitative and qualitative data were collected once, immediately after completion of the immersive VR training. The quantitative component described participants' perceived learning outcomes and experiences, while qualitative responses provided contextual explanations of those experiences. The study followed a pragmatic mixed-methods approach that integrates numerical and narrative data to understand educational practice in real-world settings(Fetters et al., 2013).

Setting

Training took place at Jinja Civil Service College, Uganda, from 26 to 27 May 2026, where standalone Meta Quest headsets were used with the SIM Lab App as the user interface. As shown in Figure 1, the four simulation modules were: postpartum hemorrhage (EMOTIVE), cardiopulmonary resuscitation, ABCDE (Airway, Breathing, Circulation, Disability, Exposure) emergency assessment, and eclampsia management. These were developed locally in Unreal Engine and 3ds Max. Modules were delivered in English. Each participant completed individual sessions of approximately 15 minutes per module and received facilitator support at a 1:5 facilitator-to-learner ratio. The training emphasized active participation, interaction with clinical scenarios, and applying learning to practice (Saab et al., 2023).

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

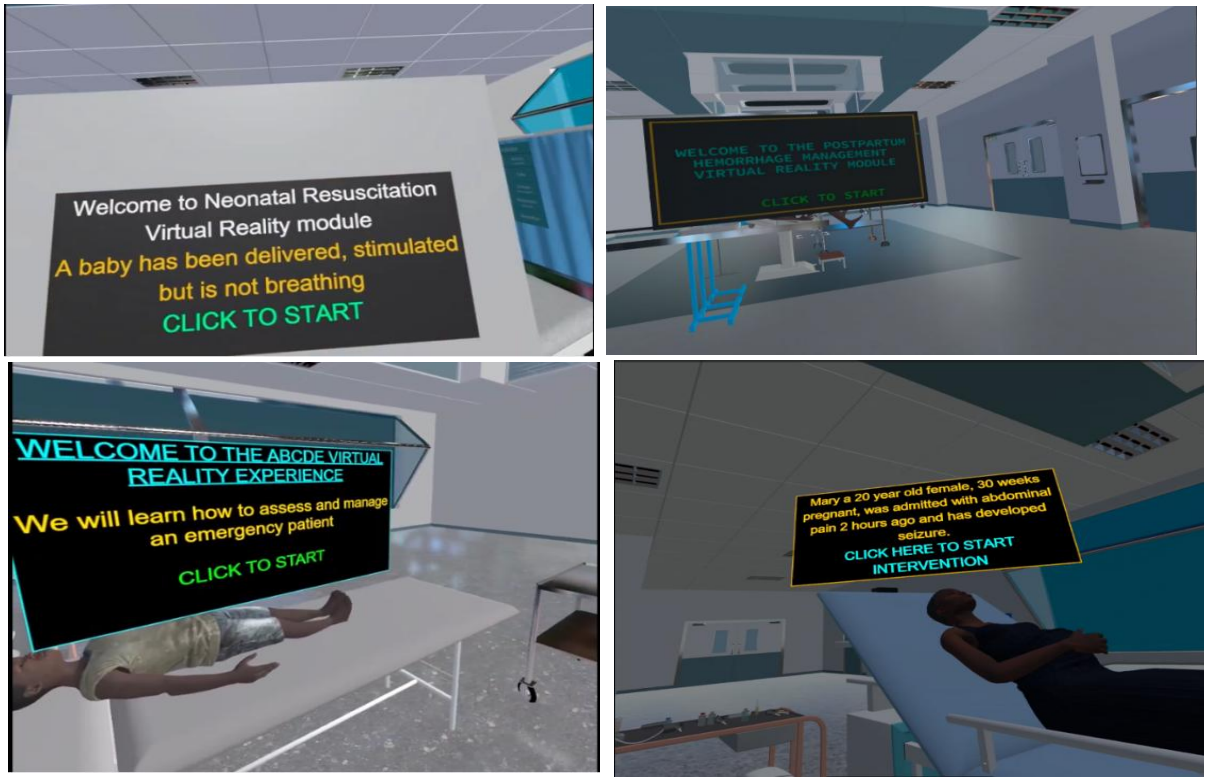

Figure 1: Four locally developed VR simulation modules covering postpartum hemorrhage (EMOTIVE), cardiopulmonary resuscitation (CPR), ABCDE emergency assessment, and eclampsia management

Participants

Eligible participants were healthcare professionals (29 women and 11 men) who completed both the VR training and the post-training questionnaire. Participants represented nursing, midwifery, emergency care, clinical practice, and nursing education, with experience ranging from less than one year to more than 15 years. Participants were purposively recruited from health centers and hospitals collaborating with Enabel WeCare Uganda, and participation was voluntary as part of a pilot study conducted alongside continuing professional development activities. A sample of 40 participants was considered appropriate for a pilot study because the aim was to assess feasibility, user experiences, and early learning outcomes across diverse professional groups rather than to make population-level estimates. Participants were required to complete at least one VR simulation module and the post-training questionnaire. Individuals who did not complete the training sessions or declined consent were excluded from the study.

Data Collection

Data were collected with a structured questionnaire administered immediately after the VR sessions. The instrument was adapted from validated tools in immersive learning, healthcare simulation, and adult education, and a content panel reviewed it for relevance before use.

Participants rated their clinical knowledge retrospectively before and after training on a 5-point scale. A retrospective pre-post design was used because baseline ratings were not collected before participants used the headsets.

The final questionnaire had seven sections: participant demographics, perceived knowledge gain, clinical competency, module evaluation, user experience, future adoption, and overall workshop evaluation. Quantitative items used a 5-point Likert scale from strongly disagree to strongly agree and covered perceived knowledge gain, engagement, motivation, relevance to practice, theory-practice integration, equipment usability, and adoption intentions. Open-ended questions at the end asked participants to describe skills gained, technical or operational challenges with VR, and recommendations for

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

future training (Sadeghi et al., 2023). We assessed the reliability of the Likert-scale items for the learning and adoption domains using Cronbach's alpha. The threshold for acceptable internal consistency was 0.70. Cronbach's alpha was 0.853, 95% CI 0.776 to 0.913.

Bias

Several measures were taken to reduce potential sources of bias. All participants completed the same standardized VR training using identical equipment, simulation modules, facilitator support, and a post-training questionnaire. Responses were collected anonymously immediately after the training to reduce recall bias. The questionnaire combined structured Likert-scale items with open-ended questions to allow participants to describe their experiences in their own words. Because participation was voluntary and purposive, the findings should be interpreted as reflecting the experiences of this pilot sample rather than the wider healthcare workforce.

