Canadian Journal of Educational and Social Studies
Vol. 6(2), 2026, pp. 72-87

Integrating Virtual Reality in Healthcare Education: A Needs Assessment from the Perspective of Moroccan Medical Students

Amal Barkouk[1] & Manar Jallal[2] & Zineb Serhier[3] & Mohammed Bennani Othmani[4]

[1,2,3,4] Department of Medical Informatics, Faculty of Medicine and Pharmacy of Casablanca, Hassan II University, Casablanca, Morocco
Correspondence: Amal Barkouk, Hassan II University, Morocco
Email: amalbarkouk@gmail.com

DOI: 10.53103/cjess.v6i2.470

Abstract

Background: Virtual reality (VR) provides immersive simulation platforms for clinical skills development in safe environment. The developing landscape, Morocco included, lacks localized evidence on institutional readiness and implementation needs. This study aims to assess needs, barriers, and readiness for VR-based learning from Moroccan students' perspectives. Methods: A descriptive cross-sectional study was held at the Faculty of Medicine and Pharmacy of Casablanca, involving 86 medical students. Data was collected using a structured questionnaire including demographics, VR experience, expectations, and implementation requirements. Descriptive and univariate analysis were used. Results: While 88.4% of students knew about VR, only 27.9% had ever used it. However, acceptance was universal (96.5%) with preferred applications including surgery (80.2%), emergency medicine (50%), and anatomy (98.8%). Realistic scenarios (75.6%), adaptive content (67.4%), and high-quality rendering (60.5%) were demanded by the students. No significant associations were found between acceptance and demographics ($p>0.05$). Conclusion: Moroccan medical students demonstrate strong VR readiness. Effective implementation requires treating connectivity issues, creating locally relevant resources, and ensuring organizational support for formal curricular integration.

Keywords: Virtual Reality, Medical Education, Medical students, Morocco, Needs Assessment

Introduction

Medical education is witnessing a rapid transformation as digital learning technologies are increasingly used along with the traditional didactic methods (Tokuç & Varol, 2023). One of the major drivers of this landscape change is virtual simulation (VS), in the form of Virtual reality (VR) or Augmented reality (AR), which offers students a highly immersive and interactive environment where they can develop clinical skills, such as clinical reasoning and communication, without exposing real patient to any safety risks

(Keskitalo, 2012). Globally, VS is recognized for being a safe, low-stakes platform where learners can practise skills and even make mistakes with no harm in a replicated clinical setting (Q. Wu et al., 2022). The Middle East and North Africa (MENA) region is increasingly placing strategic emphasis on the modernisation of education through e, learning and incorporating 21st century skills to equip future health workers with the required competencies (World Health Organization, 2021).

Global evidence confirms that VS-based instruction effectively enhances learners' knowledge, psychomotor skill acquisition, and overall satisfaction (Kim & Kim, 2023). These technologies are especially helpful in teaching complex spatial relationships in anatomy and improving hand-eye coordination in surgical procedural training (Ahsan, 2025). However, switching to virtual platforms is often hindered by high initial setup costs, the lack of compatible hardware, and unstable internet connectivity (Ahsan, 2025; Mukhtar et al 2020; Arif et al., 2024). Furthermore, many instructors think the technology is a beneficial addition, but they lack the necessary techno-pedagogical skills to integrate VS effectively into existing curricula (Ewais et al., 2022).

For an effective implementation of VS, a structured approach, such as the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model, is required. This type of model usually starts with an evaluation of contextual requirements (Garira, 2020). While some regional peers have begun exploring staff readiness and infrastructure (Muinga & Paton, 2019; Li et al., 2024; Otuyemi et al., 2025), a lack of published research on medical education in Morocco remains lacking. Since challenges across institutions and geographical locations are varied, there is still insufficiency of evidence from high-income or different regional contexts. Currently, it seems there is a lack of a localized analysis of institutional readiness, regulatory obstacles, and stakeholder expectations in Morocco. This study aims to fill this gap by assessing the specific needs, barriers, and infrastructure readiness for developing virtual simulation in Moroccan medical schools.

Methods

This was a descriptive cross-sectional study conducted in April 2025 at the Faculty of Medicine and Pharmacy of Casablanca, Morocco. The study population included First year to sixth year students in General Medicine. A stratified probabilistic sampling was used by year of study and clustered by students theoretical and practical courses for the preclinical students (year 1 and 2) and rotation groups for the clinical students (year 3 to year 6).

Data was collected using a self-administered structured questionnaire designed based on relevant articles. Besides demographic data (age, sex, study year), the developed questionnaire covered items on students' previous experience with VR and their expectations of the potential of VR integration into medical curricula. This also included the assessment of assumed advantages and disadvantages. Additional free-text answers

could be submitted to suggest ideas on VR training scenarios. For the analysis of free-text answers, we grouped them according to disciplines and provided reasons for the participant's decision and reported the most given answers. The instrument was designed specifically for this study and was not pretested or validated prior to data collection due to time constraints and the exploratory nature of the research, which aimed primarily to obtain a preliminary overview of students' experiences and perceptions.

