# The use of virtual patient simulations in psychology: A scoping review

**Syeada Imam Hossain,**
School of Psychological Sciences, Macquarie University

**Joshua Kelson**
School of Psychology, Charles Sturt University

**Ben Morrison**
School of Psychological Sciences, Macquarie University

Virtual patient (VP) simulations can offer educational benefits in healthcare disciplines by supplementing traditional training approaches and enabling the acquisition of clinically relevant skills and knowledge. Although the existing body of literature covers VP usage in healthcare professions such as medicine and nursing, there are no current reviews highlighting the use of VP simulations in the field of psychology. The aim of this scoping review was to examine the educational impact of VP simulations on learning and user experience outcomes among psychology students and clinicians. Cochrane Library, PsycINFO, PubMed, Scopus, ERIC, IEEE Xplore and SAGE journals databases were searched up to June 2023. Studies of all designs and comparator groups were included if they appraised the effectiveness and user experience of any VP simulation aimed at addressing learning outcomes among psychology students and clinicians. A total of nine studies met the inclusion criteria. Overall, VP simulations hold promise in facilitating improvements in skill acquisition, clinical competence and knowledge. Although user impressions were largely positive, there were notable technical challenges that hampered their usability and learning effectiveness. Further research and standardisation of VP simulations are needed to draw definite conclusions about the effectiveness of these simulations in psychology education.

*Implications for practice or policy:*

- Educators could incorporate VP simulations into psychology curricula to enhance the learning experience of students and impact skill and knowledge acquisition and clinical competence.
- Higher education policymakers could advocate for further research and standardisation of VP simulations in psychology education to establish evidence-based guidelines, fostering a more comprehensive and consistent educational environment for psychology students and clinicians.
- Course developers or coordinators could establish a standardised approach to assess core professional competencies required for practice.

*Keywords:* virtual patients, simulation, psychology, psychologist, education, training, review

## Virtual patients

The current landscape of healthcare education appears to embrace more online and digital simulations to supplement face-to-face clinical training. A relatively recent addition to these digital learning tools is the use of virtual patients (VPs). Although standardised or simulated patients (actors or lay-people trained to portray a patient in a realistic or standardised way) have typically been used for teaching and assessment purposes (Cleland et al., 2009), their use has been largely unfeasible given the shift to online education during the COVID-19 pandemic. Therefore, VPs have been used as a viable alternative.

VPs are computer simulations of virtual humans within clinical situations used for teaching, education or assessment in the health professions (Cook et al., 2010; Issenberg et al., 2005). Most VPs can be programmed to respond to text and voice input (Washburn et al., 2020), allowing students to virtually take on the role of healthcare providers to obtain histories and make clinically relevant decisions in a safe learning environment (Plackett et al., 2022). Although early VP programmes involved clunky avatars with unrealistic appearances, body movements and responses, recent iterations have leveraged current technologies to improve the overall graphics and user interface to enhance the realism of the clinical simulations (Washburn et al., 2020).

Contemporary VPs can be customised to portray patients of different genders, ages, ethnicities or presenting issues (Washburn et al., 2020). In addition, many VPs have voice recognition capabilities that allow them to respond relatively accurately to student inquiries regarding their background, symptoms and history, which assists with the authenticity of the clinical scenario (Kenny & Beagan, 2004). The settings of the simulation can also be controlled, thus creating opportunities for students to experience scenarios that they may not usually encounter in their placements (e.g., violence, aggression or verbal abuse; Graj et al., 2019; Kononowicz et al., 2019). By interacting with VPs in these controlled virtual environments, students are, in a sense, able to “experiment” with their learning as it is possible to make errors and repeat a given clinical scenario as many times as needed without compromising the safety of real patients (Isaza-Restrepo et al., 2018).

As an educational tool, VPs can facilitate the acquisition of clinical skills before students interact with actual patients. Multiple meta-analyses and systematic reviews have demonstrated the effectiveness of VPs in improving clinical reasoning for students in a range of health profession courses (Cook et al., 2008; Cook et al., 2010; Kononowicz et al., 2019; Tolarba, 2021). Reviews have also indicated that VPs can aid in improving healthcare and medical students’ knowledge and skills when used within blended learning course designs (Kononowicz et al., 2019; Vallée et al., 2019).