Data Analysis

Quantitative and qualitative data were analyzed separately and integrated during interpretation. Quantitative data were processed using Microsoft Excel and Python. Given the descriptive mixed-methods design, sample size (n=40), and self-reported measures, analysis was limited to descriptive statistics, including frequencies, percentages, means, and cross-tabulations. Comparisons were used to examine patterns across professional groups and years of experience in perceived knowledge gain, engagement, motivation, relevance, theory–practice integration, and VR acceptance.
Qualitative responses were analyzed thematically following (Braun & Clarke, 2021). Responses were reviewed, coded, and grouped into recurring themes. Quantitative findings and qualitative themes were then interpreted together to provide an overall understanding of participant experiences.

Ethical Considerations

Ethical principles for research involving human participants were followed throughout the study. Participants received information about the purpose of the study before providing informed consent. Responses were collected anonymously, treated confidentially, and used only for research and educational purposes. Participation was voluntary, and participants could withdraw at any stage without consequences. The study followed ethical guidance for educational and health research involving human participants (Shrestha & Dunn, 2020; World Medical Association, 2013).

Results

Participant Characteristics and Module Selection

Figure 2 summarizes participants by professional background, years of experience, prior VR exposure, and preferred training module. The sample included midwives, emergency care providers, clinical practitioners, nurses, and nursing instructors. Midwives were the largest group; nursing instructors were the smallest. Professional experience ranged from less than one year to more than fifteen years. Most participants had not used VR before training. All professional groups completed the simulation activities. Module choice aligned with clinical role: midwives more often chose EMOTIVE and Eclampsia modules, while emergency care providers more often chose ABCDE Emergency Assessment and Resuscitation modules.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

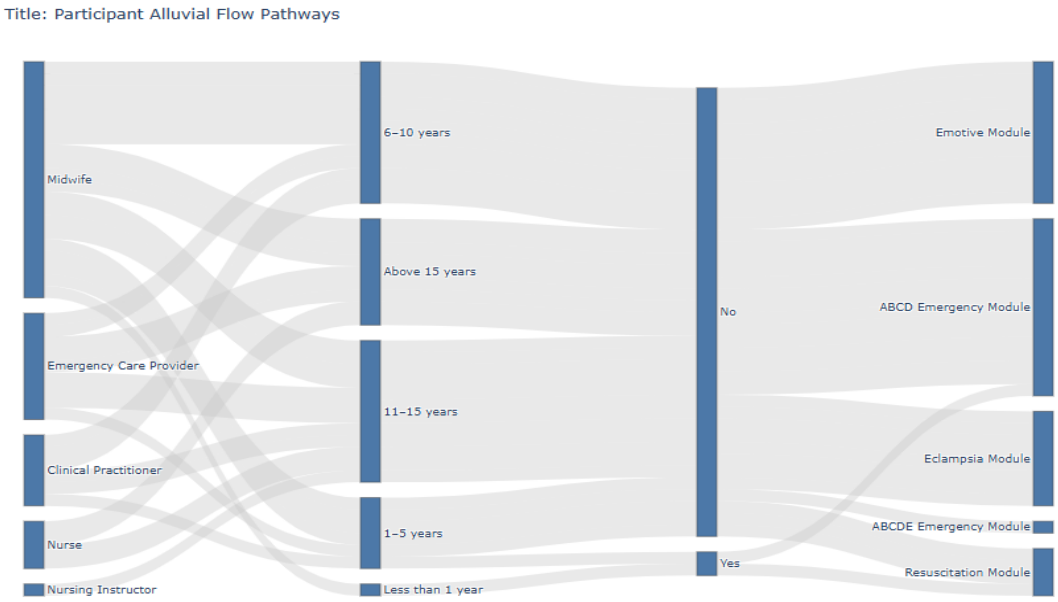

Figure 2: Participant Characteristics Across Professional Background, Experience, Previous VR Exposure, and Preferred VR Module

Perceived Knowledge Change Following VR Training

Figure 3 shows self-reported knowledge before and after training, grouped by years of experience. Mean post-training scores were higher than pre-training scores for all experience groups. Participants with less than 1 year of experience reported the largest increase and the highest post-training ratings. Those with more than 15 years of experience reported smaller increases and more variation. Knowledge was measured by retrospective self-rating before and after training.

In open-ended responses, participants described a clearer understanding of procedural steps and emergency priorities after the simulations. Several stated that simulations made complex procedures easier to understand and apply. More experienced participants also described the training as useful for refreshing existing knowledge and clinical approaches. Examples from participants: *"I was able to learn step-by-step management from the most urgent, which is controlling convulsions, to managing blood pressure and the fetal wellbeing"; "The stepwise approach to managing PPH using Emotive is very easy to follow and understand"; "It has helped me realize where I wasn't performing well before." "Enhanced my knowledge and skills by reminding me of the equipment and steps taken while dealing with PPH."; "It simulated me on the emergency rescue skills of a newborn baby within 30 minutes to normal breathing state as well as consciousness"*

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

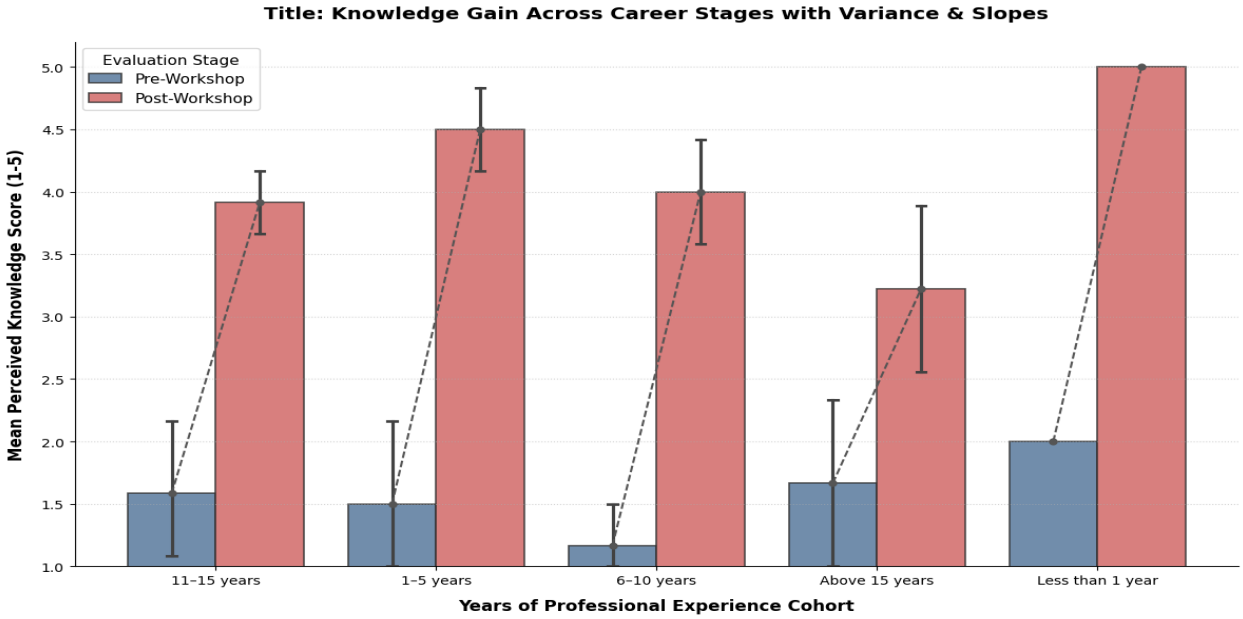

Figure 3: Changes in Self-Reported Knowledge of VR Before and After Training Across Professional Experience Groups