The sample size was calculated using Epi Info software, based on the assumption that 95.2% of students believe virtual reality should be integrated into medical education, according to a study conducted in Germany (Mergen et al., 2023). With a precision of 5% and a 95% confidence level, the minimum required sample size was estimated at 76 students. No identifying personal information such as names or addresses was collected from the participants.

Jamovi Version 2.3.21, was used for statistical analysis. Besides descriptive statistics, the integrated Chi-Square Test of Independence was performed to assess for significant associations between categorical variables. In case the test's requirements were not fulfilled, the Fisher Exact test was applied to determine any significant relationship. $p < 0.05$ was defined as the threshold for statistically significant test results.

Results

A total of 86 medical students took part in the study. The median age of the students was 20 years, ranging from 18 to 27. The participants were 60.5% male (n=52), and 39.5% female (n= 34). The students were spread out equally across all stages of their medical education. Most of them had access to online courses (62.8%). Almost half of the students (44.2%) used high-speed home internet to access these courses, 11.1% used the university network, 13.9% used mobile data, and 7.0% used public Wi-Fi hotspots. For learning mediums, smartphones were the most common, used by 53.7% of the participants, followed by laptops (38.9%), tablets (27.8%), and desktop computers (3.7%). Regular videos were the most reported preferred type of content (30.3%), followed by interactive videos (27.8%), and reading resources like PDFs or articles (27.8%), while virtual simulations and multi-choice scenarios were not as popular, with 9.3% and 1.9% respectively (Table 1).

Table 1: Sample characteristics

Variable	Category	Count	Frequency (%)
Age (median, range)	20 (18–27)		
Sex	Male	52	60.5
	Female	34	39.5
Year of study	1st year	14	16.3
	2nd year	15	17.4
	3rd year	17	19.8
	4th year	13	15.1
	5th year	13	15.1
	6th year	14	16.3
Have access to online courses	Yes	54	62.8
	No	32	37.2
Internet connection type	High-speed home internet connection	38	70.4
	University internet connection	6	11.1
	Mobile data	7	13.0
	Public Wi-Fi hotspots	2	3.7
Device used	Desktop computer	2	3.7
	Tablet	15	27.8
	Laptop	21	38.9
	Smartphone	29	53.7
Most preferred media for online learning	Document (PDF, articles)	15	27.8
	Regular videos	18	33.3
	Interactive videos	15	27.8
	Virtual simulation	5	9.3
	Multi-choice scenarios	1	1.9

Type of Training Sought Online

Online courses in medical or scientific subjects were the most sought type of training by the students (27%), followed by clinical reasoning or case management (19%), while desired supplementary explanatory content for reinforcement was at 16%. Fewer students used virtual reality-based training for immersive experience (10%) or sought specialized topics like anatomy or imaging (9%). Only 5% of the students reported taking

research and methodology courses, and 4% took content outside the medical sphere, while other 4% had not participated in any online training (4%).

Challenges during Online Learning

Students reported many difficulties during online learning. The most common reported issues were information overload and inadequate content organization (52%), personal challenges, such as low motivation or difficulty retaining focus (22%), and limited opportunities for interaction or asking questions (18%). Poor internet connectivity was reported as a technical issue (14%). Some students indicated lack of high-quality or relevant learning materials (14%), while a smaller proportion faced language barriers or financial constraints related to access to paid content (4%).

VR Experience

Among the 86 respondents, the majority (88.4%) reported being familiar with the concept of VR, but only 27.9% had used it before. They experienced mostly through video games (75%) and entertainment-related applications (45.8%), while fewer students used VR for medical training (12.5%) or research purposes (4%) (Figure 1). Most students (82.6%) reported VR not being currently used in medical school. If present, its use was limited to clinical procedure simulation (8.1%), emergency training (9.3%), and anatomy education (4.7%). Despite the limited exposure, the majority (96.5%) indicated that VR should be integrated into medical education.