Although VPs offer pedagogical benefits, some limitations have been identified with their use. Since VP-based training often involves automated presentations of clinical scenes or situations, there may be limited flexibility for instructors or examiners to pause the simulation for teaching or assessment purposes (Parsons et al., 2017). Another constraint that has been considered is that students’ learning experiences can be disrupted if the VP does not respond correctly (Washburn et al., 2016). Namely, less sophisticated VPs can often make nonsensical or incorrect responses to straightforward questions, which can consequently impair students’ immersion (Rogers et al., 2020). For instance, in a feasibility study investigating the use of a VP simulation to enhance the assessment skills of social work students, Washburn et al. (2016) found that students experienced difficulties with the accuracy of the VP software’s voice recognition. The VP would often miss parts of the questions they asked, which led to frustration and reduced engagement. Concerns also exist that these tools may lead to students being less empathetic due to being emotionally detached to the VPs, who may not convey realistic human emotions, body language or non-verbal cues (Kenny & Beagan, 2004). Despite these potential shortcomings, VPs are still a useful adjunct to traditional classroom learning, leading to the view that they should complement, but not replace, actual patient contact (Edelbring et al., 2011; Kononowicz et al., 2019).

## VP use in psychology education

VPs certainly offer educational advantages to the training of students in different healthcare disciplines, providing an environment for the development of clinically relevant skills. Although they have demonstrated value in medical (Consorti et al., 2012), nursing (Chen et al., 2020) and pharmacy education (Fidler, 2020), their use is relatively novel in behavioural science programmes, such as psychology. Psychology training, particularly postgraduate training and its associated professional competencies (Australian Psychology Accreditation Council, 2019, pp. 17–18), is concerned with building students’ skills in working within a range of clinical scenarios and with clients who present with different mental health problems that vary in complexity and severity. The development of such skills, however, is heavily reliant on the availability of direct client hours via student placements (i.e., performing of tasks such as consultation, diagnosis, psychological assessment, treatment and interventions; Psychology Board of Australia, 2024b). As with the training of other healthcare professionals, the provision of these direct client hours has been difficult due to the COVID-19 pandemic and the impact it had on student placements. Pandemic-related placement disruptions not only had consequences for student learning and progress but have also led to concerns about future workforce shortages (Paparo et al., 2021).

These impacts are especially worrying given the continued expected impacts of the pandemic on global health and well-being, particularly with respect to psychological health (Australian Institute of Health and Welfare, 2022). As a result, there is a significant need for ways to ensure a sustainable reserve of capable psychologists to meet the growing demand for psychological support services. A possible way to meet this demand and assure the continuity of training for psychology students is with the use of VPs. They can provide trainees with valuable learning experiences that prepare them for the challenges of real clinical work and also ensure that these learning experiences are provided in a manner that protects the general public (Paparo et al., 2021). VPs have the added potential of addressing multiple limitations related to the current training approach of postgraduate psychology, which are detailed below.

### *Providing a controlled learning environment to practise relevant skills*

Positive client outcomes are contingent on effective skills in communication, active listening and psychological assessment (Paparo et al., 2021). Traditionally, these skills are developed during role-playing activities where students act out specific clinical scenarios with one another and often take on the role of both the client and the psychologist. Although this method of teaching is typically appreciated by students and instructors (Alexander et al., 2018; Serrano et al., 2017), it may be hindered by a lack of authenticity brought on by students' inadequate acting abilities, the possible discomfort of acting in front of their peers and a stronger connection with the role of the psychologist than that of the client (Melluish et al., 2007; Pomerantz, 2003).

The preferred way to address these difficulties is to use trained actors to play standardised or simulated patients, but there is the potential for a lack of realism and validity with their use (Gormley et al., 2012). Given standardised patients are trained to represent specific conditions, they may over- or under-emphasise certain symptoms and thus cause the simulated clinical encounter to feel artificial or bear little resemblance to the realities of clinical practice (Gormley et al., 2012). Standardised patients can also prove to be costly and logistically unfeasible (Rogers et al., 2020), which leaves room for VPs to serve as flexible and potentially cost-effective adjuncts. Unlike standardised patients, there is an unlimited number of times VPs can be used during the day and multiple students can concurrently interact with them (Washburn et al., 2016). By providing a structured and controlled learning environment, students can develop and practise skills without jeopardising client safety (Bearman et al., 2013). There is the additional opportunity of identifying and discussing ethical concerns that may be associated with the VP simulation, thus fostering risk management skills and improving students' professional confidence before interacting with real clients (Paparo et al., 2021).

### *Ensuring a breadth and variety of clinical scenarios*

Competent psychologists should ideally be prepared to handle the demands of a variety of clinical situations and client types (Meghani & Ferm, 2021). Although placements generally provide rich learning experiences, they can often be limited in the volume of clients as well as the diversity and severity of client presentations that students encounter. When this clinical variety is not afforded by the placement, VPs may fill this gap by simulating a range of student-client encounters in realistic and challenging ways (Sunnqvist et al., 2016). This not only supports exposure to cases that rarely appear in placements but also promotes learning equality as all students can experience a breadth of client presentations during their training (Paparo et al., 2021).

