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ORIGINAL RESEARCH

Virtual patient simulations for addictive disorders: usability and perceived educational value

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Abstract

Background and objective: Health educators increasingly use Virtual Patient (VP) simulations to support experiential learning and clinical skill development. However, in addiction education, evidence regarding their usability and perceived learning value remains limited. This study aimed to assess undergraduate students' perceptions of the usability and learning potential of three interactive VP simulations designed to enhance motivational interviewing skills in addictive disorders. Exploratory analyses examined whether students' education level or gender were associated with these outcomes.

Methods: Students enrolled in one undergraduate psychology course and one course within an undergraduate addiction certificate were invited to participate. Participants completed up to three VP scenarios (alcohol use, gambling, and problematic internet use), followed by an online questionnaire assessing usability, engagement, emotional realism, and perceived learning value using Likert-scale items and open-ended questions. We analyzed quantitative data using non-parametric tests and conducted a deductive thematic analysis on the open-ended responses.

Results: Overall, students reported high levels of usability, engagement, and perceived learning value across all three scenarios, with no significant differences between scenarios. Senior undergraduate students reported more favourable evaluations than first- and second-year students on some items. Qualitative responses highlighted the experiential and immersive nature of the simulations as strengths, while also identifying technical issues and navigation as areas for improvement.

Conclusions: In addiction education, particularly among advanced learners, VP simulations appear to be a well-accepted tool for potentially supporting reflective and interpersonal skill development. Future research should examine learning outcomes longitudinally and extend evaluation to other contexts.

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Simulations de patients virtuels avec des troubles liés à la dépendance : utilisabilité et valeur pédagogique perçue

Résumé

Contexte et objectif : De plus en plus, les formateurs en santé recourent à des simulations avec des patients virtuels (PV) pour favoriser l'apprentissage par l'expérience et le développement des compétences cliniques. Cependant, dans le domaine de la formation sur les addictions, les données relatives à leur facilité d'utilisation et leur valeur pédagogique perçue restent limitées. Cette étude visait à évaluer la perception qu'ont des étudiants de premier cycle de la facilité d'utilisation et du potentiel pédagogique de trois simulations interactives de patients virtuels conçues pour améliorer les compétences en matière d'entretien motivationnel dans le domaine des troubles liés à l'addiction. Des analyses exploratoires ont cherché à déterminer si le niveau d'études ou le sexe des étudiants étaient associés à ces résultats.

Méthodes : Des étudiants inscrits à un cours de psychologie de premier cycle et à un cours dans le cadre d'un certificat de premier cycle en toxicomanie ont été invités à participer. Les participants ont réalisé jusqu'à trois scénarios de PV (consommation d'alcool, jeu et utilisation problématique d'Internet), suivis d'un questionnaire en ligne évaluant la facilité d'utilisation, l'engagement, le réalisme émotionnel et la valeur pédagogique perçue à l'aide d'items sur échelle de Likert et de questions ouvertes. Nous avons analysé les données quantitatives à l'aide de tests non paramétriques et mené une analyse thématique déductive des réponses ouvertes.

Résultats : Dans l'ensemble, les étudiants ont fait état de niveaux élevés de facilité d'utilisation, d'engagement et de valeur d'apprentissage perçue pour les trois scénarios, sans différence significative entre ceux-ci. Les étudiants en fin de programme ont donné des évaluations plus favorables que les étudiants de première et deuxième année sur certains points. Les réponses qualitatives ont mis en évidence la nature expérientielle et immersive des simulations comme des atouts, tout en identifiant les problèmes techniques et la navigation comme des domaines à améliorer.

Conclusions : Dans le domaine de la formation sur les addictions, en particulier chez les apprenants avancés, les simulations en réalité virtuelle semblent être un outil bien accepté, susceptible de favoriser le développement des compétences réflexives et interpersonnelles. Les recherches futures devraient examiner les acquis en apprentissage de manière longitudinale et étendre l'évaluation à d'autres contextes.

Introduction

Addictive disorders contribute to approximately 200 deaths each day in Canada and generate an estimated $49 billion in annual costs from substance use alone.[1] Both mortality and economic costs have steadily increased over time.[1] Preparing healthcare professionals to effectively support individuals with addictive behaviors is an urgent educational priority given the magnitude of these societal consequences. Yet, training programs in psychology and psychiatry have not kept pace with this growing need and generally offer limited opportunities for specialized education on addiction.[2,3] An environmental scan of Canadian adult clinical psychology graduate programs indicated that just over half had faculty members with interests in addictions.[4] However, only two programs (7.41%) offered a graduate course in addiction, and 13 (48.15%) provided practicum opportunities in the field.