Adult Learning Experiences Across Professional Groups

Figure 4 represents scores across five learning dimensions: relevance of the training content, learner engagement, motivation, theory-practice connection, and overall satisfaction. Responses were generally positive across all professional groups, including clinical practitioners, emergency care providers, midwives, nurses, and nursing instructors.

Content relevance received the highest ratings across most groups. Participants commonly reported that the VR scenarios reflected situations they encounter in their daily clinical work. Engagement and motivation were also rated highly, with participants describing the learning experience as active and easier to follow compared with traditional approaches. Participant quotes: *"Helps to bridge the gap between theory and practice. Helps to reduce anxiety while managing conditions"; "It applies to my work"; "Active participant"*

Ratings for the theory-practice connection remained positive but showed slightly more variation across groups. Participants explained that the simulations helped them connect classroom learning with clinical actions and decision-making. Variation in responses across professional groups was generally small. Participant quotes: *"Learning at one's own pace, plus a chance for repeating several times."It motivates staff to attend the CME"*

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

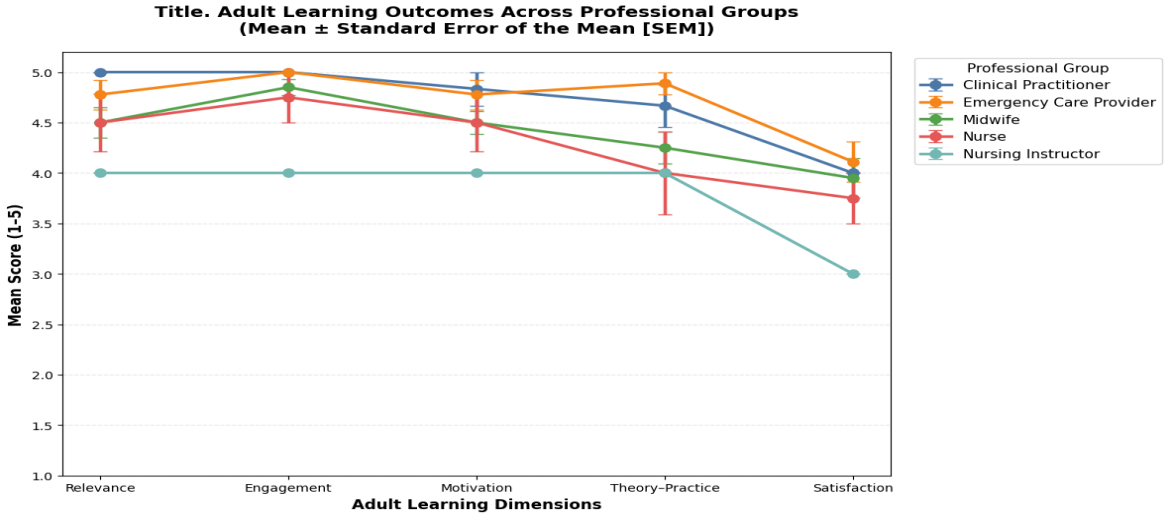

Figure 4: Adult Learning Outcomes Across Professional Groups (Mean ± Standard Error of the Mean [SEM])

Module Preference by Professional Background

Figure 5 shows module preferences by professional group. Participants preferred modules that matched their routine responsibilities and learning needs. The EMOTIVE module was valued for maternal emergency care. ABCDE and Resuscitation modules were preferred by emergency care providers for their relevance to patient assessment, emergency response, and clinical decision-making. Module selection appeared to reflect perceived clinical relevance rather than ease of use.

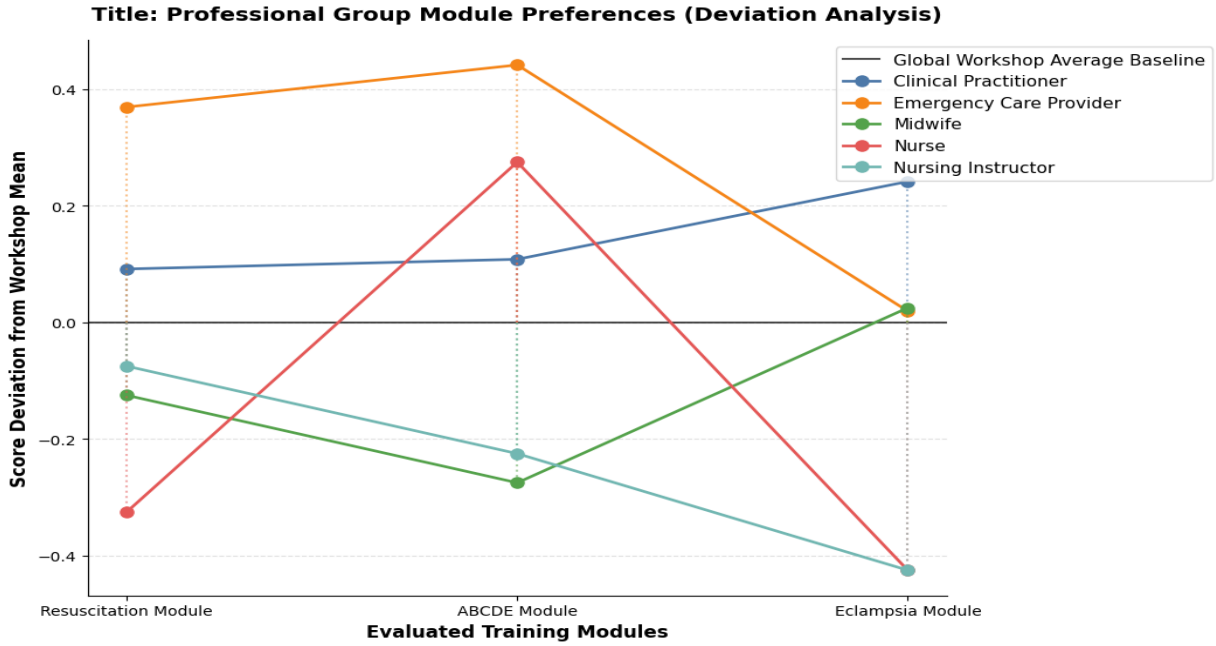

Figure 5: Variation in Module Preference Across Professional Groups Relative to the Workshop Mean

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

Challenges During VR Use

Figure 6 presents the challenges participants experienced while using the VR system and shows how these challenges appeared together during training. The most reported challenges were motion discomfort or dizziness (n = 23) and difficulty using the controllers (n = 23). Other common challenges included limited practice time (n = 21) and difficulty navigating the virtual environment (n = 20). Technical interruptions were reported less often (n = 12), while fear of making mistakes during simulation was less common (n = 7). Only a small number of participants reported no challenges (n = 2).