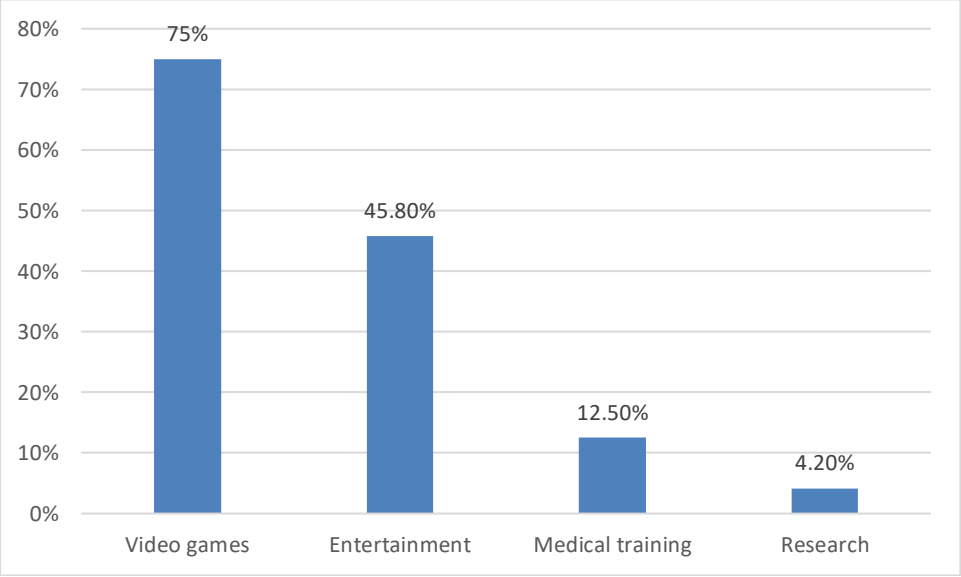

Figure 1: General VR usage domains

VR Integration

Surgery (80.2%), Emergency Medicine (50%), General Medicine (45.3%), Gynecology (38.4%), and Ophthalmology (36%) were the most valuable specialties identified by students (Figure 2). At the preclinical level, almost all students (98.8%) considered anatomy to be the subject benefitting the most from VR-based learning, followed by physiology (50%), biology (24.4%), and physics (18.6%) (Figure 3). Regarding the teaching formats, students perceived practical or hands-on sessions (91.9%), followed by seminars (38.4%), and traditional lectures (29.1%) as the most valuable (Figure 4).