### *Facilitating reflective practice*

A core clinical competency to encourage professional development within psychological training is the ability to engage in reflection, as it can lead to students having a greater understanding and consideration of the situations that they have experienced in placements or during training (Sunnqvist et al., 2016). Unlike the experience of working with real clients, using VPs can provide students with the opportunity to train with the simulation many times in one sitting and permit them to pause and play it as needed (Washburn et al., 2020). This repeated practice helps students hone their clinical competence by reflecting on gaps in their knowledge and skills. For example, social work students in Washburn et al.'s (2016) VP study stated that the flexibility to repeat the simulations allowed them to improve their clinical assessment skills and prepared them for the realities of working with actual clients. Finally, working with VPs also provides students the chance to observe their fellow students and discuss common points of learning via peer feedback (Melluish et al., 2007).

### The current study

VPs offer multiple benefits to the teaching of healthcare disciplines by supplementing traditional training approaches and enabling the acquisition of clinical competencies. Moreover, they have the potential of mitigating the burdens faced by education providers to source adequate direct client hours for students during placements (Paparo et al., 2021). As previously discussed, reviews on VP simulations have largely focused on other healthcare professions such as medicine and nursing, but there is a comparative lack of reviews examining VPs in the behavioural sciences, such as psychology. This current scope of literature highlights the advantages of the use of VPs and provides encouragement for the value that they could add to the education of students in postgraduate psychology programmes. As there are currently no other scoping reviews on the learning effectiveness and user experience of VP simulations in psychology education, the aim of this review was to close this gap by addressing the following research questions:

(1) What VP simulation programmes have been used within the field of psychology education?
(2) What psychology knowledge and skill training areas have the VP simulations focused on (e.g., diagnostic skills, interviewing or other)?
(3) What learning effectiveness and user experience outcomes were obtained from the psychology students and clinicians who used the VP simulations?

## Method

This scoping review was conducted in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) extension for scoping reviews (PRISMA-ScR; Tricco et al., 2018).

### Eligibility criteria

All studies needed to report on VP simulation effectiveness and user engagement outcomes obtained from psychology participants (i.e., psychology students and/or practitioners). This widely included any standardised or unstandardised measure of key psychology knowledge and skill training outcomes (e.g., diagnostic reasoning, interviewing, counselling) as well as user experience outcomes (such as usability, acceptability, safety or attrition). The VP simulation could be delivered on any computerised system (e.g., personal computer, mobile device). Studies of any research design (i.e., quantitative, qualitative or mixed methods) were eligible for inclusion with none excluded based on methodological quality. Studies with or without comparators of any kind were also eligible for inclusion (e.g., comparison of the use of VP simulations to other traditional education modalities such as lectures, readings, group or classroom discussions, video recordings, web-based tutorials, virtual classrooms and non-digital simulations such as standardised patients or mannequin-based training). Peer-reviewed journal articles written in English were eligible for inclusion.

### Search strategy

The review involved searches of the scientific research databases up to June 2023: Cochrane Library, PsycINFO, PubMed, Scopus, ERIC, IEEE Xplore and SAGE journals. The following keywords were used to search the databases: (“virtual” OR “digital”) AND (“patient” OR “avatar” OR “human” OR “client”) AND (“simulation”) AND (“psychology” OR “psychologist” OR “psychological” OR “psychiatry” OR “social work”).

The reference lists of all included or eligible sources were also screened for additional studies.

### Article selection

Following the search of all databases, the identified citations were collated and de-duplicated. Remaining article titles and abstracts were then scanned, and full-text appraisal was conducted on potential articles for final study inclusion. The three of us resolved any disagreements on inclusion through discussion and mutual agreement.

### Data extraction

Data from the included studies were extracted into a standardised coding sheet. The data extraction items for results tabulation covered the following areas:

(1) Reference source: first author surname, year of publication and journal article title.
(2) Study design: methodology, any comparator trial arms, and outcome measurement points (pre-test, mid-test, post-test and any follow-up measurements).
(3) Population: country of origin, total sample size and non-identifiable participant characteristics such as age and gender.
(4) VP simulation details: programme name, hardware, software, number of modules, intervention length, participant usage time, therapist guidance and educational content.
(5) Effectiveness: standardised measure names, outcomes and effect sizes.
(6) User experience: reported outcomes on intervention safety, acceptability, usability, attrition rate and intention-to-treat analyses.

Attrition in this review was defined and measured as the relative number of participants who started using the VP simulation but did not complete measurements during test or at post-test.

### Quality assessment

This scoping review included randomised and non-randomised controlled trial studies. To critically appraise and report on their methodological quality, Hong et al.’s (2018) Mixed Methods Appraisal Tool was utilised. This tool involves answering a set of screening and methodology questions based on the design category of each study (i.e., qualitative, quantitative randomised controlled trial (RCT), quantitative non-randomised, quantitative descriptive and mixed methods).