The co-occurrence pattern showed that these challenges were often experienced together rather than separately. Difficulty using controllers frequently occurred alongside navigation difficulties and motion discomfort, while limited practice time was also commonly reported together with these challenges. Technical interruptions appeared less connected to the main usability concerns, and fear of making mistakes was reported less frequently than physical and interaction-related challenges.

Despite these challenges, participants generally continued to report positive learning experiences and expressed willingness to use VR again in future training. Overall, participants reported more usability and access-related challenges than concerns about adopting VR.

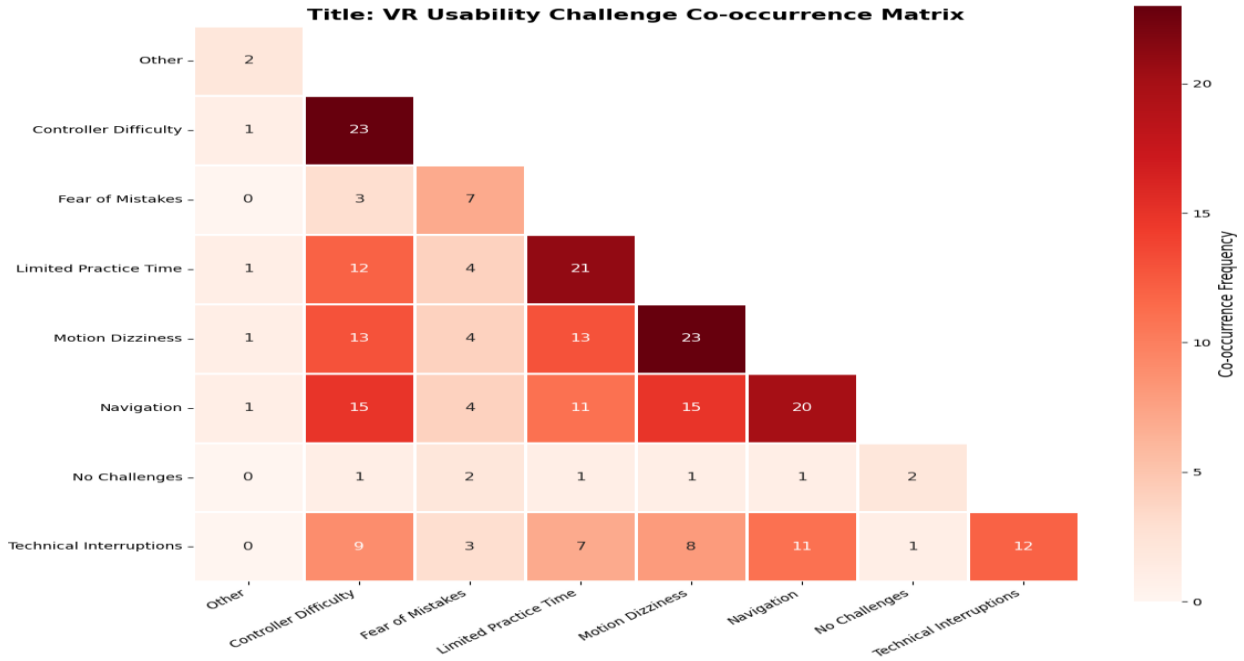

Figure 6: Co-occurrence Matrix of Reported VR Usability Challenges

Acceptance and Future Adoption

Figure 7 shows participants' intentions regarding future VR use in healthcare training. Acceptance was high across all three measures: recommending VR to other professionals, belief that VR can strengthen workforce preparation, and support for integrating VR into nursing and midwifery education. Ninety-eight percent of participants responded positively to all three measures. Two percent were uncertain. No participants opposed future use. Response patterns were similar for recommendations, workforce preparedness, and curriculum integration. Participants linked positive views to increased confidence, safer opportunities to practice procedures, and improved preparedness for emergency care. Despite reported challenges, participants remained willing to continue using VR.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

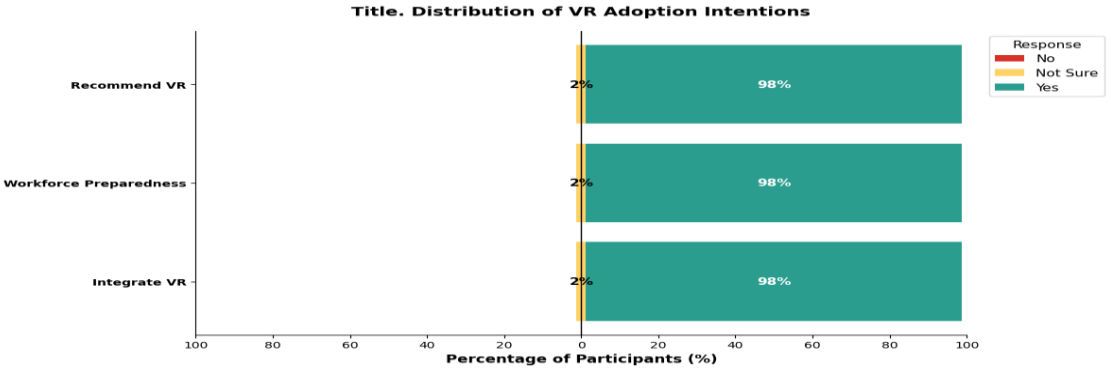

Figure 7: Distribution of Participant Intentions Toward Future Adoption of VR

Table 1: Participant Characteristics

Variable	Category	N	Percent
Gender	Female	29	72.5%
	Male	11	27.5%
Age Group	36-45 years	18	45.0%
	26-35 years	17	42.5%
	46-55 years	3	7.5%
	Above 55 years	1	2.5%
	18-25 years	1	2.5%
Profession	Midwife	20	50.0%
	Emergency Care Provider	9	22.5%
	Clinical Practitioner	6	15.0%
	Nurse	4	10.0%
	Nursing Instructor	1	2.5%
Experience	11-15 years	12	30.0%
	6-10 years	12	30.0%
Experience	Above 15 years	9	22.5%
Experience	1-5 years	6	15.0%
Experience	Less than 1 year	1	2.5%

The study included 40 healthcare professionals, predominantly female (72.5%), with most participants aged 26-45 years (87.5%). Midwives represented half of the sample (50.0%), followed by emergency care providers (22.5%). Most respondents had moderate to extensive professional experience, with 82.5% reporting six or more years of practice, indicating that findings reflect perspectives from experienced healthcare workers.