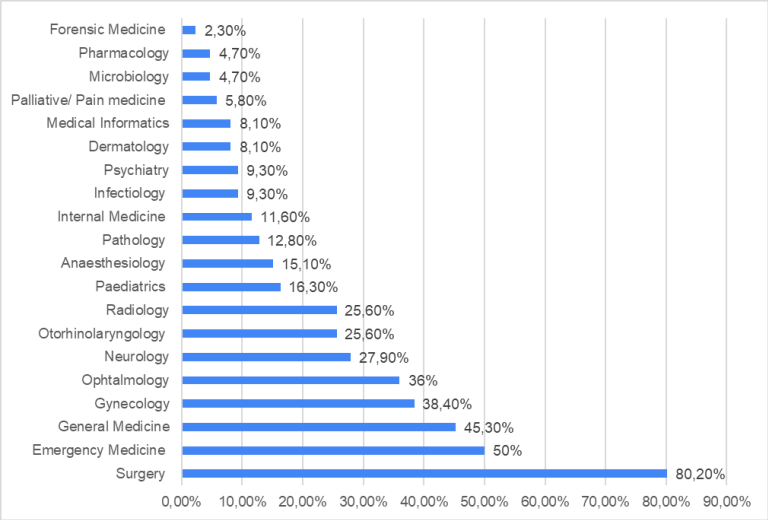

Figure 2: Most valuable clinical specialties taught by VR

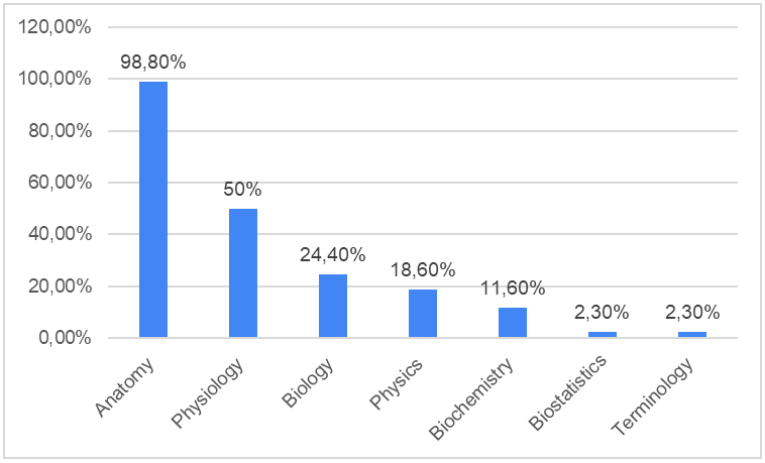

Figure 3: Most helpful preclinical subjects taught by VR

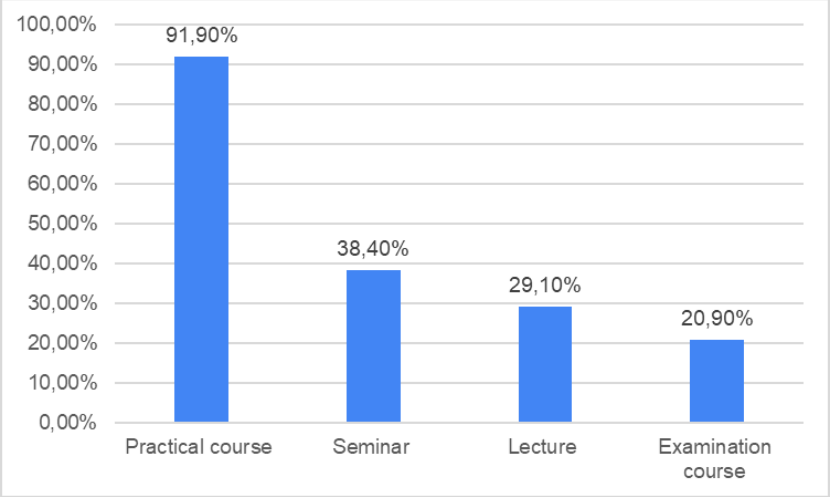

Figure 4: Teaching formats in VR

The students identified 3D anatomical visualization (77.9%), clinical skills training (68.6%), and simulated patient case practice (30.2%) as the most helpful applications of VR. Fewer people thought VR was useful for interprofessional collaboration (15.1%) or for nursing skills training (25.6%) (Figure 5). The most frequently mentioned technical needs for VR learning were realistic medical situations (75.6%), high-quality image rendering (60.5%), opportunities for scenario repetition (60.5%), and adaptive content to the student's skill level (67.4%) (Figure 6). Most students (37.2%) favored VR sessions lasting 30 to 45 minutes, while 34.9% preferred shorter sessions of 15 to 30 minutes (Figure 7).