### Data analysis

A narrative synthesis approach was used to analyse and report on the data obtained in this scoping review. This approach involves summarising the data and describing them in text. A meta-analysis was not conducted due to the small number of eligible papers found and the non-uniformity observed between their extracted data items.

## Results

### Study selection

Figure 1 shows that the literature search yielded 3,403 papers, along with two additional papers sourced via a general search (i.e., via the Google search engine without targeting specific databases). A total of 2,740 remained after de-duplicating citations. Of these records, nine met the eligibility criteria.

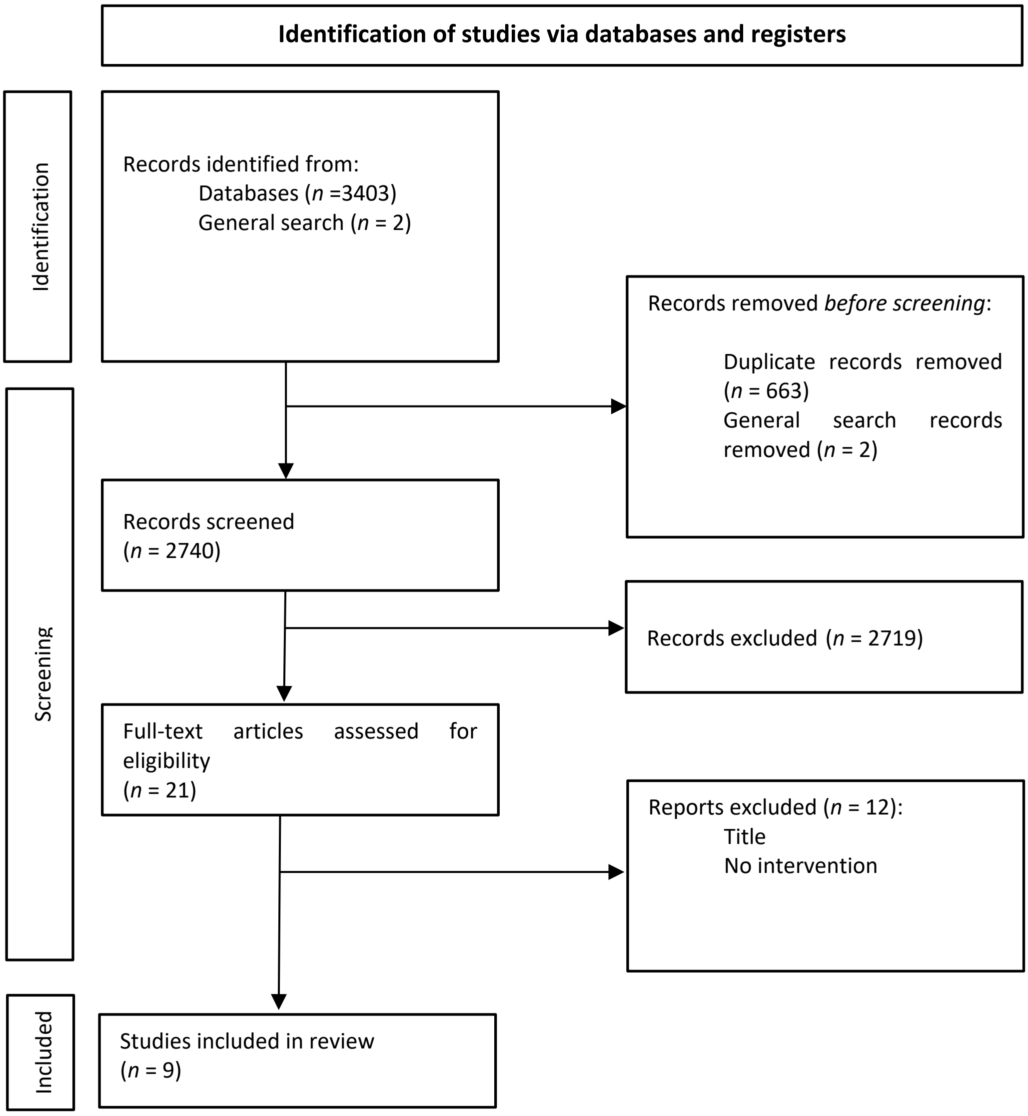


*Figure 1.* PRISMA-ScR flowchart for the identification of studies

In total, 3,403 articles were retrieved from Cochrane Library (*n* = 287), ERIC (*n* = 71), PsycINFO (*n* = 176), PubMed (*n* =561), Scopus (*n* = 1,578), IEEE Xplore (*n* = 285) and SAGE journals (*n* = 445). After removing 663 duplicates, 2,740 articles were evaluated. At this stage, articles were screened on the basis of their participants, type of intervention and outcomes. The main reasons for exclusion are presented in Figure 1. Nine publications were ultimately included in this review.