Table 2: Objective-Based Quantitative Results

Objective	Indicator	Mean/Percent
Knowledge change	Before	1.48
	After	3.90
Adult learning	Engagement	4.88
	Motivation	4.60
	Theory-practice	4.42
Module preference	Emotive	35%
Usability	Ease of use	3.15
Future use	Recommend VR	97.5%
Knowledge change	Before	1.48

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

Quantitative findings demonstrated a substantial improvement in perceived VR knowledge following training (Mean increased from 1.48 to 3.90). Participants reported high levels of engagement (Mean=4.88), motivation (Mean=4.60), and perceived connection between theory and practice (Mean=4.42). The Emotive module emerged as the most preferred (35%), while intention for future adoption was strong, with 97.5% recommending VR for healthcare education.

Qualitative Themes from Participant Narratives

Qualitative findings complemented the quantitative results by showing that participants viewed VR as a practical, engaging, and confidence-building learning approach. Themes highlighted improved translation of theoretical knowledge into clinical practice, active participation, motivation, and confidence, and repetitive practice that supported skill mastery. Despite usability and resource challenges, participants generally perceived that the educational benefits of immersive VR outweighed implementation constraints (Steen et al., 2024).

Table 3: Emerging themes identified from participant narratives describing experiences with immersive virtual reality training

Objective	Quantitative Result	Qualitative Theme	Illustrative Quote	Meta Inference
Knowledge Change	Mean increased from 1.48 to 3.90	Improved Understanding	*"Helps to bridge the gap between theory and practice."*	Knowledge gains supported
Adult Learning	Engagement=4.88	Increased Motivation	*"Confidence building. Development of skills."Improves someone's confidence during emergency management."*	Active experiential learning
Module Preference	Emotive most preferred	Learning Through Practice	*"It is self-paced, interactive, and allows repetition that enables mastery of the skills."Learning at one's own pace, plus a chance for repeating several times."Repetitive practice."*	Modules aligned with work needs
Usability	Ease=3.15	Positive despite challenges	*"Awakens us healthcare givers and reduces medical errors to patients."*; *"Brings confidence and reality in patient care and management."*	Benefits outweighed constraints
Qualitative Experience	Themes extracted	Repetition	*"It is self-paced, interactive, and allows repetition that enables mastery of the skills."Learning at one's own pace, plus a chance for repeating several times."Repetitive practice."*	Practice reinforced learning

Overall, the findings indicate that immersive VR training was associated with improved perceived knowledge, strong learner engagement, increased confidence, and positive acceptance among healthcare professionals. Quantitative outcomes and qualitative narratives converged to suggest that VR supported experiential learning and strengthened readiness for clinical practice.

Discussion

This study examined how immersive Virtual Reality supports adult learning among nursing and midwifery

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

professionals in Uganda. Specifically, it explored: 1) assess perceived knowledge change across experience levels; 2) evaluate adult learning experiences across relevance, engagement, motivation, theory-practice connection, and satisfaction; 3) describe module preferences by professional background; 4) identify usability and access challenges; 5) determine intentions toward future use, recommendation, and curriculum integration of VR; and 6) explore qualitative experiences of VR-supported learning. The discussion interprets findings in relation to these objectives.

Immersive VR as an Adult Learning Environment in Healthcare Training

Participants described immersive VR as a practical learning approach that strengthened understanding, participation, confidence, and application of knowledge. Quantitative findings together with participant narratives suggest that VR functioned beyond a digital tool and was experienced as an interactive learning environment that supported safe practice and active engagement (Liu, 2023). Positive experiences were observed across professional groups and levels of experience. Although most participants had limited prior exposure to VR technology, learning experiences remained favorable, suggesting that immersion and usability did not depend heavily on previous VR familiarity (Aufenanger et al., 2025).

Participants reported higher perceived knowledge following training, particularly among those with less clinical experience, while experienced clinicians viewed VR as a useful opportunity to refresh existing practice (Huh et al., 2026; Waldock et al., 2026). This pattern is consistent with evidence from simulation-based healthcare education in East Africa showing improvements in knowledge and confidence following repeated practical training (Hanson et al., 2021; Williams et al., 2019).

Alignment with Adult Learning Principles

The findings align with Knowles' Andragogy Theory, which states that adults learn most effectively when training is highly relevant, experiential, and immediately applicable to their workplace duties. Participants consistently indicated that VR scenarios reflected clinical situations encountered in daily routine practice in Ugandan hospitals." Comments such as: *"Helps to bridge the gap between theory and practice,"* and *"Because that's my part of expertise and I believe it will reduce errors during active management of emergency cases"* illustrate how participants valued practical applicability over the novelty of the technology itself (Clay et al., 2024).

High ratings for content relevance and theory-practice integration further support this interpretation. Adult learners often disengage from educational activities that feel disconnected from their professional realities. In this study, clinicians naturally gravitated toward the modules that matched their specialized workflows. Midwives preferred the EMOTIVE and Eclampsia simulations, while emergency responders prioritized the ABCDE triage and Resuscitation pathways. These patterns suggest that module preference was influenced primarily by perceived professional usefulness rather than technological appeal. (Houlden & Crichton, 2024).

Participant narratives reinforced these findings by describing improved procedural understanding, stronger sequencing of emergency actions, and increased confidence in applying knowledge. Responses such as *"I was able to learn step-by-step management from the most urgent, which is controlling convulsions, to managing blood pressure and the fetal wellbeing,"* and *"The stepwise approach to managing PPH using Emotive is very easy to follow and understand"* indicate that immersive environments supported movement from theoretical learning to clinical application. Similar observations have been reported in nursing simulation literature and healthcare education studies conducted in Uganda (Kaakinen & Arwood, 2009; J. N. Najjuma et al., 2020).

Engagement, Motivation, and Ownership of Learning

Participants described the sessions as interactive, practical, and more involving than conventional instruction. Reported experiences included active participation, self-paced learning, and opportunities for repeated practice. Rather than observing procedures passively, learners interacted directly with clinical scenarios and experienced consequences of their decisions, consistent with literature showing that immersive environments strengthen learner attention and participation (Mosling et al., 2026; Srikasem et al., 2025).

From an adult learning perspective, these findings reflect principles of learner autonomy and self-directed learning. Participants associated immersion with improved concentration, confidence, and willingness to continue practicing (Physiopedia contributors, 2026).