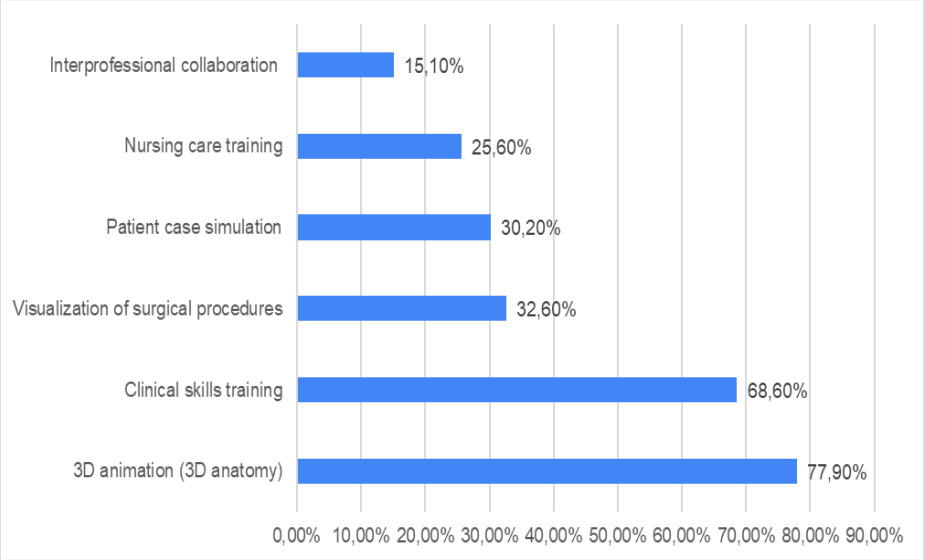

Figure 5: Most helpful applications of VR

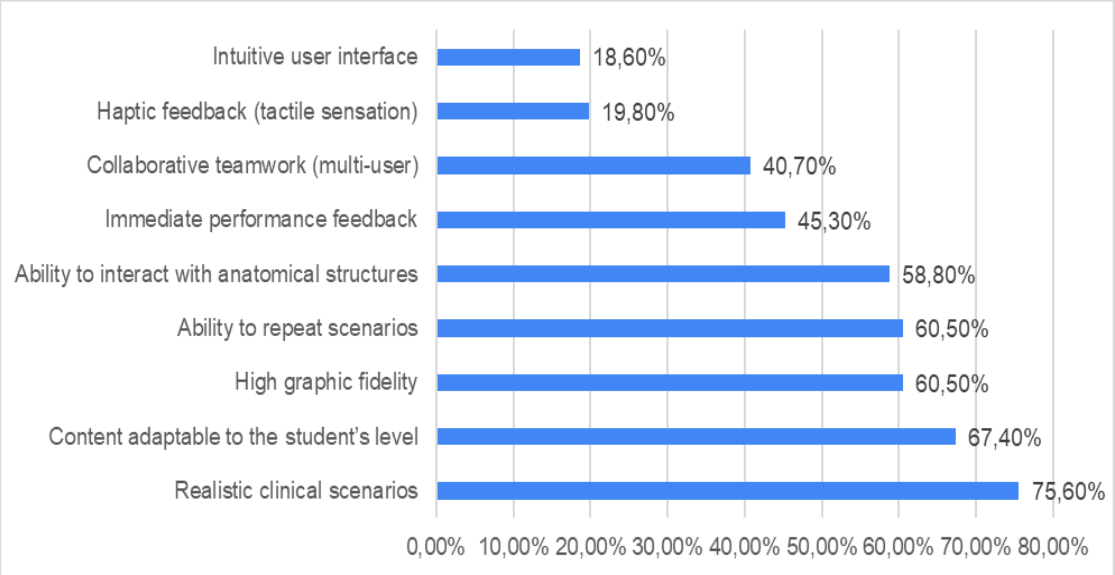

Figure 6: technical needs in VR applications

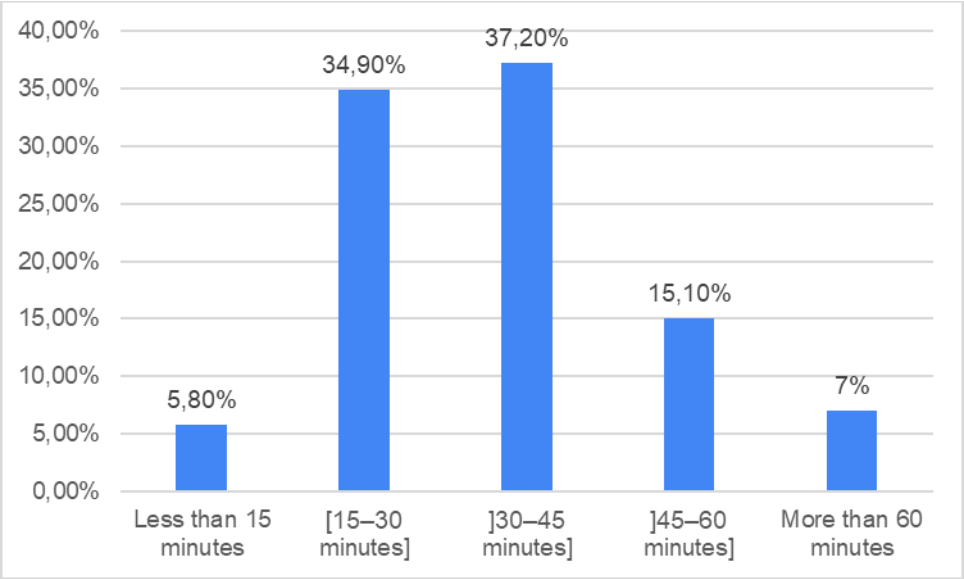

Figure 7: Preferred sessions durations

Students reported several potential benefits of VR in medical education. The most frequently cited advantage was increased confidence in clinical practice (64%), preparedness for real-life clinical situations (36%). Moreover, 32.6% of the students saw the value of simulating rare or complex conditions, while 31.4% reported enhancements in clinical reasoning skills (31.4%). Fewer participants emphasized the immersive nature of VR-based learning (26.7%). Only one respondent (1.2%) said that VR offered no educational benefit (Figure 8).