## Participant characteristics

A total of 763 participants tested and gave user feedback on VP simulations (see Table 1 in Appendix A, https://doi.org/10.25949/28022456.v1). They were largely from Australia (*n* = 294), followed by the Netherlands (*n* = 261), the USA (*n* = 87), Poland (*n* = 85) and Taiwan (*n* = 36). Sample sizes ranged from 22 to 261 participants, with a median of 65 participants. Of the available data, mean participant age was 27 years. Participants were mainly female with an average sample proportion of 82% (range of 70% to 86.1%). Most participants were students; however, there were nine participants who were licensed counselling psychologists.

## Details of the VP simulations

All studies tested a unique VP simulation intervention (see Table 2 in Appendix B, https://doi.org/10.25949/28022456.v1). Hardware involved standard desktop computers or personal computers and/or laptops. Two studies made use of virtual reality head-mounted displays (e.g., Oculus Rift, HTC Vive; Lan et al., 2023; Rogers et al., 2020), microphones and hand-motion controllers. Software incorporated passive or active virtual environments with audio, video, text-based interfacing and interactivity (e.g., visual cues, speech recognition technology and feedback functions) and online modules (i.e., an online blended simulation-based learning programme composed of clinical demonstrations and virtual simulations). Intervention lengths ranged from one to 10 sessions. Participant usage time with the VP simulation ranged from 20 to 60 minutes per session, and two studies delivered the VP simulation in a single session. Most VP interventions were tested with facilitator guidance, except for three that delivered the VP as purely self-guided (A. Campbell et al., 2015; Lan et al., 2023; Mastroleo et al., 2020).

## Research designs and comparators

Participant VP simulation use was appraised in three quantitative RCT studies, four quantitative non-randomised studies and two mixed methods studies. There were no qualitative or quantitative descriptive studies. Two studies made use of a single group research design (see Appendix A, https://doi.org/10.25949/28022456.v1). To collect data on VP outcomes, eight studies used surveys or questionnaires (A. Campbell et al., 2015; Graj et al., 2019; Hulsbergen et al., 2023; Mastroleo et al., 2020; Rogers et al., 2020; Walkeiewicz et al., 2022; Washburn et al., 2020; Zalewski et al., 2020), one study used semi-structured interviews (Graj et al., 2019), two studies obtained direct user commentary (Rogers et al., 2020; Washburn et al., 2020), one study collected user engagement data during experimentation (Washburn et al., 2020), two studies used expert ratings (Lan et al., 2023; Walkiewicz et al., 2022) and two studies used system-generated scoring based on user interaction with the VP (Hulsbergen et al., 2022; Walkiewicz et al., 2022). Comparators included standardised patients, classroom role- plays, the reading of articles or a therapy manual and lectures. Seven studies had pre- and post-test assessments on user outcomes, though one also had a follow-up assessment and one had assessments during the active VP test phase.

## Effectiveness measures and outcomes

Details of the measures and outcomes of VP simulation effects on diagnostic accuracy, psychological interview techniques, therapy skills, clinical reasoning and decision-making and student emotions and motivation are summarised in Table 2 (see Appendix B, https://doi.org/10.25949/28022456.v1). Measures included the Diagnostic Reporting Form (American Psychiatric Association, 2013), Social Work Skills Self-Efficacy measure (Bandura, 2006; Holden et al., 2002), Usability Feedback Form (modified version of the System Usability Scale; Brooke, 1996), Need for Closure Scale (Webster & Kruglanski, 1994), Efficacy at Fulfilling the Need for Closure Scale (Bar-Tal & Kossowska, 2010), Implicit Self-Theory Scale (Chiu et al., 1997), Basic Hope Inventory (Trzebiński, & Zięba, 2004), Positive and Negative Affect Schedule (Crawford & Henry, 2004), Brief Emotional Experience Scale (Rogers et al., 2020; Skead et al., 2018), Interviewing Self-Efficacy Survey (adapted from the Counselling Self-Estimate Inventory; Larson et al., 1992), Counselor Activity Self-Efficacy Scales (Lent et al., 2003), and the Yale Adherence and Competence Scale (Carroll, 2000). Two studies also made use of knowledge and performance tests developed by the respective research teams (Graj et al., 2019; Hulsbergen et al., 2022). Of the studies that reported them, VP simulation effect sizes ranged from small (Campbell et al., 2015) to large (Graj et al., 2019; Hulsbergen et al., 2022; Washburn et al., 2020) in magnitude.

## User engagement with the VP simulations

The average attrition rate was 30.6% across all studies that reported it, with a range of 0% to 73.5% (see Appendix B, https://doi.org/10.25949/28022456.v1). Most studies used non-standardised questions on VP simulation user experience factors of student satisfaction, student experience (e.g., levels of interest, engagement and immersion), perceived realism, content and training helpfulness, usability, as well as perceived enjoyment, motivation and learning. However, two studies used modified versions of the System Usability Scale, which is a standardised measure on system usability (Brooke, 1996).