Repeated practice emerged consistently across participant narratives. Learners valued opportunities to repeat procedures, identify errors, and continue practicing without patient risk. These experiences appeared to strengthen procedural confidence and reinforce experiential learning (Wilkes et al., 2026).

Changes in Professional Perspective

Qualitative findings suggest that immersive simulations also encourage reflection on professional practice. Several participants noted that simulated scenarios helped reveal gaps in emergency management and encouraged reconsideration of established approaches. Repeated exposure contributed to increased confidence and awareness of areas for improvement. These reflections are consistent

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

with Mezirow's Transformative Learning Theory, which proposes that meaningful educational experiences can prompt reassessment of assumptions and changes in professional thinking (Briese et al., 2020). Although long-term behavioral outcomes were not measured, participant accounts suggest that VR created conditions that supported reflective learning.

Acceptance of VR Despite Practical Constraints

Participants expressed strong support for future VR use, including recommending the approach to colleagues, integrating it into training programs, and using it to strengthen workforce preparation. This acceptance remained high despite reported challenges.

Common barriers included motion discomfort, controller difficulty, navigation problems, limited practice time, and occasional technical interruptions. These challenges frequently occurred together but did not appear to reduce overall acceptance. Participants generally perceived the educational value of VR as greater than temporary operational limitations. Similar patterns have been reported in immersive healthcare education, where perceived usefulness is a stronger driver of adoption than ease of use (Liu, 2023; Sim et al., 2022; Victoria et al., 2025).

Implications for Implementation in Resource-Constrained Settings

Participants identified several requirements for sustainable implementation, including improved hardware access, longer training periods, additional clinical modules, reliable software performance, and dedicated practice spaces. Comments: *"Continuous training to all health facilities in the country to impart more knowledge to health care givers,"* and *"At least training for five days because the gadgets are not easy to master within a few days."* These findings support the use of VR as a complement to existing classroom and simulation approaches rather than a replacement. Such blended approaches may be particularly relevant in resource-constrained healthcare education systems where opportunities for repeated clinical practice are limited (Johansen et al., 2025).

Contribution to Healthcare Education

This study contributes evidence from a resource-constrained setting by focusing on how immersive technologies support learning experiences rather than technical performance outcomes alone. The findings suggest that immersive VR may strengthen adult learning processes through clinical relevance, learner engagement, repeated practice, and stronger connections between theory and practice. These observations provide additional insight into how immersive approaches may be integrated into healthcare education in similar contexts.

Generalizability

This study was conducted as a pilot immersive VR training in Uganda involving 40 healthcare professionals from different disciplines and levels of clinical experience. The findings provide evidence that immersive VR was positively received and supported engagement, motivation, theory-practice integration, and perceived learning within this educational context. Because participants were purposively selected from a single training setting, the results should be interpreted within similar healthcare education environments rather than as representative of all healthcare training settings. Differences in infrastructure, availability of VR equipment, facilitator expertise, and institutional support may influence implementation and learning outcomes in other contexts. In addition, the study assessed immediate participant perceptions after training and did not examine long-term knowledge retention or changes in clinical practice. Therefore, the findings provide context-specific evidence that may inform similar resource-constrained settings but should not be generalized to all healthcare education environments.

Conclusion

This study found that immersive virtual reality provided a positive learning experience for nursing, midwifery, emergency care, and other healthcare professionals participating in a pilot training programme in Uganda. Participants perceived VR as relevant to their clinical work, engaging, and useful for strengthening understanding, confidence, and the connection between theory and practice. Although participants experienced challenges such as limited practice time, equipment discomfort, and occasional technical interruptions, these issues did not reduce their willingness to use VR in future training. Overall, the findings suggest that immersive VR can complement existing healthcare education by providing safe opportunities for experiential learning and repeated practice. Future studies should evaluate long-term knowledge retention, clinical competence, and patient-related outcomes using larger and more diverse samples.

Limitations

This study relied on self-reported data collected immediately after the workshop, including retrospective pre-training ratings, which reflect participants' immediate perceptions rather than long-term learning. The study did not follow participants over time and therefore could not determine whether knowledge and skills were retained or applied in clinical practice. Most participants had no previous experience with virtual reality, and the novelty of the technology may have influenced some responses. In

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

addition, the study assessed perceived learning rather than objective measures of clinical competence or patient outcomes. Because this was a descriptive pilot study, the analysis was limited to descriptive statistics and did not include inferential testing.

Recommendations

Future VR training should provide longer hands-on practice sessions to allow learners enough time to become familiar with the technology and complete simulation exercises confidently. Healthcare training institutions should gradually integrate immersive VR into existing simulation and continuing professional development programmes rather than using it as a stand-alone teaching method. Investment in additional VR equipment, technical support, and facilitator training would improve accessibility and reduce interruptions during learning. Future research should include larger and more diverse samples, objective assessments of clinical competence, and follow-up evaluations to determine whether learning is retained and transferred into routine clinical practice.

Acknowledgment

The authors sincerely appreciate Enabel, the Belgian Agency for International Cooperation, for facilitating and supporting the training that made this study possible. We also extend our gratitude to all participants for willingly taking part in the training and contributing valuable insights and reflections through the survey. The study design, interpretation of findings, and all conclusions presented remain entirely the responsibility of the authors.

List of Abbreviations

VR: Virtual Reality
EMOTIVE: Postpartum Hemorrhage module (specific simulation module)
ABCDE: Airway, Breathing, Circulation, Disability, Exposure (emergency assessment)
PPH: Postpartum Hemorrhage
CI: Confidence Interval
CME: Continuing Medical Education (inferred from context in participant quotes)
ICT4D: Information and Communication Technology for Development
n: Number (sample size)
M: Mean
Unreal Engine: Software to develop VR content
3ds Max: third dimensions Maximum
SIM Lab App: Simulation lab application

Funding

This study did not receive any specific funding. However, Enabel (the Belgian Agency for International Cooperation) provided support for the training activities, including logistics, equipment, and workshop facilitation.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

Author Contributions

Steve Ronald Mwanje (SRM) conceptualized the study, coordinated the training activities, collected data, analyzed the findings, and drafted the manuscript.
Ambrose Felix Okello (AFO) contributed to the workshop design, data collection activities, review of study findings, and manuscript development.
Abbey Ssekalema (AS) led the review and validation of the Virtual Reality content modules and contributed technical guidance on simulation design and implementation.
Lilian Ritah Barungi (LRB) contributed to organizing training and content modeling in the work environment.
Martin Okoed (MO) contributed to the conceptualization of the study, workshop design, data analysis, interpretation of findings, and provided critical review and substantive editing of the manuscript.
Agnes Asiimwe (AA) contributed to data collection, manuscript review, and overall supervision of the study.
The workshop design was jointly developed by SRM, AFO, AS, AA, and MO. Data collection was conducted by SRM, AFO, and AA. Data analysis was undertaken by SRM and MO. Critical review, substantive editing, and supervision of the manuscript were provided by MO and AA. All authors reviewed and approved the final manuscript.