Students often graduate without adequate preparation to work with individuals living with addictive disorders, exposing future professionals to relational and ethical challenges and perpetuating gaps in care.[5] Further, practicing mental health professionals who frequently encounter these populations are also at risk of inadequate preparation.[6] Stigma toward people living with addiction is a persistent barrier to effective intervention, which manifests through judgmental

attitudes, distancing, or disengagement and undermines the quality of care.[7,8] During initial training, the lack of structured opportunities for experiential and reflective learning often reinforces these biases.[9] Pedagogical approaches must allow learners to engage safely and meaningfully with realistic clinical situations to address stigma and foster empathy.

Interactive virtual patient (VP) simulations offer a promising solution to these educational gaps. Defined as: "an interactive computer simulation of a computer programmable patient (or avatar) in a real-life clinical scenario for the purpose of medical training, education, or assessment that will respond to learner decisions,"[10(p.1)] VP simulations immerse students in dynamic, scripted encounters that require learners to actively make clinical decisions and observe their consequences. Kolb's experiential learning model explains their pedagogical potential,[11,12] as this model posits that learning occurs through iterative cycles of action, reflection, and conceptualization. VP simulations support these cycles by allowing learners to experiment with different clinical approaches, reflect on their decisions, and learn from outcomes, all without real-world consequences. Numerous studies highlight the effectiveness of online learning in health profession education, particularly in terms of flexibility, reproducibility, and adaptability to diverse learner profiles.[13]

Although medical and nursing education research has widely explored VP simulations, research exploring their application to addictive disorders training remains limited, despite the documented need for innovative strategies to address gaps in addiction training.[2–4,14] A review of the published literature on VPs with addictive disorders found that all simulations focused on substance use, primarily in the context of screening, brief intervention, and referral to treatment.[14] No simulations addressed behavioural addictions such as gambling disorder. Five out of eight studies assessed usability, and consistently reported favourable learner perceptions of VP simulations, with usability ratings ranging from "good" to "very good" and high perceived usefulness. However, learners also identified limitations related to the naturalness of VP interactions.

While Kolb's model explains the learning processes activated by VP simulations, the National League for Nursing/Jeffries Simulation Theory[15,16] provides guidance on how to intentionally design and structure these experiential learning activities to support engagement and reflection. This framework emphasizes the importance of pre-briefing, guided simulation progression, instructional cues, and debriefing to promote meaningful learning experiences. In the present study, the term feedback refers to automated, in-simulation responses provided to learners following their decisions, whereas debriefing refers to a structured post-simulation process aimed at supporting reflection and integration of learning. Such structured experiential approaches have enhanced clinical reasoning, empathy, and interpersonal skills, competencies strongly associated with improved care quality and professional growth.[17,18] However, in traditional curricula, opportunities to implement these approaches remain limited due to time constraints, resource limitations, and faculty resistance.[9]

The educational benefits of VP simulations depend, in part, on learners' ability to engage effectively with the technology. When design or technical barriers interfere with navigation, decision-making, or feedback, the intended learning processes may be compromised. For VP simulations to achieve their full educational potential, usability must be rigorously evaluated. Poor interface design, technical issues, or unclear navigation can hinder engagement and distract from learning objectives, whereas well-designed in-simulation feedback mechanisms enhance motivation and skill acquisition.[14,19] Incorporating user feedback into iterative design processes is therefore essential to optimize both usability and pedagogical relevance.[20]

This study aimed to assess the perceptions of undergraduate psychology and addiction studies certificate students regarding the usability and learning potential of three interactive VP simulations developed to foster interpersonal and reflective skills in the context of addictive disorders. The simulations featured real actors portraying patients to enhance the realism of the interactions. In addition, exploratory analyses examined whether student characteristics were associated with perceived usability. By evaluating both usability and perceived learning potential, this study provides

novel evidence on how VP simulations can be integrated into undergraduate addiction curricula, offering a scalable method to enhance experiential learning and prepare students for clinical encounters.

Methodology

This study adopted a quantitative-dominant design with an embedded qualitative component to better understand usability and perceived learning value from the participants' point of view.[21] The integration between quantitative and qualitative elements occurred at the interpretation stage: we used qualitative data to illustrate and contextualize statistical trends observed in the quantitative analysis. The two data types were collected concurrently, within a single online questionnaire, ensuring that both addressed the same constructs of usability, perceived effectiveness, and satisfaction.

Participants

The study recruited participants from two undergraduate courses. One course was a three-credit undergraduate Addiction Psychology course, comprised mostly of students from the psychology pro--ram, but also open to students from other disci--lines (n = 296). The second course was a three-credit Behavioural Addictions course which is part of an undergraduate certificate on addictions (n = 13). Recruitment occurred through in-class announcements and online posts on the course platforms, and participation was entirely voluntary. Inclusion criteria were enrollment in one of the partic--pating courses and completion of at least one VP simulation. No exclusion criteria were applied. Participation was anonymous, and no academic credit or compensation was provided.