### Quality assessment results

The included studies were quality assessed with the Mixed Methods Appraisal Tool criteria (Hong et al., 2018). Within the RCT studies, Walkiewicz et al. (2022) did not completely report their randomisation processes in accordance with the assertion by Hong et al. that researchers should explicitly outline the randomisation schedule and it is not sufficient to use statements such as "we randomly allocated" or "using a randomised design". Baseline comparisons between groups were not discernible in Walkiewicz et al. as there was no mention of group baseline figures for each measure. Additionally, Walkiewicz et al. could not meet complete outcome data defined as $\geq$ 80% due to withdrawal rates and participants not adhering to the assigned interventions. Of the remaining RCT studies, Mastroleo et al. (2020) and Hulsbergen et al. (2022) appropriately performed randomisation and reported comparable baseline group analyses. Unlike Mastroleo et al.'s study, which had complete outcome data, that of Hulsbergen et al. made no mention of withdrawal rates or participant adherence to all conditions. The outcome assessors of all these studies (Hulsbergen et al., 2022; Mastroleo et al., 2020; Walkiewicz et al., 2022) were blinded to the measures provided.

Of the quantitative non-randomised papers, the representativeness of the sample population was difficult to determine for two studies due to limited description of the inclusion and exclusion criteria for the target population of the sample (Campbell et al., 2015; Zalewski et al., 2020). Another study acknowledged that their sample did not completely represent the larger population due to a small sample size primarily comprising females (Lan et al., 2023). All studies (A. Campbell et al., 2015; Lan et al.,2023; Rogers et al., 2020; Zalewski et al., 2020) included measurements that were appropriate for both the outcome and intervention (e.g., clearly defined and accurately measured variables, justified and validated measurements that were appropriate for answering the research question), accounted for confounders in the design and analysis and administered the intervention as intended. Zalewski et al. did not have complete outcome data of 80% or above due to a participant withdrawal rate of 24%. Similarly, participants in A. Campbell et al.'s (2015) study did not contribute to all measures. There was no mention of withdrawal or dropout rate within the remaining studies (Lan et al., 2023; Rogers et al., 2020).
All the mixed methods studies in this review (Graj et al., 2019; Washburn et al., 2020) included a sufficient rationale for employing a mixed methods research design, effectively integrated the qualitative and quantitative components to answer the research question, adequately interpreted the findings from the integration of both components, addressed divergences or inconsistencies between qualitative results and, finally, adhered to the quality criteria of both quantitative and qualitative methods.

## Discussion

This scoping review sought to provide an overview of the learning effectiveness and user experience of VP simulations in psychology education by summarising the available research on the types of VP simulation programmes that have been used within the field of psychology education, the areas of psychology knowledge and skills training the VP simulations have focused on and the learning effectiveness and user experience outcomes obtained from the users of the VP simulations. Nine studies investigating VP simulation interventions on psychology students and clinicians were reviewed. As a whole, the outcomes of the review suggest that VP-based training presents a promising approach for skill and knowledge development, and the simulations were generally well-received by users.

### Types of simulation programmes used in psychology education

All the included publications employed or developed VP simulations that were designed with the intention of replicating clinical scenarios emulating the real world or actual client case studies. Much like how postgraduate psychology students on placement encounter clients or patients with a range of mental disorders, and of varying ages, genders, ethnicities and life experiences, they are likely to experience a similar variation in client presentations via exposure to the VPs included in this review. Depending on the way that they were programmed, the majority of the reported VP simulations were short recordings of characters or human avatars that responded to the user via text-based dialogue, verbal (auditory) communication or facial expressions. One publication involved the use of a training module that comprised clinical demonstrations and virtual simulations (Graj et al., 2019).

The customisable nature of these types of simulations (e.g., modifiable patient characteristics or clinical settings) meant that the learning situations the students experienced were closely aligned to the challenges that a psychology trainee may be confronted with in real clinical practice (Stamer et al., 2022; Washburn et al., 2020). Some research teams even made attempts to further enhance elements of the simulation to increase immersion and lead to greater perceptions of realism, including the integration of speech recognition technology and enhanced facial or bodily expressions (Lan et al., 2023), projecting the VPs onto a large screen to make them more life-size (Washburn et al., 2020), as well as utilising additional hardware such as head-mounted displays (Rogers et al., 2020). These features led to students perceiving the VPs as having a better sense of presence. Rather than viewing them as simply part of a computer programme, they treated them with the empathy they would afford to real people (Lan et al., 2023).