Author Biographies

Steve Ronald Mwanje - Steve Ronald Mwanje is an ICT professional, ICDL trainer, and Virtual Reality (VR) trainer with a Master of Information Technology. His professional and research interests include ICT for Development (ICT4D), digital literacy, immersive learning technologies, virtual reality in education, and digital transformation in low-resource settings. He has participated in several digital skills and innovation initiatives aimed at strengthening workforce capacity and technology adoption across Uganda.
St Simon Peter's Vocational Institute -Hoima, Uganda
Email: mwanjesteve2@gmail.com
Ambrose Felix Okello - Ambrose Felix Okello is an ICT4D professional with experience in software development and digital transformation initiatives in Uganda and beyond. He has contributed to technology integration in health training institutions and secondary schools, supporting innovation in

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

teaching, learning, and institutional management. He holds a Master of Information Technology.
Email: ambokello@gmail.com; ORCID: 0009-0006-0686-4119

Abbey Ssekalema - Abbey Ssekalema is a Virtual Reality content creator, animator, and digital media specialist at Cyberprints Ltd. He specializes in the design and development of immersive learning environments, educational simulations, animation, and interactive digital content. His work focuses on applying emerging technologies to enhance learning experiences and professional skills development. Email: abbey700@gmail.com

Lilian Ritah Barungi - An Intervention Officer – Public Health (EMS), and contributed to the organization and coordination of the training activities, as well as supporting adaptation of the training content to align with real workplace and clinical practice environments. Email: lillian.nakisozi@enabel.be

Martin Okoed - Martin Okoed is a digital transformation and learning innovation specialist with experience in ICT integration, professional development, pedagogy, and institutional development. He holds a Master of Information Technology and a Postgraduate Diploma in Educational Policy, Leadership, and Management. His work and research focus on digital transformation, technology adoption, educational innovation, and grassroots innovation in low-resource settings.

Agnes Asiimwe -Agnes Asiimwe is a registered nurse and healthcare practitioner at Guardian Health Services. She has experience in clinical practice, patient care, healthcare training, and workforce development. Her professional interests include healthcare quality improvement, emergency care preparedness, and the use of innovative technologies to strengthen healthcare education and service delivery. Email: agnesasimwe54@gmail.com

References

1. Abeni, E.-A. (2020). Andragogy: A Theory in Practice in Higher Education. *Journal of Research in Higher Education*, *4*(2), 54–69. https://doi.org/10.24193/JRHE.2020.2.4
2. Aufenanger, S., Bastian, J., Bastos, G., Castelhano, M., Dias-Ferreira, C., Fokides, E., Gavalas, D., Kasapakis, V., Agelada, A., Kostas, A., Koutromanos, G., Makrides, G., Morgado, L., Pedrosa, D., Szemberg, T., Sofos, A., & Szpond, J. (2025). Immersive virtual reality learning environments for higher education: A student acceptance study. *Computers & Education: X Reality*, *7*, 100105. https://doi.org/10.1016/j.cexr.2025.100105
3. Birkheim, S. L., Calogiuri, G., & Martinsen, R. (2023). Advancing immersive virtual reality-based simulation practices: developing an evidence-based and theory-driven pedagogical framework for VR-based simulations of non-technical skills among healthcare professionals. *Interactive Learning Environments*, 1–13. https://doi.org/10.1080/10494820.2023.2186896
4. Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, *18*(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238
5. Briese, P., Evanson, T., & Hanson, D. (2020). Application of Mezirow's Transformative Learning Theory to Simulation in Healthcare Education. *Clinical Simulation in Nursing*, *48*, 64–67. https://doi.org/10.1016/j.ecns.2020.08.006
6. Cheng, L., Pang, W. Y. J., & Kong, A. (2025). A virtual reality game for older adults' immersive learning. *Scientific Reports*, *15*(1), 22195. https://doi.org/10.1038/s41598-025-07354-2
7. Clay, C. J., Budde, J. R., Hoang, A. Q., & Gushchyan, A. (2024). An evaluation of the effectiveness of immersive virtual reality training in non-specialized medical procedures for caregivers and students: a brief literature review. *Frontiers in Virtual Reality*, *5*. https://doi.org/10.3389/frvir.2024.1402093
8. Epuitai, J., Adongo, P. R., Oboth, P., Apili, F., Kumakech, E., Owusu-Sekyere, S., & Wandabwa, J. N. (2025). Experiences and perceptions of students and faculty with clinical simulation in Uganda: an exploratory study. *BMC Medical Education*, *25*(1), 746. https://doi.org/10.1186/s12909-025-07322-4
9. Fealy, S., Jones, D., Hutton, A., Graham, K., McNeill, L., Sweet, L., & Hazelton, M. (2019). The integration of immersive virtual reality in tertiary nursing and midwifery education: A scoping review. *Nurse Education Today*, *79*, 14–19. https://doi.org/10.1016/j.nedt.2019.05.002
10. Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs: principles and practices. *Health Serv Res.*, *6*(2), 2134–2156.
11. Hanson, C., Atuhairwe, S., Lucy Atim, J., Marrone, G., Morris, J. L., & Kaharuza, F. (2021). Effects of the Helping Mothers Survive Bleeding after Birth training on near miss morbidity and mortality in Uganda: A cluster-randomized trial. *International Journal of Gynecology & Obstetrics*, *152*(3), 386–394. https://doi.org/10.1002/ijgo.13395
12. Houlden, R., & Crichton, F. (2024). Want doctors to use VR simulation? Make it mandatory,

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

accessible, educationally valuable, and enjoyable! *MedEdPublish*, *14*, 8. https://doi.org/10.12688/mep.20040.2