Procedure

The researchers invited all students enrolled in the two undergraduate courses to participate. Students in the Addiction Psychology course completed three VP simulations depicting distinct addictive behaviours (alcohol, gambling, and problematic internet use), while students in the undergraduate certificate class completed only one simulation (i.e., gambling, which was presented in the context of a course module on relapse prevention). Of the 901 possible questionnaire completions (3 x 296 + 1 x 13), the researchers received 92 complete questionnaires, representing a questionnaire completion rate of 10.2%. As students could complete up to three questionnaires and responses were collected anonymously, the number of unique respondents and the participant response rate could not be determined.

Participants could choose to complete the simulations in any order they wished. Participants accessed the simulations individually via a secure learning platform. Each simulation lasted approximately 20 minutes and included a structured sequence of interactive video vignettes followed by automated formative feedback. Upon completion of each simulation, students were redirected to and completed an online questionnaire hosted on the university Office 365 Forms platform independently. The researchers provided the same link to all students, and tracked no personal information, ensuring complete anonymity. The average completion time for the questionnaire was 4.6 minutes.

VP simulations: design and pedagogical features

In-house software developers based at the principal investigator's (AM) university developed the VP simulations using Articulate 360, an e-learning authoring platform. Both Kolb's Experiential Learning Theory[11] and Jeffries' Simulation Theory[16] informed the pedagogical design of the VP simulations. Specifically, the scenarios were developed to support each stage of Kolb's experiential learning cycle.[11] Students first engaged in a concrete experience through interaction with a realistic VP. They were then encouraged to engage in reflective observation through automated feedback and reflective prompts, connect their experiences to abstract conceptualization through explanations grounded in motivational interviewing principles, and engage in active experimentation by testing different response options and observing their consequences. Consistent with the Jeffries Simulation Theory,[16] simulations also incorporated structured pre-briefing, guided progression through the scenario, immediate formative feedback, and a psychologically safe environment in which learners could make mistakes without adverse consequences.

Briefing. Prior to each session, participants completed a short pre-briefing module designed to orient them to the simulation environment, explain the

learning objectives, clarify the use of the interface, and highlight principles of psychological safety and professional conduct. This pre-briefing lasted approximately five minutes and aimed to ensure that students could engage with the simulation confidently and effectively.

Simulation content and feedback. Each VP scenario began with a brief presentation of the main character, including their name, age, reasons for seeking support and the learning objectives of the scenario, which oriented students to the intended skills and reasoning processes. Actors were seated against a neutral green background and spoke directly into the camera, providing a realistic and engaging patient encounter. The scenarios depicted authentic clinical encounters with addictive behaviours, incorporating affective and verbal cues, adaptive branching, and responses contingent on students' choices. Professional actors portrayed the characters, and clinicians and clinical psychologists with expertise in addiction-related matters and motivational interviewing techniques developed the scripts collaboratively. At the end of each scene, students were presented with a list of choices in written form and could select their intended response. Following each selection, the simulation provided immediate, automated feedback designed to convey response-specific information and support learners' reflection on their clinical decisions. Consistent with established feedback frameworks emphasizing information about task performance, the strategies underlying performance, and guidance for subsequent improvement,[20,22] the feedback aimed to help learners understand the rationale for their choices, reconsider potentially disadvantageous responses, and identify more appropriate communication strategies. When students selected potentially disadvantageous responses, the virtual patient reacted defensively or with frustration, allowing learners to ob--erve the potential interpersonal consequences of their decisions and reconsider their approach.

Design and development considerations. The estimated cost per scenario was approximately $12,000 to $14,000 CAD, including clinicians' time (~48h), professors' time (~96h), techno-pedagogical support (~48h), professional actors, and video production costs.

Measures

Quantitative component. The researchers developed a novel usability questionnaire for this study, based on Asarbakhsh and Sandars' three-dimensional model (effectiveness, efficiency, satisfaction).[23] The investigators translated the nine items to French and five students from a similar population pretested them to ensure clarity and face validity. Cronbach's alpha in this sample for the overall scale was 0.81, indicating acceptable internal consistency. Example items include: "The simulation helped me better understand clinical reasoning" and "Navigation within the simulation was intuitive." Participants rated all items on a four-point Likert scale (0: completely disagree; 3: completely agree). The researchers selected a four-point Likert scale without a neutral midpoint to encourage respondents to indicate a direction in their evaluation of the simulations. In addition to these items, respondents indicated their gender, university, educational level (first year, second year, third or higher, certificate), and which VP scenario they were evaluating.

Qualitative component. To supplement the interpretation of the quantitative results and better understand student perceptions, three open-ended questions were developed by the course instructors inviting participants to elaborate on perceived benefits, difficulties, and comparisons with other learning formats: 1) What specific aspects of the virtual patient simulation did you find most beneficial to your learning?; 2) Were there any aspects of the virtual patient simulation that you found difficult or less useful? If so, what changes would you suggest to improve the learning experience in a future version of the simulation?; and 3) How does the simulation compare to other training you have received?

Analytical plan

Quantitative analyses. The researchers analyzed descriptive and inferential statistics from the nine usability questions using SPSS version 30.[24] We conducted Chi-square (χ^2) tests to explore the links between responses and certain categorical variables (e.g., the scenario used). We conducted Kruskal-Wallis tests to assess differences on each of the nine usability items because of the non-normal distribution of responses. We conducted post-hoc Mann-Whitney tests when statistically significant differences emerged for pairwise comparisons between groups.

The significance threshold was set at .05 for all statistical tests.

Qualitative analyses. Two authors (TG and AM) independently conducted a deductive thematic analysis on the responses to open-ended questions.[25] Each performed an initial coding of all responses. Given the concise nature of the written comments, they coded manually using Microsoft Excel rather than using specialized qualitative analysis software. After the independent coding phase, the two coders met to compare and discuss their categorizations until they reached full consensus on the final thematic structure. Therefore, the two authors estimated inter-rater agreement through discussion rather than statistical coefficients, given the small corpus and the interpretative nature of the data.[26] This approach ensured analytic transparency and interpretative coherence despite the brevity of the qualitative material. The authors defined thematic categories *a priori* based on the research objectives and the main dimensions explored in the questionnaire, namely, perceived benefits, limitations and areas for improvement, and comparison with other pedagogical approaches.

Ethical considerations

The Université Laval Research Ethics Board deemed this study exempt from ethical approval (file #2024-551). Nonetheless, the researchers implemented measures to protect students. They informed participants verbally and in writing that participation was voluntary and anonymous. An online informed consent form preceded the questionnaire, requiring active confirmation before proceeding. The researchers stored the data securely on password-protected university servers and analyzed the data only after course completion.

Results

We collected a total of 92 responses (77 women, 15 men). Due to response anonymity, the exact number of participants could not be determined since one student could provide more than one response (i.e., up to one response per VP scenario). We collected seventy-one responses from students in the psychology undergraduate course, and 21 from those enrolled in the undergraduate certificate course. Of these, 51 responses pertained to the gambling VP scenario, 23 to the problematic internet use scenario, and 18 to the alcohol scenario. The combined quantitative and qualitative results show that students across both courses and levels of study generally had a positive opinion of the interactive digital simulation tool.

Quantitative data

Statistical analyses show that all participants received the simulations well, with no statistically significant differences between the three scenarios offered (Table 1). As indicated by mean scores ranging from 2.17 to 2.74 for positively worded statements, students generally strongly agreed with the usability statements. The only item with a negative valence (i.e., "I felt an informational overload or difficulty following the simulation") had a mean score of 1.38, indicating split attitudes among respondents. No gender differences emerged on usability scales, except for the item "The simulation appeared emotionally realistic to me" (H (2) = 5.756, p = .016), for which women (M = 2.61, SD = 0.67) reported being more in agreement with the statement than men (M = 2.13, SD = 0.83).

The researchers observed a few notable effects of educational level. Kruskal-Wallis tests revealed statistically significant differences on items "The use of a virtual patient is a valuable addition to traditional teaching" (H (3) = 10.694, p = .014) and "I would be open to using this type of simulation again in the future" (H (3) = 8.944, p = .030). Post-hoc Mann-Whitney tests revealed that first-year undergraduate students reported lower agreement with the statement, "The use of a virtual patient is a valuable addition to traditional teaching" compared to third-year undergraduate students (U = 187, p = .011) and individuals enrolled in an undergraduate certificate (U = 339, p = .021). Second-year undergraduate students did not show any statistically significant difference with any other group.

For the item "I would be open to using this type of simulation again in the future," post-hoc Mann-Whitney tests revealed lower agreement among first year (U = 195.5, p = .017) and second-year undergraduate students (U = 68, p = .044) compared to third-year undergraduate students. Students enrolled in the undergraduate certificate did not show any statistically significant difference with any other group.

Table 1. Mean acceptability scores for all virtual patient scenarios

	Combined *M* (*SD*)	Gambling *M* (*SD*)	PIU *M* (*SD*)	Alcohol *M* (*SD*)	Kruskal-Wallis *p* value
Navigation within the simulation was intuitive and easy.	2.17 (0.97)	2.33 (0.86)	2.13 (0.92)	1.78 (1.22)	.20
The level of difficulty was appropriate for achieving the learning objectives of this simulation.	2.51 (0.72)	2.51 (0.67)	2.57 (0.73)	2.44 (0.86)	.87
The use of a virtual patient is a valuable addition to traditional teaching.	2.74 (0.71)	2.76 (0.68)	2.7 (0.76)	2.72 (0.75)	.90
The virtual patient helped me develop clinical reasoning skills that I can apply in clinical practice.	2.48 (0.83)	2.47 (0.81)	2.48 (0.95)	2.50 (0.79)	.88
Overall, the use of the virtual patient enhanced my learning.	2.59 (0.73)	2.59 (0.7)	2.61 (0.78)	2.56 (0.78)	.88
I would be open to using this type of simulation again in the future.	2.63 (0.82)	2.57 (0.88)	2.65 (0.78)	2.78 (0.73)	.48
I found the simulation engaging and immersive.	2.50 (0.85)	2.49 (0.81)	2.43 (0.99)	2.61 (0.78)	.78
I experienced an information overload or difficulty following the simulation.	1.38 (1.14)	1.51 (1.12)	1.13 (1.18)	1.33 (1.14)	.39
The simulation appeared emotionally realistic to me.	2.53 (0.72)	2.61 (0.63)	2.35 (0.83)	2.56 (0.78)	.44

Note. Scores range from 0 (completely disagree) to 3 (completely agree). M: Mean, PIU: Problematic internet use, SD: Standard deviation. Some participants may have contributed responses to more than one VP simulation. Consequently, observations may not be fully independent, and statistical comparisons should be interpreted with caution.

Qualitative insights complementing quantitative findings

The qualitative findings largely converged with the quantitative results and provided insight into the factors underlying students' ratings. For example, participants' descriptions of the simulations as immersive, interactive, and helpful for translating theoretical concepts into practical situations reflected high levels of agreement observed for perceived learning value, engagement, and emotional realism. At the same time, qualitative comments helped contextualize the comparatively lower ratings observed on some usability items by identifying specific challenges related to navigation, pacing, and feedback. Together, these findings provide a more nuanced understanding of students' experiences with the VP simulations. Given the study's quantitative-dominant design, we will present these qualitative findings briefly to illustrate and contextualize the main trends observed in the usability data.

Perceived educational benefits. Students emphasized the usefulness of immediate and formative feedback, which helped them understand the rationale behind their answers and strengthen their clinical reasoning ("The feedback showed me exactly why my answer wasn't ideal and what I could have asked differently," Participant 74). They also valued the interactivity and realism of the simulations ("It felt like talking to a real person. The reactions made it easier to stay engaged," Participant 23). For many, the simulations facilitated transfer of theoretical knowledge into practice, particularly for developing communication and empathy skills.

Identified limitations and areas for improvement. Some participants reported technical or design-related challenges, such as navigation difficulties or overly long sequences. A few also noted stress or confusion due to similar response options or the patient's simulated impatience ("Sometimes I wasn't sure which answer was best. And the patient seemed frustrated too quickly," Participant 9). Participant suggestions for improvement included clearer feedback after incorrect answers, shorter segments, and greater flexibility in video playback.

Comparison with other learning approaches. When compared with traditional teaching methods, the simulations were perceived as more immersive and motivating, promoting active engagement and reflection. However, some students from non-clinical fields expressed that the scenarios felt less relevant to their disciplinary context:

> *I study law and took this class as an elective. I have no experience or tools for providing helping or intervention support in my program. I find that the theory used to prepare the modules is not well suited to situations like mine. It would have been helpful to have a basic ABC of the helping relationship and some broad guidelines for choosing which questions to ask.* (Participant 7)

Discussion

This study examined students' perceptions of the usability and educational value of an interactive virtual patient (VP) simulation focused on addictive disorders. Overall, findings indicate high usability and strong satisfaction across participants, with quantitative and qualitative findings converging across several dimensions. Students reported high levels of engagement, emotional realism, and perceived learning value in the questionnaire, while open-ended responses attributed these positive perceptions to the simulations' realism, interactive decision-making process, and immediate formative feedback. Similarly, although overall usability ratings were favourable, qualitative comments identified navigation difficulties and technical issues that may help explain variability observed across some usability indicators. The researchers' interpretation of students' perceptions of the VP simulations is strengthened by convergence between both data sources. Importantly, our findings extend the evidence on VP simulations into addiction education, a context where structured experiential learning remains scarce.[14] By demonstrating both high usability and perceived educational value among undergraduate students, this study provides preliminary support for the integration of VP simulations as a novel pedagogical strategy in addiction curricula. As an engaging educational modality, VP simulations may facilitate the delivery of addiction training, which has been shown to improve knowledge and reduce stigmatizing attitudes toward individuals with addictive disorders.[27,28] Students not only rated the simulations positively but also articulated reasons for their evaluations, underscoring the tool's potential to foster safe and reflective practice prior to direct clinical exposure. These results are consistent with previous research showing that VP simulations enhance learner engagement and facilitate the transfer of theoretical knowledge into practice.[10,13,20] Participants' emphasis on the simulations' interactivity, emotional realism, and formative feedback echoes prior evidence that these features are critical for promoting authentic learning experiences and sustaining motivation,[20] which paves the way for further evaluation of changes in learning outcomes following participation in these simulations. Taken together, these results are also consistent with established theoretical models of simulation-based education, such as the Jeffries Simulation Framework,[16] which emphasizes the central role of simulation design elements (e.g., interactivity, in-simulation feedback, realism), learner characteristics, and psychological safety in achieving positive educational outcomes. By focusing on clinical presentations with addictive behaviours, the present study contributes to filling an important gap in the literature and highlights the po--ential of VP simulations to improve preparedness for clinical encounters involving substance use and behavioural addictions. Furthermore, observed differences across academic levels align with research on digital learning tools, which suggests that learners' prior experience and clinical familiarity influence perceived relevance and usability. These findings underscore the importance of tailoring simula--ion design to the learner's developmental stage, en--uring that novice students receive additional scaf--olding while advanced learners benefit from more complex and nuanced scenarios.

Interpretation and theoretical integration

The positive evaluations of the VP simulations can be interpreted through Kolb's experiential learning model, which conceptualizes learning as a cyclical process comprising four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation.[11] In this study, the simulations provided students with concrete experiences by immersing them in realistic clinical encounters with virtual patients presenting addictive behaviours, thereby simulating authentic professional interactions. Integrated feedback and reflective worksheets encouraged reflective

observation, allowing learners to critically examine their decisions and emotional responses. This process may have helped students engage in abstract conceptualization by linking their experiences to theoretical frameworks and clinical reasoning, consolidating knowledge and identifying best practices, although further assessment of specific learning outcomes would be warranted.

Finally, the dynamic nature of the scenarios supported active experimentation, enabling learners to test alternative strategies and anticipate outcomes, which may foster adaptability and confidence. By operationalizing experiential learning principles in a controlled, low-risk environment, VP simulations may offer a valuable means of developing empathy, communication skills, and professional judgment before students encounter real patients. Although previous longitudinal and experimental studies have shown that VP simulations can improve these clinical skills in other healthcare fields,[29,30] this has yet to be demonstrated in the field of addiction.

Practical implications and areas for improvement

Differences in evaluations across academic levels suggest that undergraduate students in their third year or later perceived greater value in the VP simulations compared to first- or second-year students. This pattern likely reflects the influence of prior clinical exposure and theoretical knowledge on learners' ability to contextualize and apply simulation-based experiences. For example, students enrolled in the undergraduate certificate are often working professionals seeking additional training in addictive disorders, whereas third-year psychology students commonly pursue volunteer and other helping experiences in preparation for graduate school. However, the present study did not permit this specific analysis, and future research is warranted to examine this hypothesis.

Participants identified several areas for improvement emphasizing that poor interface design and cognitive overload can undermine engagement and learning outcomes, which aligns with existing usability research.[19] These observations also resonate with broader user experience principles that prioritize clarity, consistent in-simulation formative feedback, and manageable task demands. First, interface and usability enhancements are essential to optimize learner experience. Reported technical limitations, such as navigation difficulties and occasional bugs, should be addressed to ensure fluid interaction. Incorporating pacing controls and duration indicators could help manage cognitive load and reduce stress during longer sequences. Second, feedback design emerged as a critical area for refinement. While formative feedback was appreciated, participants suggested clearer explanations for incorrect responses and more adaptive feedback tailored to learners' level of expertise, which is consistent with evidence on the pedagogical power of feedback in fostering motivation and skill acquisition.[15] Finally, contextualization for novice learners is necessary to increase perceived relevance and reduce anxiety among early-stage students. Strategies may include simplifying scenario complexity, strengthening pre-briefing materials, and providing additional guidance throughout the simulation. Research on digital learning tools supports these scaffolding approaches and highlights the importance of aligning instructional design with learners' developmental stage.[10,13,20] Overall, these recommendations underscore the need for iterative design processes that integrate user feedback to enhance both usability and pedagogical effectiveness. By addressing these usability concerns, VP simulations can better fulfill their potential as scalable, evidence-based tools for addiction education.

Educational and clinical implications

Beyond usability considerations, this study's findings highlight the potential of VP simulations as a complementary educational tool in addiction training. Although the benefits of simulation-based learning are well documented in other health professions, their application to addiction education remains less explored. First, VP simulations offer a safe and controlled environment for experiential learning, which is particularly valuable in addiction education where direct clinical exposure is often limited by ethical and logistical constraints. By enabling students to engage with realistic scenarios, these tools can help reduce stigma toward individuals with addictive disorders,[27,28] a barrier widely documented in the literature.[7,8] Second, VP simula-

tions support the development of interpersonal and communication skills before real-world clinical practice.[31] These competencies, including active listening and empathy, are strongly associated with better care outcomes and professional growth.[11,17] Integrating such simulations into curricula can complement traditional didactic approaches by promoting active engagement and reflective learning, as recommended in experiential learning frameworks.[11] Finally, VP simulations represent a scalable and flexible pedagogical strategy that can be adapted across disciplines and levels of training. Their ability to provide standardized yet customizable learning experiences makes them a valuable addition to competency-based education models in health professions.[10,14–16]

Limitations and future directions

This study provides an initial exploration of students' experiences with VP simulations focused on addictive behaviours; however, several limitations should be acknowledged. The low response rate observed in this study may be explained by several contextual factors. Participation in the study was entirely voluntary and not associated with any financial or academic incentives. In addition, students were recruited in the context of regular coursework and were simultaneously required to complete multiple mandatory academic activities, which may have limited their availability and motivation to respond to optional research questionnaires. Although response rate alone is an imperfect indicator of data quality in educational settings and should be interpreted in relation to the purpose of the evaluation,[32] it remains important to consider the potential for non-response bias. Accordingly, the low questionnaire completion rate increases the potential for non-response and self-selection bias, as students with particularly positive or negative experiences may have been more likely to participate. Consequently, the findings should be interpreted with caution and may not be representative of all students who completed the VP simulations.

We could not determine the exact number of unique participants because responses were anonymous and students could complete up to three questionnaires. Consequently, some participants may have contributed multiple observations, meaning that the independence assumption underlying the between-group analyses may not have been fully satisfied. The findings should therefore be interpreted with caution. Additionally, anonymous responses prevented tracking individual trajectories across multiple simulations, limiting the ability to examine learning progression. The brevity of qualitative comments constrained the depth of thematic analysis, and the study relied exclusively on self-reported perceptions rather than objective measures of skill acquisition, which may introduce bias. Although the usability questionnaire demonstrated good internal consistency, additional psychometric evaluation, including assessment of its factor structure and test–retest reliability, was beyond the scope of the present study. Researchers must fully validate the questionnaire before it is applied in other settings or populations. Finally, subgroup comparisons, including those by gender, should be interpreted cautiously given the relatively small number of male participants and the possibility that some participants contributed multiple observations.

Future research should address these limitations by using larger, more diverse samples, including students from multiple disciplines and training levels, to enhance external validity. Longitudinal designs could examine how repeated exposure to VP scenarios influences clinical confidence, communication skills, and attitudes toward individuals with addictions, outcomes identified as critical in previous work on experiential learning.[30] Evaluating the transfer of skills to real-world practice and comparing VP simulations with other pedagogical approaches in controlled trials are important. Expanding this research to frontline professionals who in-eract with individuals experiencing addictions could provide insights into the tool's applicability beyond academic settings. Finally, researchers could conduct iterative testing of revised VP scenarios incorporating usability improvements identified in this study, such as enhanced feedback and contextualization for novice learners, to help optimize the pedagogical impact and scalability of VPs. In summary, this exploratory study of the use of VP simulations in training undergraduate students and healthcare professionals working with a population suffering from addiction provides added value of using this method and promising avenues for the future of training.

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Conflict of Interest:

All authors declare they have no conflicts of interest.

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References

1. Canadian substance use costs and harms scientific working group. *Canadian substance use costs and harms 2007–2020.* Ottawa, Ontario: Canadian Centre on Substance Use and Addiction; 2023. Available from: https://csuch.ca/documents/reports/english/Canadian-Substance-Use-Costs-and-Harms-Report-2023-en.pdf [Accessed on DATE].
2. DeJong SM, Balasanova AA, Frank A, et al. Addiction teaching and training in the general psychiatry setting. *Acad Psych.* 2022 Jun 1;46(3):381–8. https://doi.org/10.1007/s40596-021-01431-0
3. Dimoff JD, Sayette MA, Norcross JC. Addiction training in clinical psychology: are we keeping up with the rising epidemic? *Amer Psychol.* 2017;72(7):689–95. https://doi.org/10.1037/amp0000140
4. Corace K, Arès I, Overington L, Kim HS. Substance use and mental health disorders: psychologists' role in bridging the gap. *Can Psychol.* 2022;63(3):405–12. https://doi.org/10.1037/cap0000299
5. Ayu AP, Schellekens AFA, Iskandar S, Pinxten L, De Jong CAJ. effectiveness and organization of addiction medicine training across the globe. *Eur Addict Res.* 2015 May 5;21(5):223–39. https://doi.org/10.1159/000381671
6. Blevins CE, Rawat N, Stein MD. Gaps in the substance use disorder treatment referral process: provider perceptions. *J Addict Med.* 2018;12(4):273–7. https://doi.org/10.1097/ADM.0000000000000400
7. Yang LH, Wong LY, Grivel MM, Hasin DS. Stigma and substance use disorders: an international phenomenon. *Curr Opin Psych.* 2017 Sep;30(5):378–88. https://doi.org/10.1097/YCO.0000000000000351
8. van Boekel LC, Brouwers EPM, van Weeghel J, Garretsen HFL. Stigma among health professionals towards patients with substance use disorders and its consequences for healthcare delivery: systematic review. *Drug Alcohol Depend.* 2013 Jul 1;131(1–2):23–35. https://doi.org/10.1016/j.drugalcdep.2013.02.018
9. Wurdinger S, Allison P. *Faculty perceptions and use of experiential learning in higher education.* 1;2017 Jan 29;13(1). https://doi.org/10.20368/1971-8829/150
10. Richardson CL, Chapman S, White S. Establishing the acceptability and usability of an animated virtual patient simulation. *Explor Res Clin Soc Pharm.* 2021 Dec 1;4:100069. https://doi.org/10.1016/j.rcsop.2021.100069
11. Kolb DA. *Experiential learning: experience as the source of learning and development.* Englewood Cliffs, NJ: Prentice Hall; 1984.

12. Kolb AY, Kolb DA. Learning styles and learning spaces: enhancing experiential learning in higher education. *AMLE.* 2005 Jun 1;4(2):193–212. https://doi.org/10.5465/amle.2005.17268566
13. Nowell L, Dhingra S, Carless-Kane S, et al. A systematic review of online education initiatives to develop students remote caring skills and practices. *Med Educ Online.* 2022 Dec 31;27(1):2088049. https://doi.org/10.1080/10872981.2022.2088049
14. Morvannou A, Allami Y, Jobin EY. Virtual patients with substance use disorders in healthcare professional education: a scoping review. *Can Med Educ J.* 2024 Dec;15(6):72–83. https://doi.org/10.36834/cmej.78344
15. Jeffries PR. *Simulation in nursing education: From conceptualization to evaluation.* 3rd ed. Philadelphia: Wolters Kluwer; 2021.
16. Jeffries PR. *The NLN Jeffries simulation theory.* Philadelphia: Wolters Kluwer; 2016.
17. Hojat M, Maio V, Pohl CA, Gonnella JS. Clinical empathy: definition, measurement, correlates, group differences, erosion, enhancement, and healthcare outcomes. *Discov Health Syst.* 2023 Feb 27;2(1):8. https://doi.org/10.1007/s44250-023-00020-2
18. Caulfield A, Vatansever D, Lambert G, Van Bortel T. WHO guidance on mental health training: a systematic review of the progress for non-specialist health workers. *BMJ Open.* 2019 Feb 1;9(1):e024059. https://doi.org/10.1136/bmjopen-2018-024059
19. Tang ACY, Wong N, Wong TKS. Learning experience of Chinese nursing students in an online clinical English course: qualitative study. *Nur Educ Today.* 2015 Feb 1;35(2):e61–6. https://doi.org/10.1016/j.nedt.2014.11.017
20. Wisniewski B, Zierer K, Hattie J. The power of feedback revisited: a meta-analysis of educational feedback research. *Front Psychol.* 2020 Jan 22;10. https://doi.org/10.3389/fpsyg.2019.03087
21. Creswell JW, Clark VLP. *Designing and conducting mixed methods research.* SAGE Publications; 2017.
22. Hattie J, Timperley H. *The power of feedback. review of educational research.* 2007;77(1):81–112. https://doi.org/10.3102/003465430298487
23. Asarbakhsh M, Sandars J. E-learning: the essential usability perspective. *Clin Teach.* 2013 Feb;10(1):47–50. https://doi.org/10.1111/j.1743-498X.2012.00627.x
24. IBM Corp. *IBM SPSS Statistics for Macintosh.* Armonk, NY: IBM Corp; 2024.
25. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006 Jan 1;3(2):77–101. https://doi.org/10.1191/1478088706qp063oa
26. Braun V, Clarke V. Toward good practice in thematic analysis: Avoiding common problems and be(com)ing a knowing researcher. *Internat J Transgen Health.* 2023 Jan 25;24(1):1-6. https://doi.org/10.1080/26895269.2022.2129597
27. Gomez E, Gyger M, Borene S, et al. Using SBIRT (Screen, Brief Intervention, and Referral Treatment) training to reduce the stigmatization of substance use disorders among students and practitioners. *Subst Abuse.* 2023 Jan 1;17:11782218221146391. https://doi.org/10.1177/11782218221146391
28. Murphy J, Russell B. Stigma reduction through addiction and naloxone education. *J Crim Just Educ.* 2023 Apr 3;34(2):185–98. https://doi.org/10.1080/10511253.2022.2068632
29. Jadoon M, Naushad K, Aman F, Khan Y, Durrani M, Ali S. Virtual patients for communication skills training: a mixed methods evaluation. *Cureus.* 2025 Aug;17(8):e91005. https://doi.org/10.7759/cureus.91005
30. Foster A, Chaudhary N, Kim T, et al. Using virtual patients to teach empathy: a randomized controlled study to enhance medical students' empathic communication. *Simul Healthc.* 2016 Jun;11(3):181–9. https://doi.org/10.1097/SIH.0000000000000142
31. Lister M, Vaughn J, Brennan-Cook J, Molloy M, Kuszajewski M, Shaw RJ. Telehealth and telenursing using simulation for pre-licensure USA students. *Nurs Educ Pract.* 2018 Mar 1;29:59-63. https://doi.org/10.1016/j.nepr.2017.10.031
32. Nulty DD. The adequacy of response rates to online and paper surveys: what can be done? *Assess Eval Higher Educ.* 2008 Jun 1;33(3):301–14. https://doi.org/10.1080/02602930701293231