Although the current types of VP simulations used in psychology education suggest great potential for offering students realistic clinical environments to practise in, there were some limitations identified that hindered their fidelity and immersion. The primary approach to interaction with most of the VPs included in this review was via choosing the correct response from a list of presented response options. Although Lee et al. (2020) provided evidence to suggest that users can still learn using this method, it is not representative of the dynamics and nuances of real-life conversations. Rogers et al. (2020) claimed that because these types of VP programmes are semi-scripted and usually include only two response options, they can be too restrictive. This text-based communication method may also limit students' performance on important outcome measures. Washburn et al. (2020) therefore proposed that future iterations of VP simulations are designed with voice recognition components of higher accuracy, as well as sophisticated emotional responsiveness from the VPs. This ensures that these VPs focus further on the interpersonal components of the clinical conversation, rather than simply relaying information (Washburn et al., 2020). Should VP simulations still incorporate response options, Rogers et al. argued that they should include at least four response options to maintain sufficient interactivity and immersion. This also allows for shared learning opportunities where students can discuss and compare why they chose specific responses with their peers or instructors.

## Psychology knowledge and skills training areas

There was a broad variety of competency-based skills and knowledge tested using the VP simulations within this review, ranging from diagnostic accuracy, clinical interview and assessment skills to student self-efficacy and confidence, and knowledge of clinical placement risks. In their meta-analysis comparing the effectiveness of skill acquisition through traditional clinical education versus simulation-based practice in medical education, McGahie et al. (2011) found that simulation-based practice is more effective. Similarly, the students within the included studies demonstrated increased skill acquisition in comparison to other traditional training modalities such as standardised patients (Walkiewicz et al., 2022; Washburn et al., 2020), role-plays (A. Campbell et al., 2015), reading a therapy manual (Mastroleo et al., 2020), and reading articles (Hulsbergen et al., 2022). Students also demonstrated improved scores on knowledge tests on delivering bad news (Hulsbergen et al., 2022), the identification of clinical and environmental risks, as well as how to handle hazardous clinical situations (Graj et al., 2019).

The provision of immediate and relevant feedback during the use of some of these VPs was also instrumental in improving students' clinical skill acquisition (Cook et al., 2010). For instance, the VP used in the Mastroleo et al. (2020)'s paper provided an on-screen coach that would provide written guidance and visual cues (e.g., thumbs up) to assist students in promptly identifying and learning from their mistakes. Whereas students on real placements would typically need to wait for their supervisor to listen to or watch a recorded clinical session before they receive feedback, this real-time feedback approach can be timelier and more productive.

Although the psychology trainees involved in the included studies demonstrated gains in clinical skills and knowledge, these findings should be considered within the context of several design and methodological limitations. The study sample sizes were relatively small, and the VP simulation training sessions were brief, with the shortest being only one session long. These interventions are therefore insufficient in indicating long-term changes in clinical competencies. A key benefit of VP simulations, however, is that they can be run as many times as needed to promote continuous practice and skill acquisition.

In their study, Washburn et al. (2020) had two VP conditions where one group received additional practice and training opportunities with the simulation and another group did not. They observed that the students in the condition with no additional training did not display the same improvements in diagnostic accuracy as those in the additional training condition. This suggests that there is the possibility for improving clinical capabilities with repeated VP interaction and there is the potential for sustained skill gains. Finally, the included studies all utilised a variety of VP simulations and examined performance in different skills or competencies (e.g., initial clinical assessment, computer-based training skills, diagnostic accuracy). As such, there is no standardised or objective VP-based assessment that can be reported.

### Learning effectiveness and user experience outcomes

User opinions are important to consider as they predict whether people will accept or use a technology in the future (Zhang et al., 2020). This technology adoption can also be viewed through the technology acceptance model (Davis, 1989), which outlines how perceived usefulness and perceived ease of use are drivers for an individual's use of a new technology. There were differing user impressions within the included publications that assessed users' attitudes towards the VP simulations, but the general sentiments were that students were satisfied with the VP simulations, rated their acceptability of the technology as high (Mastroleo et al., 2020, and felt that they were helpful in assisting them to learn clinically relevant content (Graj et al., 2019). The remaining studies examining user experience observed no significant differences in student usability scores between conditions (Washburn et al., 2020) or had students reporting significantly greater enjoyment, motivation and learning in the non-VP simulation group (Campbell et al., 2015).