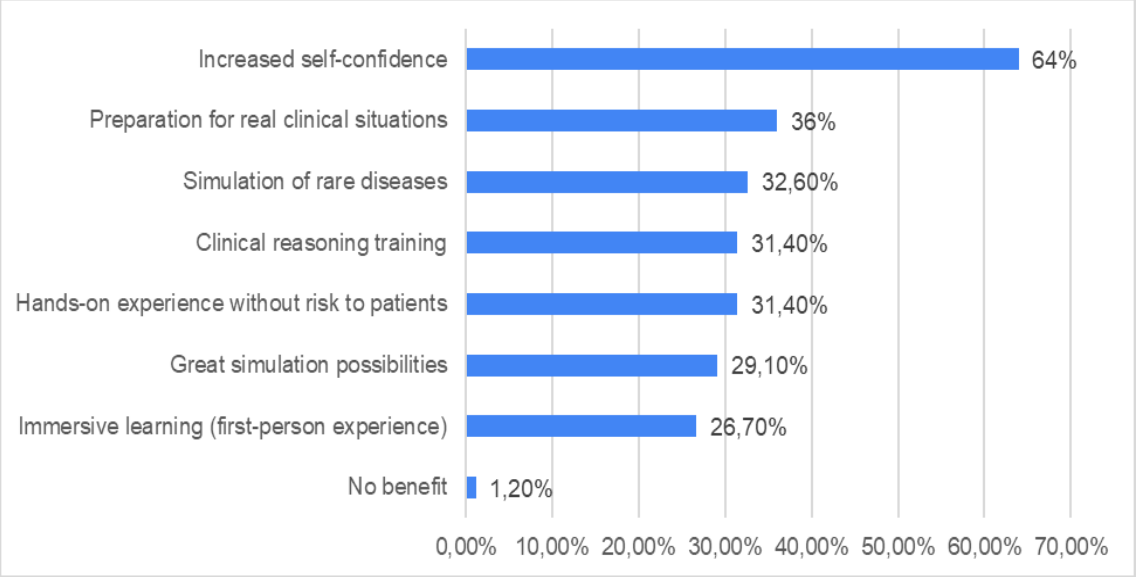

Figure 8: Perceived potential benefits of VR integration in medical education

Suggested Scenarios

When asked to suggest future applications of VR in medical education, 26% of students suggested clinical case simulations, followed by emergency situations (17%), and surgical procedures (16%). Anatomical training was chosen by 9% of the respondents, while 3% of them mentioned training for rare or complex cases, and another 3% asked for training in technical procedures. Some students did not provide any suggestions (25%).

Hopes for VR Development

Analysis of open-ended responses revealed that formal integration of VR in medical training programs is necessary (42%), followed by improving accessibility and ease of use of VR technologies (18%) and offering better opportunities for clinical skills training (15%). Some students believed VR could help reduce medical errors (6%) or facilitate future changes in how medical education is carried out (8%), while fewer students emphasized the need for rapid implementation (4%). Some students were unsure or did not provide an opinion on future VR development (7%).

Factors Associated with VR Usage

Table 2 shows the factors associated with past VR usage among medical students. Male students reported higher VR usage than females (38.2% vs. 21.2%), although the association was not statistically significant (p = 0.084). VR usage was more frequent

among students in the early years of medical training, particularly in the 1st and 2nd years, and decreased progressively in later years; however, this association was not significant (*p* = 0.177). Students with prior knowledge of VR reported higher usage compared with those without such knowledge (31.6% vs. 0%), with unsignificant association (p=0.056).

Table 2: factors associated with past VR usage

Factors	Yes N (%)	No N (%)	P-value
Sex			
Female	11 (21.2)	41 (78.8)	0.084
Male	13 (38.2)	21 (61.8)	
Study year			
1st year	6 (42.9)	8 (57.1)	
2nd year	7 (46.7)	8 (53.3)	
3rd year	4 (23.5)	13 (76.5)	0.177
4th year	3 (23.1)	10 (76.9)	
5th year	3 (23.1)	10 (76.9)	
6th year	1 (7.1)	13 (92.9)	
Knowledge of RV			
Oui	24 (31.6)	52 (68.4)	0.056
Non	0 (0.0)	10 (100)	

Factors Associated with Acceptance of VR

The analysis revealed universally high VR acceptance (>95%) among medical students with no statistically significant differences across age (p=0.962), sex (p=1.000), study year (p=0.548), or prior VR usage (p=0.557) (Table 3). Acceptance rates were nearly identical between females (96.2%) and males (97.1%) and consistent across all study years, ranging from 92.3% to 100%, with peak acceptance observed in years 2-3. Acceptance of VR integration was high among students with no prior VR exposure (95.2%), on par with those who had some VR experience (100%).

Table 3: Factors Associated with VR Acceptance

Factors	Yes N (%)	No N (%)	P-value
Age in years: median (min-max)	20 (18-27)	22 (18-23)	0.962
Sex			
Female	50 (96.2)	2 (3.8)	1.000
Male	33 (97.1)	1 (2.9)	
Study year			
1st year	13 (92.9)	1 (7.1)	
2nd year	15 (100.0)	0 (0.0)	
3rd year	17 (100.0)	0 (0.0)	0.548
4th year	12 (92.3)	1 (7.7)	
5th year	13 (100.0)	0 (0.0)	
6th year	13 (92.9)	1 (7.1)	
Usage of VR			
Yes	24 (100.0)	0 (0.0)	0.557
No	59 (95.2)	3 (4.8)	

Discussion

Our study shows that Moroccan medical students have high digital access but low exposure to VR learning. Access to online courses was mostly via smartphones and high-speed internet (62.8%), but only 27.9% of the students had prior experience with VR, usually for entertainment purposes. Nevertheless, 96.5% accepted VR integration, a sign of a strong receptiveness to innovation. Students reported information overload (52%), lack of motivation (22%), and low interactivity (18%) as hindrances to successful online learning. They believed that clinical skills training, including surgery (80.2%) and emergency medicine (50%) would greatly benefit from VR, as well as preclinical disciplines such as anatomy (98.8%). Most students preferred that the VR session would last 30-45 minutes, and that realistic scenarios (75.6%) and adaptive content (67.4%) would be prioritized in technical development.

The high acceptance rate is consistent with the literature. Immersion uses autonomy, clear goals, and feedback affecting inner motivation (Wenk et al., 2023). The students in our study hope VR will help improve confidence and prepare them for real clinical situations, which shows how VR has a potential to address the proven stress related to theory-based practice. Overcoming the engagement and focus difficulties on the current online learning format relies on this motivational pull. The passivity and distraction associated with traditional digital content can be improved thanks to the immersive quality of VR, by producing an active engagement in the learning process (Barton et al., 2020).

The 3D embodiment aspect of VR is particularly useful in spatial learning and psychomotor skills training, which explains the prevalent VR usage in anatomy and clinical

skills training, while providing a safe space for practice without risk, making VR a proven pedagogical learning medium (Bani Salameh et al., 2024; Jallad & Işık, 2025). This goes on par with the usage of VR for better "clinical reasoning or case management" and "supplementary explanatory content". Furthermore, medical students possess various learning styles - kinesthetic, visual, and auditory – sensory aspects knowingly associated with the flexible quality of VR (B. Wu et al., 2020). VR can also support personalized learning by customizing scenarios and adjusting difficulty based on skill level, while assuring an opportunity for case repetition, thus addressing issues of information overload, focus retention and varying skill levels reported by the students.

The implementation process is not without major barriers. Our study emphasizes challenges related to infrastructure and medical curriculum similar to other developing settings (Chimbganda et al., 2024). Connectivity and accessibility issues require VR solutions to must be low-bandwidth and compatible across platforms. The use of technologies like H5P in low-connectivity environments is also highlighted in the literature, which is also applicable in Morocco, especially in varying accessibility contexts (Aisyah et al., 2025). Moreover, there is a remarkable lack of high-quality localized content, warranting an effective integration by developing VR scenarios that are relevant to the Moroccan medical curriculum and healthcare environment.

Students' suggestions can be a useful addition for improvement. The technical development can benefit from their need of "realistic medical situations," "high-quality rendering," and "adaptive content". The students also need adjustable, tailored scenarios to guarantee adherence and prolonged engagement, while preventing fatigue by setting the session duration at 30-45 minutes (Ratan et al., 2025). Furthermore, technology alone is not enough, there needs to be a "formal integration into training programs", as stated by the students. Institutional support must be assured, with faculty development, and curriculum integration, in order to create a facilitating environment. An actionable implementation roadmap would proceed with high-impact, cost-effective modules (such as anatomy and fundamental clinical procedures) that can be simulated and run on commonly accessible devices, starting as a supplement to existing methods, to gradually familiarize the students and staff alike. Faculty members and educators must be involved in the design process to develop clinically accurate and pedagogically sound content.

Limitations

This study has limitations. The sample size obtained is moderate, and sourced from a single institution, which may affect the generalizability of the results to all Moroccan medical schools. The cross-sectional design only allows for measurement at a single, specific point in time. Moreover, this study only explores acceptance and expectations, and does not evaluate learning efficacy, an outcome potentially assessed in future interventional studies.

Conclusion

This requirement analysis demonstrates how VR is an important tool to be integrated within the Moroccan medical education landscape. The limitations of the current digital learning system can be mitigated using immersive, practical, and adaptive learning tools, as clearly shown by the students' high level of acceptance and clear expectations for VR use. These needs should drive the successful development and implementation of VR technology, by creating accessible and relevant resources for the Moroccan medical education system, thus contributing to a more skilled future healthcare workforce.

References

Ahsan, Z. (2025). Integrating artificial intelligence into medical education: A narrative systematic review of current applications, challenges, and future directions. *BMC Medical Education*, *25*(1), 1187. https://doi.org/10.1186/s12909-025-07744-0

Aisyah, D. N., Setiawan, A. H., Lokopessy, A. F., Mayadewi, C. A., Endryantoro, M. T. A., Wibowo, V., et al. (2025). Assessing internet quality across public health centers in Indonesia: Cross-sectional evaluation study. *JMIR Medical Informatics*, *13*, e65940. https://doi.org/10.2196/65940

Arif, L. S., Soemantri, D., & Findyartini, A. (2024). Needs analysis of virtual reality implementation in Indonesian medical curricula: A qualitative study. *Education in Medicine Journal*, *16*(3), 59–75. https://doi.org/10.21315/eimj2024.16.3.6

Bani Salameh, A. K., Malak, M. Z., El-Qirem, F. A., Alhussami, M., & El-hneiti, M. (2024). Effect of virtual reality simulation as a teaching strategy on nursing students' satisfaction, self-confidence, performance, and physiological measures in Jordan. *Teaching and Learning in Nursing*, *19*(1), e235–e241. https://doi.org/10.1016/j.teln.2023.11.005

Barton, A. C., Sheen, J., & Byrne, L. K. (2020). Immediate attention enhancement and restoration from interactive and immersive technologies: A scoping review. *Frontiers in Psychology*, *11*, 2050. https://doi.org/10.3389/fpsyg.2020.02050

Chimbganda, S., Moyo, T., & Moyo, C. (2024). Barriers to virtual reality implementation for health and safety training of construction workers in Zimbabwe. In *Development and investment in infrastructure in developing countries: A 10-year reflection*. CRC Press.

Ewais, A., Salah, Z., & Hamed, G. (2022). Need analysis for higher educational institutions for using virtual reality – TESLA project: Staff willingness and readiness for using VR in teaching. *International Journal of Emerging Technologies in Learning*, *17*(22), 216–231. https://doi.org/10.3991/ijet.v17i22.34355

Garira, E. (2020). Needs assessment for the development of educational interventions to

improve quality of education: A case of Zimbabwean primary schools. *Social Sciences & Humanities Open*, *2*(1), 100020. https://doi.org/10.1016/j.ssaho.2020.100020

Jallad, S. T., & Işık, B. (2025). The effectiveness of immersive virtual reality simulation as an innovative learning strategy for acquisition of clinical skills in nursing education: Experimental design. *Games for Health Journal*, *14*(2), 110–118. https://doi.org/10.1089/g4h.2023.0139

Keskitalo, T. (2012). Students' expectations of the learning process in virtual reality and simulation-based learning environments. *Australasian Journal of Educational Technology*, *28*(5). https://doi.org/10.14742/ajet.820

Kim, H. Y., & Kim, E. Y. (2023). Effects of medical education program using virtual reality: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, *20*(5), 3895. https://doi.org/10.3390/ijerph20053895

Li, X., Elnagar, D., Song, G., & Ghannam, R. (2024). Advancing medical education using virtual and augmented reality in low- and middle-income countries: A systematic and critical review. *Virtual Worlds*, *3*(3), 384–403. https://doi.org/10.3390/virtualworlds3030021

Mergen, M., Meyerheim, M., & Graf, N. (2023). Towards integrating virtual reality into medical curricula: A single center student survey. *Education Sciences*, *13*(5), 477. https://doi.org/10.3390/educsci13050477

Muinga, N., & Paton, C. (2019). Virtual reality for medical and nursing training in low- and middle-income countries. *Pathways for Prosperity Commission.*

Mukhtar, K., Javed, K., Arooj, M., & Sethi, A. (2020). Advantages, limitations and recommendations for online learning during COVID-19 pandemic era. *Pakistan Journal of Medical Sciences*, *36*(COVID19-S4). https://doi.org/10.12669/pjms.36.COVID19-S4.2785

Otuyemi, O. D., Ijarotimi, O. A., Komolafe, A. O., Aregbesola, S. B., Adetutu, O. M., Akinwale, O. B., et al. (2025). Adopting virtual reality in medical education: Insights from clinical students and lecturers in a Nigerian university. *Nigerian Journal of Clinical Practice*, *28*(5), 582. https://doi.org/10.4103/njcp.njcp_739_24

Ratan, R., Lin, Q., Lim, C., Park, R., Lover, A., Han, E., et al. (2025). Time matters in VR: Students benefit from longer VR class duration, but certain outcomes decline after 45 minutes, with large individual variance. *Computers & Education*, *235*, 105328. https://doi.org/10.1016/j.compedu.2025.105328

Tokuç, B., & Varol, G. (2023). Medical education in the era of advancing technology. *Balkan Medical Journal*, *40*(6), 395–399. https://doi.org/10.4274/balkanmedj.galenos.2023.2023-7-79

Wenk, N., Penalver-Andres, J., Buetler, K. A., Nef, T., Müri, R. M., & Marchal-Crespo, L. (2023). Effect of immersive visualization technologies on cognitive load, motivation, usability, and embodiment. *Virtual Reality*, *27*(1), 307–331. https://doi.org/10.1007/s10055-021-00565-8

World Health Organization. (2021). *Global strategic directions for nursing and midwifery 2021–2025* (1st ed.). World Health Organization.

Wu, B., Yu, X., & Gu, X. (2020). Effectiveness of immersive virtual reality using head-mounted displays on learning performance: A meta-analysis. *British Journal of Educational Technology*, *51*(6), 1991–2005. https://doi.org/10.1111/bjet.13023

Wu, Q., Wang, Y., Lu, L., Chen, Y., Long, H., & Wang, J. (2022). Virtual simulation in undergraduate medical education: A scoping review of recent practice. *Frontiers in Medicine*, *9*, 855403. https://doi.org/10.3389/fmed.2022.855403