13. Huh, Y.-J., Kim, J. W., Yoon, N., Jeong, S., Kong, H.-J., & Myung, S. J. (2026). Immersive Virtual Reality Training to Improve Novice Physicians' Emergency Response Skills: Randomized Controlled Trial. *JMIR Medical Education*, *12*, e71455–e71455. https://doi.org/10.2196/71455
14. Johansen, F., Toft, H., Stalheim, O. R., & Løvsletten, M. (2025). Exploring the potential of virtual reality in nursing education: learners' insights and future directions. *Advances in Simulation*, *10*(1), 7. https://doi.org/10.1186/s41077-025-00337-3
15. Kaakinen, J., & Arwood, E. (2009). Systematic Review of Nursing Simulation Literature for Use of Learning Theory. *International Journal of Nursing Education Scholarship*, *6*(1). https://doi.org/10.2202/1548-923X.1688
16. Knowles, M. S. (1984). *Andragogy in Action. Applying Modern Principles of Adult Education.* Jossey-Bass.
17. Liu, Y. (2023). Analysis of Interaction Methods in VR: Virtual Reality. *Highlights in Science, Engineering and Technology*, *39*, 395–407. https://doi.org/10.54097/hset.v39i.6559
18. Merriam, S. B. (2001). Andragogy and Self-Directed Learning: Pillars of Adult Learning Theory. *New Directions for Adult and Continuing Education*, *2001*(89), 3–14. https://doi.org/10.1002/ace.3
19. Mezirow, J. (1997). Transformative Learning: Theory to Practice. *New Directions for Adult and Continuing Education*, *1997*(74), 5–12. https://doi.org/10.1002/ace.7401
20. Mosling, M., Horn, J., & Xanthoulis, A. (2026). Stepping into the virtual ward: a qualitative study on first-year residents' experiences with VR simulation. *BMC Medical Education*, *26*(1), 400. https://doi.org/10.1186/s12909-026-08729-3
21. Najjuma, J., Bajunirwe, F., Mbalinda, S., Ssedyabane, F., Mwebembezi, G., Moore, S., Kaddumukasa, M., & Atukunda, E. (2025). Barriers and Facilitators of Simulation-Based Education in Stroke Nursing Management at a Regional Referral Hospital in Southwestern Uganda: A Qualitative Study. *Advances in Medical Education and Practice*, *Volume 16*, 1317–1329. https://doi.org/10.2147/AMEP.S535086
22. Najjuma, J. N., Bajunirwe, F., Twine, M., Namata, T., Kyakwera, C. K., Cherop, M., & Santorino, D. (2020). Stakeholder perceptions about the establishment of medical simulation-based learning at a university in a low-resource setting: a qualitative study in Uganda. *BMC Medical Education*, *20*(1), 379. https://doi.org/10.1186/s12909-020-02301-3
23. Physiopedia contributors. (2026). Bibliographic details for Adult Learning Styles and Principles. *Physiopedia,* 363379. https://www.physiopedia.com/index.php?title=Adult_Learning_Styles_and_Principles&oldid=363379
24. Saab, M. M., McCarthy, M., O'Mahony, B., Cooke, E., Hegarty, J., Murphy, D., Walshe, N., & Noonan, B. (2023). Virtual Reality Simulation in Nursing and Midwifery Education. *CIN: Computers, Informatics, Nursing*, *41*(10), 815–824. https://doi.org/10.1097/CIN.0000000000001010
25. Sadeghi, M., Nematollahi, M., Farokhzadian, J., Khoshnood, Z., & Eghbalian, M. (2023). The effect of scenario-based training on the Core competencies of nursing students: a semi-experimental study. *BMC Nursing*, *22*(1), 475. https://doi.org/10.1186/s12912-023-01442-2
26. Shrestha, B., & Dunn, L. (2020). The Declaration of Helsinki on Medical Research involving Human Subjects: A Review of the Seventh Revision. *Journal of Nepal Health Research Council*, *17*(4), 548–552. https://doi.org/10.33314/jnhrc.v17i4.1042
27. Sim, J. J. M., Rusli, K. D. Bin, Seah, B., Levett-Jones, T., Lau, Y., & Liaw, S. Y. (2022). Virtual Simulation to Enhance Clinical Reasoning in Nursing: A Systematic Review and Meta-analysis. *Clinical Simulation in Nursing*, *69*, 26–39. https://doi.org/10.1016/j.ecns.2022.05.006
28. Spies, C., Seale, I., & Botma, Y. (2015). Adult learning: What nurse educators need to know about mature students. *Curationis*, *38*(2). https://doi.org/10.4102/curationis.v38i2.1494
29. Srikasem, S., Seephom, S., Viriyopase, A., Phutrakool, P., Khowinthaseth, S., & Narajeenron, K. (2025). Comparing the Effectiveness of Multimodal Learning Using Computer-Based and Immersive Virtual Reality Simulation–Based Interprofessional Education With Co-Debriefing, Medical Movies, and Massive Open Online Courses for Mitigating Stress and Long-Term Burnout in Medical Training: Quasi-Experimental Study. *JMIR Medical Education*, *11*, e70726. https://doi.org/10.2196/70726
30. Steen, C. W., Söderström, K., Stensrud, B., Nylund, I. B., & Siqveland, J. (2024). The effectiveness of virtual reality training on knowledge, skills, and attitudes of health care professionals and students in assessing and

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/sjhrafrica.v7i2.2757
Original Article

treating mental health disorders: a systematic review. *BMC Medical Education*, *24*(1), 480. https://doi.org/10.1186/s12909-024-05423-0

31. Victoria, N., Isaac, G., Jonathan, K., Charles, B. H., Esther, N. D., Kintu, M. T., Elizabeth, N., Gerald, C., Nelson, L. E., Marvin, K. A., Mwaka, F. M., Tyler, L. J., Alenyo, A. N., & Fred, B. (2025). Acute trauma care training in undergraduate medical education programs in Uganda: A cross-sectional survey of final year medical students. *African Journal of Emergency Medicine*, *15*(2), 602–606. https://doi.org/10.1016/j.afjem.2025.01.003
32. Waldock, W. J., Bucko, A. M., Ehigie, N., Briffa, C., Zalli, A., Brown, C., Cowell, A., Sam, A. H., & Walls, R. (2026). The effectiveness of virtual reality simulated scenarios at improving medical students' confidence and engagement in clinical communication: an observational cohort study. *BMC Medical Education*, *26*(1), 126. https://doi.org/10.1186/s12909-025-08384-0
33. Wilkes, S., Maggio, L. A., Martin, P. C., Melton, J., & Zheng, B. (2026). Self-Directed Learning in Health Professions Education: A Systematic Review and Meta-Analysis. *Perspectives on Medical Education*, *15*(1), 37–52. https://doi.org/10.5334/pme.2128
34. Williams, E., Bazant, E. S., Holcombe, S., Atukunda, I., Namugerwa, R. I., Britt, K., & Evans, C. (2019). "Practice so that the skill does not disappear": mixed methods evaluation of simulator-based learning for midwives in Uganda. *Human Resources for Health*, *17*(1), 24. https://doi.org/10.1186/s12960-019-0350-z
35. World Medical Association. (2013). World Medical Association declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA* (Vol. 310, Number 20, pp. 2191–2194). American Medical Association. https://doi.org/10.1001/jama.2013.281053

Publisher Details:

Student's Journal of Health Research (SJHR)

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: studentsjournal2020@gmail.com

WhatsApp: +256 775 434 261

Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa