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Virtual patient simulation to enhance medical students' clinical communication and decision-making skills: a pilot study

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Abstract

Background The integration of virtual reality (VR) into medical education has accelerated globally over the past decade, offering immersive and risk-free learning environments. This pilot study explores the impact of VRPatients™-Meta Quest 3 simulations in clinical communication and decision-making among medical students.

Methods In a mixed-methods design, eleven undergraduate medical students participated in two VR sessions during the spring semester of the 2024/25 academic year. The pilot course was organized into two instructional blocks, each comprising three 90-minute sessions delivered over two consecutive weeks, incorporating VR-based training as part of the learning activities. A matched pre- and post-course survey measured the participants' comfort with VR, perceived realism, confidence in clinical communication and decision-making, openness to VR integration into their studies, and headset usability using 5-point Likert scales and open-ended questions, followed by focus group interviews. Descriptive statistics and thematic analysis were performed.

Results Post-intervention mean scores improved markedly in VR comfort (3.0 ± 0.8 to 4.6 ± 0.5), communication confidence (3.0 ± 1.1 to 4.5 ± 0.5), and decision-making confidence (2.9 ± 0.9 to 3.8 ± 0.9). Headset usability and comfort was rated highly (4.7 ± 0.5). Thematic analysis of the qualitative results revealed that students regarded immersion, clinical communication practice, and safe decision-making environments as key benefits. All participants recommended the curricular integration of VR.

Conclusion This pilot study provides preliminary evidence that immersive VR simulation can significantly enhance medical students' clinical communication and decision-making skills in a safe, low-risk environment. The intervention was well-received and demonstrated technical feasibility. Larger controlled trials, objective outcome measures, and longitudinal evaluation are warranted to solidify VR's role in medical education.

Keywords Virtual reality, Virtual patients, Medical education, Simulation, Clinical communication, Decision-making

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Introduction

Medical education is undergoing significant transformation, driven by the need to prepare future physicians with competencies essential for navigating increasingly complex clinical situations. Simulation-based education has become an important asset in medical training, offering innovative methods to bridge the gap between theoretical instruction and real-world clinical experience, and fostering competencies such as clinical reasoning, effective communication, and patient-centred decision-making [1–3]. Lately, traditional learning environments, constrained by ethical considerations, logistical barriers, and patient safety concerns, are increasingly supplemented by simulation-based methodologies, such as manikins or simulated patients [4–7]. These methods provide safe, repeatable, and ethically appropriate opportunities for learners to practice and hone essential skills. Within this context, the emergence of immersive virtual reality (VR) environments represents a significant technological breakthrough, with vast opportunities for pedagogical applications. VR's ability to offer real-time, responsive, and highly immersive simulations transforms the learning landscape by promoting not only technical proficiency but also crucial non-technical competencies such as empathy, cultural sensitivity, communication, and team collaboration [8, 9].

Contrary to conventional simulation tools that often require significant physical resources and dedicated spaces, VR provides flexibility, scalability, and portability. It enables educators to design varied clinical scenarios with high degrees of realism and interactivity, allowing for broad deployment in settings that may otherwise lack access to advanced simulation infrastructure. VR is particularly advantageous in replicating high-risk, low-frequency events that are rarely encountered during regular training but are important for clinical preparedness [10]. VR also supports deliberate practice, a pedagogical strategy that emphasizes repeated exposure, reflection, and refinement of complex skills. This approach is beneficial for the development of clinical reasoning, judgment, and decision-making capabilities [2, 11–14].

These possibilities hold exceptional promise for preclinical students and multicultural learning environments. Opportunities available for students for hands-on clinical engagement are often limited by institutional constraints, patient availability, or language proficiency gaps. VR can mitigate these barriers by providing structured, linguistically and culturally tailored scenarios that allow learners to experiment without fear of judgment or error.

A growing body of evidence supports the educational value of VR and virtual patients (VPs). Cook et al. [11] noted that virtual patient simulations encourage not only analytical reasoning but also the development of intuitive, experience-based clinical thinking. Other studies, including those by Consorti et al. [15] and Saleh [16], support the role of VR in skill acquisition without compromising patient safety, highlighting its efficacy as both a teaching and assessment tool. Technological advances, such as the widespread use of ChatGPT, have since enabled the development of AI-powered virtual patients that can adapt to learner behaviours and input in real-time, thus simulating more lifelike interactions [17].

Despite the growing evidence for simulation-based learning, limited research has explored immersive VR applications within multicultural and trilingual medical training environments, particularly using the Meta Quest 3 and VRPatients™ platform to support communication-focused education. Recent research from the region demonstrates that high-fidelity simulation plays a significant role in strengthening clinical competence and learner confidence. Ayed et al. [18] reported that simulation markedly improves clinical decision-making among nursing students, while Toqan et al. [19] found substantial gains in self-satisfaction and self-confidence following immersive training. Additional studies by Jawabreh et al. [20] and Hodrob et al. [21] further confirmed that high-fidelity simulation enhances students' clinical practice, performance, and confidence across mental health and airway-management scenarios. Collectively, these findings highlight the strong educational value of simulation-based learning and support the integration of advanced immersive technologies into health professions education.

As the first wave of Gen Alpha students enters higher education, their familiarity with digital technologies, preference for interactive and gamified learning, and expectation for personalized learning experiences make VR particularly well-suited to their needs. Integrating VR aligns with these characteristics, supporting engaging, future-ready, and culturally responsive education.

In response to this identified gap above, the University of Pécs Medical School (UPMS) designed and piloted a novel VR-based training course, delivered through Meta Quest 3 headsets and supported by the VRPatients™ software, presenting a compelling case for investigating VR's effectiveness in diverse educational contexts. UPMS offers trilingual medical education (in English, German, and Hungarian), creating a unique learning environment for both local and international students, as reflected in studies using the DREEM framework to evaluate medical education in Hungary [22]. This multilingual and multicultural classroom setting not only embodies the opportunities of internationalised medical training but also highlights the challenges of developing intercultural competences in diverse cohorts [23–26].

Therefore, the pilot course was conceptualized to address the following critical areas: enhancing core clinical competencies, particularly clinical reasoning and communication skills, and simultaneously equipping students to navigate the complexities of communicating with diverse patient populations in a multicultural healthcare context. Given VR's capacity for personalization and experiential learning, it offers a fitting response to these needs, providing equitable and engaging learning environments that support competence development across cultural contexts. This alignment makes VR particularly relevant in a trilingual, multicultural institution such as UPMS, where both academic and intercultural challenges shape the student experience. Through carefully designed scenarios and scaffolded learning structures, VR has the potential to create equitable, engaging, and future-ready educational environments that resonate across cultural divides. Thus, the course provides a foundation for evaluating how VR can be scaled and adapted to other medical schools seeking to enhance both clinical and cross-cultural training.

Theoretical background

The design and teaching approach of this pilot course were grounded in established learning theories. *Experiential learning theory* stood as a base concept, which views learning as a cycle of concrete experience, reflection, conceptual understanding, and active experimentation [27, 28]. The immersive, scenario-based nature of virtual patient simulations aligns exceptionally well with this framework, providing students with opportunities to apply clinical knowledge in realistic, risk-free environments, reflect on their performance using feedback provided by both the software and the educators, and refine their approach through repeated engagement.

Additionally, the course drew on *situated learning theory* [29], emphasizing the crucial importance of authentic contexts and social participation in developing professional competencies. By engaging students in interactive clinical scenarios that mirror real-world complexity, the course aimed to bridge the gap between theoretical knowledge and practical application, particularly in the areas of clinical reasoning and patient communication with diverse populations. These theoretical underpinnings supported the structured design of the virtual simulation tasks, the deliberate scaffolding of language and communication challenges inherent in a multicultural learning environment, and the framework for debriefing activities.

Building on this foundation, the present pilot study sought to explore how such a theoretically informed virtual patient simulation course could support the development of clinical communication and reasoning skills in undergraduate medical students. To examine its educational value and feasibility, the study was guided by the following research questions:

RQ1: How does participation in a virtual patient simulation class influence medical students' clinical reasoning and communication skills?
RQ2: How do medical students perceive the educational value of immersive virtual patient simulations in clinical training?
RQ3: How feasible and effective is the integration of immersive virtual patient simulations into the undergraduate medical curriculum?

By addressing these questions, the study contributes to the growing body of research on virtual simulation-based medical education and offers practical insights into the pedagogical, technological, and curricular implications of incorporating immersive virtual patient experiences into undergraduate medical training.

Methods

A multidisciplinary team of medical doctors, medical communication specialists, simulation and educational technology experts, and instructional designers developed a modular VR-based training programme using the VRPatients™ platform. Meta Quest 3 headsets were selected for their portability, ease of use, and immersive capabilities. The training was designed around clinical scenarios involving virtual patients of varied backgrounds, presenting common but challenging medical complaints, such as acute shortness of breath, or concussion. The emphasis was on history-taking, diagnostic reasoning, and therapeutic planning.

Participants were recruited through open course announcements and online communication channels. Enrolment was voluntary, without incentives, and the study employed a convenience sampling approach appropriate for a pilot investigation.

Given the small sample size (n = 11), only descriptive statistics were used to summarize data patterns. Recent methodological literature emphasizes that pilot studies are exploratory in nature and not designed primarily for hypothesis testing, therefore, formal power calculations or inferential analyses are not required [30, 31]. These sources recommend focusing on descriptive measures such as means and standard deviations to assess feasibility and identify data trends. Applying inferential statistics to such limited data would risk overinterpretation and lack generalizability [32]. Furthermore, as this was a brief pilot course comprising two VR sessions, the short exposure period constrains conclusions regarding long-term learning effects.

Course structure

With the intention to prepare students for the immersive learning experience, the first session commenced with structured VR familiarization, followed by targeted lead-in exercises: terminology-building, communication tasks and scenario-specific clinical orientation activities. The simulation exercises were subsequently complemented by guided debriefing sessions that emphasized clinical reasoning, the effectiveness of communication strategies, and the integration of medical knowledge into practice.

The pilot course was conducted in the spring semester of 2025 with eleven undergraduate medical students. The course was delivered in English, and participants completed six 90-minute sessions, held in two blocks, each combining VR simulations with guided pre- and post-activities, including communication practice tasks. VR simulation sessions were executed using the VRPatients™ platform and Meta Quest 3 headsets. Scenarios employed during the sessions emphasized clinical history taking, setting up diagnosis, and practising clinical communication skills. Two virtual patient scenarios were used: an elderly woman presenting with acute breathing difficulties, requiring clinical assessment and communication of management decisions, and a trauma case involving a patient with a gunshot wound. Orientation and debriefing sessions framed each simulation to support reflection and knowledge transfer. Each block began with a 90-minute pre-briefing, during which instructors reviewed the learning objectives, clarified key clinical concepts, and introduced and practiced the relevant vocabulary for the scenarios. This was followed by 90 minutes of patient case discussions and structured role-play activities to prepare participants for the virtual encounter. Students then completed 15 minutes of guided familiarization with the Meta Quest 3 headset and VR interface, after which they engaged in a 15-minute interactive simulation. Each session concluded with a 60-minute instructor-led debriefing that focused on communication strategies, clinical reasoning processes, and reflective learning.

A mixed-methods, single-arm pre-post design [33] was used to assess the impact of a VR-based patient simulation module. The following quantitative and qualitative sections were also included in the study:

1. Cognitive framing
   In order to explore students' evolving conceptualizations of virtual patients, a single-word elicitation task was administered at both the start and end of the course.
2. Matched pre- and post-course online questionnaire
   Students completed matched pre- and post-course online questionnaires. The questionnaires are available as supplementary materials. The pre- and post-surveys were developed specifically for this pilot study and included a total of 24 and 28 questions, respectively, both closed and open-ended. The questions were designed to capture a comprehensive view of the students' comfort with VR, confidence in communication and decision-making, perceived realism, and openness to continued VR use. It was structured in two main sections: (1) socio-demographic background (e.g., age, gender, country of origin, mother tongue, programme); (2) perceptions and experiences regarding VR technology, as well as self-perceptions of communication and decision-making skills. The pre-and post-surveys were conducted in English and online through the Google Forms platform. Participation was entirely voluntary, respondents were informed of their right to withdraw from the study at any point. Anonymity and confidentiality of their responses were guaranteed. The introduction to the questionnaire provided participants with detailed information regarding the study's objectives, as well as their rights as respondents. Informed consent was obtained prior to the commencement of the questionnaire, through the statement: "I understand the purpose of the questionnaire and hereby consent to participate." Without providing their consent, participants could not start the questionnaire. Additionally, assurances of data protection were clearly communicated. The estimated completion time for the survey was approximately 8–10 minutes. Students were also asked to generate and use a personal code in both the pre- and post-surveys, allowing their responses to be matched for analysis and enabling the identification of changes between the two occasions. The study was conducted in accordance with the Declaration of Helsinki, and the study protocol was reviewed and approved by the Regional Research Ethics Committee (reference number: 10296 – PTE 2025). Data analysis was conducted using descriptive statistical methods, calculating means and standard deviations. Qualitative data were gathered through open-ended responses.
3. Focus group interviews
   Further qualitative data were collected post-course through two semi-structured focus group interviews, led by the first and last authors, to explore student experiences in depth. There were five students in the first and six students in the second focus group. Audio recordings of the focus group interviews were transcribed using the built-in transcription function in Microsoft Word (Microsoft Office 365). The resulting transcripts were subsequently imported into Sketch Engine, a corpus manager and text analysis software, for qualitative text analysis and keyword exploration to identify patterns and insights related to the pilot

Fig. 1 Pre-course word cloud

course. Braun and Clarke's thematic analysis method [34] was applied, which is a systematic approach for identifying, analysing, and reporting patterns or themes within qualitative data. In this method, the interview questions guide the data collection process by shaping the content of the interviews, while the identified themes provide a structured framework for analysing and interpreting the collected data. Codes were generated inductively by the first author and reviewed by the last author. Disagreements were resolved through discussion until full consensus was reached. Representative participant quotes illustrating each theme were included in the Results section. The semi-structured interviews included the following questions

1. How would you describe the usefulness of the VR session for your learning?
2. What new knowledge or skills did you gain from participating in the session?
3. How did you experience having both clinicians and communication experts involved in the session?
4. What are your impressions of using VR technology, and how do you see its potential role in medical education?
5. What aspects of the VR session did you find most helpful, and what could be improved?
6. Is there anything else you would like to share about your experience with the VR session?

Results

Eleven medical students (aged 20–25; six females and five males) participated in the VR sessions. They represented both pre-clinical and clinical training levels and came from seven countries: Brazil, Canada, Egypt, Germany, Hungary, Iran, and Spain.

Cognitive framing outcomes

In order to explore students' evolving conceptualizations of virtual patients, a single-word elicitation task was administered via the online platform PollEverywhere at both the beginning and the end of the course. The collected responses were visualized as word clouds in real time. The following prompts were used:

Fig. 2 Post-course word cloud

Table 1 Pre- and post-intervention scores (mean ± SD)

Dimension	Pre (Mean + SD)	Post (Mean + SD)
Realism	2.9 ± 0.7	4.4 ± 0.7
Comfort VR	3.0 ± 0.8	4.6 ± 0.5
Communication confidence	3.0 ± 1.1	4.5 ± 0.5
Decision confidence	2.9 ± 0.9	3.8 ± 0.9
Openness vs. Improvement	3.6 ± 1.2	4.4 ± 0.9

1. Pre-course: *What comes to mind when you hear the word "VR"?*
2. Post-course: *What are your thoughts about VR after participating in the first session?*

Figure 1 presents the words gathered prior to the first session, while Figure 2 shows the words students associated with VR after the second session.

The word clouds display a clear shift in students' perceptions of virtual reality before and after the course. Initially, students associated VR primarily with entertainment, fiction, or unreality, as shown by terms such as *"fake," "games," "fantasy books,"* and *"matrix."* These associations suggest a certain amount of scepticism and a tendency to categorize VR as something unrelated to serious medical training, and more linked to movies, and videogames. After the course, however, the associations became more constructive and professional, with words like *"technology," "reality," "virtual,"* and *"imaginative"*, reflecting a recognition of VR's educational value and its potential to enhance learning. While some students also highlighted possible challenges through terms like *"scary"* or *"disorienting,"* these potentially reflect an appreciation of VR's immersive power rather than outright doubt. Overall, the concepts in the first and the second word cloud demonstrate a shift from scepticism toward a more balanced, positive, and realistic understanding of VR's role in medical education.

Quantitative outcomes

The online questionnaire results, as displayed in Table 1, revealed a notable improvement in students' overall perceptions and self-reported skills following the VR-based training. Perceived realism of patient scenarios increased substantially (from 2.9 to 4.4), and comfort with interacting in VR rose from 3.0 to 4.6. Communication confidence improved by 1.5 points (from 3.0 to 4.5), while decision-making confidence showed a moderate increase (from 2.9 to 3.8). Although students were initially sceptical about integrating VR into their curriculum, after the sessions they expressed greater acceptance and reported increased confidence in having VR as part of their training (3.6 vs. 4.4). Participants also rated the usability and comfort of the headset very highly (mean 4.7 ± 0.5). Overall, the data suggest that VR training exceeded expectations, particularly in realism, comfort, and communication skills, while also fostering broader acceptance of VR as a valuable educational tool.

The results of the matched pre–post questionnaire, displayed in Figure 3, demonstrate a clear positive impact of VR-based training on medical students' perceptions and self-reported competencies. Students' belief in the usefulness of VR for medical education increased from an already positive baseline to a stronger support after the intervention. Confidence in clinical decision-making also improved, although moderately in most cases. The most pronounced change was observed in clinical communication confidence, suggesting that immersive VR practice, supported by additional communication practice tasks, is particularly effective in enhancing students'

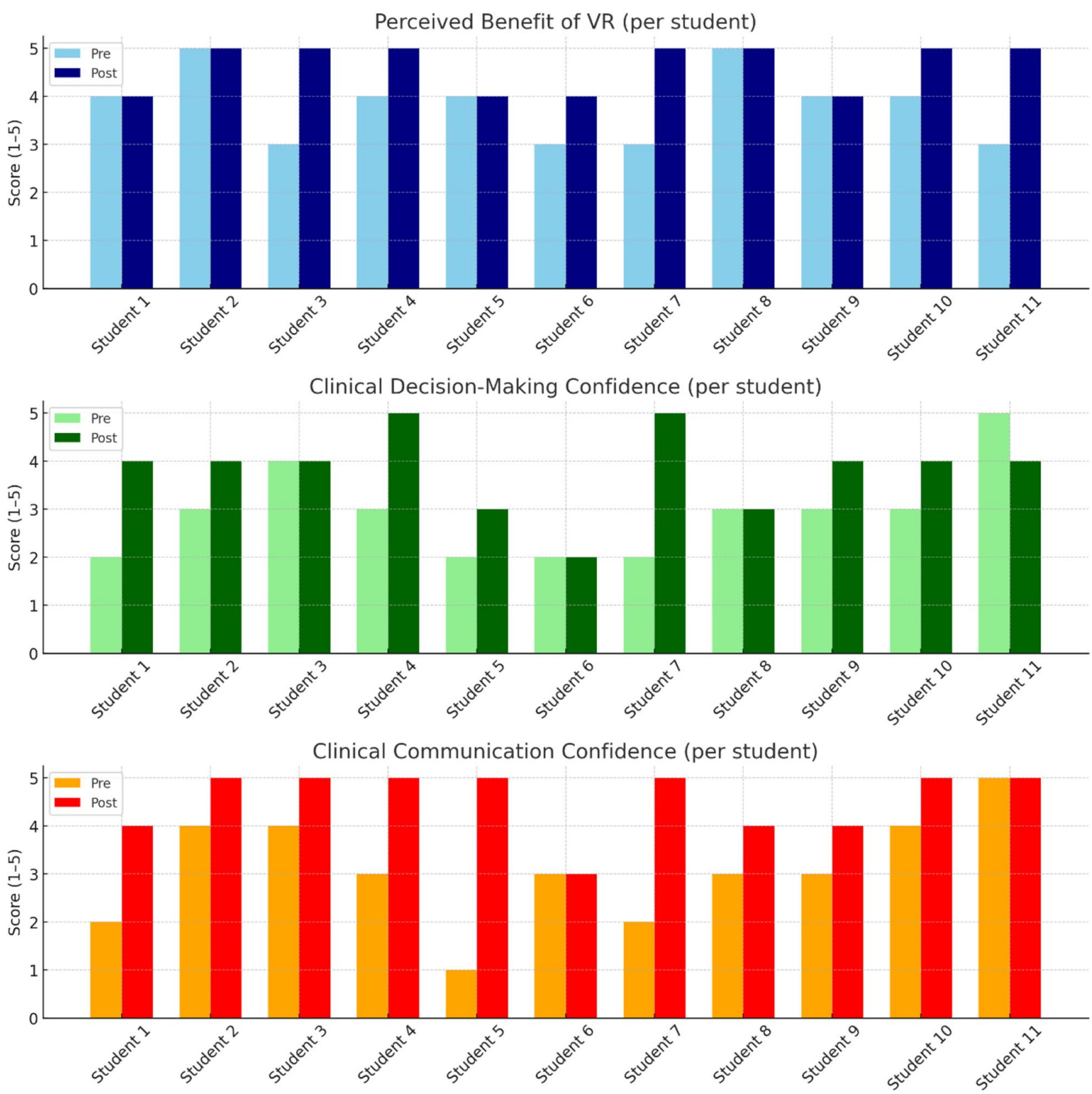

Fig. 3 Visual representation of matched pre- and post-intervention scores

Table 2 Matched pre- and post-intervention student reflections regarding the integration of VR in the medical curriculum

	What are your overall thoughts on the use of virtual reality (VR) in the medical curriculum?	
	Pre-intervention	**Post-intervention**
S1	*Beneficial*	*Beneficial*
S2	*It's the best way to practice, for example surgical skills, without having to worry about making mistakes.*	*I think it can be really beneficial for students who haven't been in contact with patients yet (for higher years students too, of course) to practice a little before having to deal with actual patients.*
S3	*I don't have an idea how can it be used*	*Underrated*
S4	*Useful*	*Extremely beneficial and helpful*
S5	*I don't have an opinion about it yet regarding the "curriculum"*	*It was helpful*
S6	*I don't know yet, I guess I will find out now*	*VR can be useful to simulate difficult or special cases*
S7	*I have no idea*	*It's great if it combines to medical studying*
S8	*I think it's interesting, could make learning things less boring and it might also improve social skills etc.*	*Should be used more*
S9	*Fake life*	*It should be taken by all students*
S10	*Honestly, I find it very practical and useful.*	*It's good, because we can practice and interact with different patients and different situations*
S11	*Good if students don't abuse it*	*I think it can be excellent for the future of medicine*

ability to interact with patients and manage diverse clinical situations.

Qualitative outcomes

The quantitative results were strongly reinforced by qualitative feedback, provided by open-ended questions and post-course focus group interviews. Students consistently described the VR sessions as both beneficial and enjoyable, highlighting gains in communication and clinical preparedness, while also expressing enthusiasm for more immersive scenarios.

Table 2 displays the matched opinions of the 11 students (S1-S11) on the potential usefulness of VR in the medical curriculum pre- and post-intervention. While initial perceptions were also positive in general, some participants indicated hesitation and scepticism during the pre-intervention survey. A clear shift can be observed in the post-intervention results, with pronounced improvement in some instances: "*Extremely beneficial and helpful*", and *"Should be used more".*

Open-ended responses of the questionnaire also offered insights into student expectations, experiences, and suggestions. Pre-course responses revealed minimal concerns, with most students replying "No" when asked about reservations, indicating overall openness to VR. Post-course reflections, however, were rich and enthusiastic. Analysing their responses, four major themes emerged:

1. Perceived value and benefits:

> *Mostly everything was new and helpful for me.*
> *Preparing for the clinical practice.*
> *Understanding how to diagnose patients.*

2. Communication and diagnostic skills:

> *Receiving information from language specialists and doctors at the same time, I was aware of how important communication is, as well as medical knowledge.*

3. Novelty and engagement:

> *It was the interaction between teachers and students, it was fun and at the same time beneficial for me.*
> *Get to know VR and have a view on its possibilities.*

4. Suggestions for improvement:

> *More time with the virtual patient."; "More VR cases.*

Focus group interviews conducted after the intervention further confirmed the positive reception of the course. Students appreciated the realism of the scenarios and the virtual patients, and the ability to practise medical communication in risk-free environments.

> *I learnt a lot of things they never tell at the clinic.*
> *The combination of linguists + doctor was superb.*

While some initial hesitation existed, they adapted quickly and immensely enjoyed using advanced technology, praised the use of the headset and platform for professional purposes, and they found the situations and cases useful for their professional development.

> *I loved using the latest tech.*
> *It was very useful."; "I learnt a lot.*

In summary, the results indicate that the VR-based simulation fostered clear improvements in both communication and decision-making confidence, while focus group feedback emphasized the usefulness and engaging nature of the sessions. Together, these findings highlight the feasibility and strong educational value of integrating VR into the medical curriculum.

Discussion

This pilot study examined how virtual reality and virtual patient simulations may enhance clinical communication, interaction, and decision-making skills among medical students. The quantitative findings, particularly the marked gains in communication confidence and decision-making confidence align with previous work demonstrating that simulation-based education supports the development of both technical and nontechnical skills and provides safe opportunities to rehearse complex clinical situations [2, 5, 8]. Our observed improvements resonate strongly with prior studies showing that virtual patients foster clinical reasoning and data gathering [1, 15], and that simulation environments enable structured trial-and-error learning without risk to real patients [35].

The expansion of immersive VR further amplifies these advantages. In line with Kyaw et al. [36], students in our study reported that the engaging and realistic format strengthened their confidence and motivation. Prior literature highlights immersion and authenticity as key drivers of learning and stress reduction [37, 38], and our cohort similarly reported increased comfort using VR and greater confidence in navigating the scenarios. These consistencies reinforce that immersive VR environments meaningfully support learner engagement and perceived preparedness.

Systematic reviews further underline the importance of interactivity, feedback, and authenticity in shaping the effectiveness of virtual patients [39]. These elements were intentionally embedded in our course design through structured case discussions, guided feedback, and reflective debriefings, which may explain the strong student reception. Emerging evidence on AI-enhanced virtual patients suggests similar benefits for history-taking and interviewing skills [40, 41], although concerns regarding accuracy and bias remain [42]. While AI components were not part of this study's VR scenarios, these findings contextualize the broader trajectory of virtual patient technologies.

The structure of the sessions also appeared to contribute meaningfully to learning. The pre-session vocabulary reviews, guided feedback, and reflective debriefings supported consolidation of skills and align with Kolb's experiential learning model [27, 28]. Situated learning theory [29] provides further justification for the use of immersive simulations, as students learn within authentic contexts that allow them to progress from observation to active decision-making. The adaptability of VR makes it well suited to diverse learner profiles and curricular goals, a feature reflected in our participants' consistently positive evaluations.

This approach was strengthened by the multidisciplinary teaching team, which brought together expertise in clinical practice, medical education, communication, and simulation technology. Their combined perspectives ensured that the learning environment was clinically relevant, pedagogically robust, and linguistically accessible.

The qualitative findings supported the quantitative improvements, with participants describing the VR sessions as engaging, motivating, and valuable for practicing communication in a safe environment. These results align with prior studies showing that virtual standardized patients enhance communication in low-stakes settings [43] and that simulation supports deliberate practice when clinical access is limited [10].

Overall, these findings indicate that VR and VP modalities can expand practice opportunities, support cognitive and communication skill development, and reduce learner stress when paired with authentic, feedback-rich design. Differences across studies appear driven less by the technology itself and more by instructional design, debriefing structure, and assessment quality. Future research should examine long-term learning outcomes, transfer to clinical performance, cost-effectiveness, and standards for VR scenario development to support broader curricular integration.

The integration of VR also aligns with institutional goals for digital transformation and learner-centred teaching, therefore this study strongly confirms the transformative potential of immersive VR technologies in developing both clinical communication and decision-making skills, particularly among international, multilingual cohorts of medical students. The observed enhancements in user comfort, perceived scenario realism, and self-assessed confidence across key competencies suggest that VR is not merely a supplement to traditional medical education, but a strategic tool that can fill critical gaps, especially in educational settings with limited access to diverse patient populations or constrained clinical placements. These advantages are particularly significant in globalized medical programmes, where heterogeneity in learners' prior training, clinical exposure, and language proficiency can create unique pedagogical challenges that traditional teaching methods may struggle to address.

Conclusion

The pilot implementation of a VR-based virtual patient course demonstrated strong educational value, with measurable improvements in student confidence and engagement. The high levels of satisfaction and endorsement suggest that immersive simulation holds significant potential for curricular integration, especially for new generations of students.

As Gen Alpha begins to enter higher education, their deep familiarity with digital technologies, preference for interactive and visually rich content, and expectation of personalized and gamified learning experiences make immersive tools such as VR particularly well suited to their learning needs. For these digital natives, simulation-based environments can create a natural bridge between their everyday modes of engagement and the professional skills required for safe and effective clinical practice. Moreover, as Gen Alpha will be training to become physicians in a healthcare landscape marked by increasing cultural and linguistic diversity, immersive simulation offers not only a means of developing core clinical competencies but also a powerful platform for fostering intercultural sensitivity and communication skills.

Future iterations of the course will expand scenario diversity and instructional time, guided by student feedback and ongoing evaluation. In this way, immersive VR simulation emerges as a compelling educational strategy to enhance clinical reasoning, communication, and cultural competence in international medical education. When integrated thoughtfully, VR can bridge linguistic and experiential gaps, providing safe, inclusive, and effective learning environments that prepare tomorrow's global physicians to thrive in the dynamic healthcare environments of the 21st century.

Limitations and future prospects

As it was a pilot study, the small sample size and lack of a control group may limit generalizability. Self-reported outcomes may also introduce bias. As participation was voluntary, self-selection bias cannot be excluded. Additionally, a novelty effect associated with first-time exposure to VR technology may have positively influenced participant engagement and perceptions. Due to the limited participant number and pilot nature of the study, inferential statistical testing was not applied, as it would lack adequate power to detect meaningful differences. Further research with larger cohorts and control groups could clarify VR's potential in medical education. Longitudinal follow-up studies are also necessary to assess long-term retention and performance outcomes.

Abbreviations

UPMS	University of Pécs Medical School
VP	Virtual Patient
VR	Virtual Reality

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-08507-7.

Supplementary Material 1

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Clinical trial number

Not applicable.

Authors' contributions

A.D. and T.N. conceptualized and designed the study and developed the methodology. A.D., T.N., K.D., and P.H. conducted the pilot study and collected the data. A.D. analysed the data and interpreted the findings. A.D. and T.N. drafted the initial manuscript, which was critically revised by K.D., P.H., and Sz.R. All authors contributed to the writing and revision of the manuscript and approved the final version.

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Data availability

The questionnaires used in this study are available in the supplementary materials. Selected individual responses to open-ended questions are included within the article. Additional data are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethics approval was granted by the Regional Research Ethics Committee (reference number: 10296 – PTE 2025). The study adhered to the principles of the Declaration of Helsinki. Information about the aim of the research was shared with all participants. Participation was voluntary. Informed consent was acquired by ensuring all participants of anonymity, confidentiality, and data protection. All data were anonymized prior to analysis and stored securely.

Consent for publication

Informed consent for participation and publication of anonymised data was obtained from all participants.

Competing interests

The authors declare no competing interests.

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