Ease of navigation, the ability to accurately depict clinical scenarios, interactivity, perceived usefulness and ease of use have been identified as the key features of perceiving a simulation to be well-designed and contribute to their training effectiveness (Davis, 1989; Washburn et al., 2016). Although some of these elements were indeed evident in several studies (e.g., interactivity with the simulation via selection of response choices, realistic depiction of placement-related clinical scenarios), user satisfaction and learning were impeded in some cases due to technical difficulties and simulation fidelity. For instance, students in the Washburn et al. study reported that it was more difficult to draw out information from the VPs because they did not voluntarily offer up information like real patients in their placements often do. Respondents also felt that the lack of reaction from the VPs in response to their empathic statements made them uneasy, and the variety of topics they could discuss with them were limited (Washburn et al., 2020). Graj et al. (2019) reported that students noted their simulation to be too long, and that the usability of their programme was impacted by technical flaws. Despite these impediments to user experience and learning effectiveness, the simulations were still well-received, and the user feedback signals the potential for improved future usability through the inclusion of components such as enhanced voice recognition and greater consistency in VP responses.

### Considerations

The findings from this scoping review suggest the feasibility of VP simulations in enhancing psychology education by facilitating the development or refinement of clinical skills, which present some strong implications for practice. Simulations are suggested to be ideal for integrating theoretical knowledge and practice (Campbell & Delaney, 2013). This is valuable for postgraduate psychology as both theoretical frameworks and practice form the basis of these programmes' curricula and teachings. Educators can accordingly consider incorporating VP simulations into learning as they may facilitate the link between what psychology students learn in class and what they learn during placements or internships. A VP simulation type that holds particular promise for mental health care and psychology-specific scenarios is the narrative-based VP (Conradi et al., 2007; Guise et al., 2011). It is centred around a case scenario that has a branching structure (i.e., there are several different choice pathways the student can take as they progress through the case) and ultimately aims to develop an authentic clinical story with the provision of feedback that links each decision to another (Guise et al., 2011). This approach is beneficial for the attainment of critical psychologist-specific skills of critical thinking and decision-making as it highlights the importance of the clinical reasoning process (Cook & Triola, 2010). The narrative structure can also improve ethical insight, cultural sensitivity and empathy (Giddens, 2007). The inclusion of VP simulation types that suit the teaching of psychological clinical cases can thus enhance students' learning experiences and puts forth a practicable way to prepare future psychologists for the realities of their profession.

Although the results from most of the included publications support the overall acceptability and viability of VP simulations, there remain some significant considerations to address prior to the widespread inclusion of these training tools within educational programmes. Primarily, the technical difficulties and inconsistencies in VP responses led to negative experiences that impaired students' abilities to communicate with the VPs in ways that reflect realistic and accurate clinical encounters with real patients. This can be a crucial point of frustration, particularly for novice and budding clinicians. Nevertheless, technology is always advancing, and these barriers reveal areas for future improvement. Productive collaboration and research between psychology educators and information technology staff or experts (e.g., e-learning specialists) will be beneficial for developing and improving these simulations. Utilising high-accuracy voice recognition software or text input, for example, can greatly improve the realism of the interaction (Washburn et al., 2016). With the growing popularity and use of head-mounted display devices, coupled with the improved capabilities of smart phones, there is the additional likelihood of greater immersion associated with VP simulations (Rogers et al., 2020). This also improves the accessibility and ease of distribution of these simulations, which has become especially relevant following the increased adoption of remote learning (e.g., following the pandemic) and presents possibilities for the training of clinicians in rural or geographically isolated areas (Mastroleo et al., 2020). Most VP scenarios can also be adapted or translated to accommodate different languages, which can be beneficial for cross-cultural and multilingual learning contexts (Guise et al., 2011).

Standardising VP simulations for the assessment of core professional competencies is also worth noting. Although it is useful to assess a range of clinical capabilities using VPs, it is also essential to determine a standardised approach that considers the specific behaviours, knowledge, skills and abilities required to safely and competently practice as a psychologist (Psychology Board of Australia, 2024a). In Australia, for instance, there are insufficient guidelines on how simulation-based training can be utilised to assess competencies and ensure the safety of students and the public (Paparo et al., 2021). Paparo et al. have accordingly proposed standardised guidelines for the incorporation of simulation-based training in postgraduate psychology programmes that can be modified for different domains of practice and programme levels. They suggested that simulations should (a) be related to the assessment of specific professional competencies, (b) assist students in developing existing skills and knowledge, yet also assist in expanding on new learning with a low possibility of causing harm, (c) reflect situations, work, or interactions that students will encounter in real-life practice, (d) emphasise experiential and active learning principles, (e) be designed and utilised in an organised and controlled fashion to ensure the minimisation of risk and that learning is targeted, (f) be supervised by qualified assessors or staff to oversee student learning, (g) have built-in review or feedback mechanisms, (h) provide opportunities for student reflection on their strengths and development areas and (i) provide feedback opportunities for stakeholders (e.g., assessors, supervisors, programme coordinators). Including these elements can inform the structured evaluation of whether students meet programme objectives and overall registration requirements, meaning course developers or coordinators can establish a standardised approach to assess core professional competencies required for practice.

The final points for consideration are the drawbacks associated with the chosen methodology. As mentioned, this scoping review aimed to examine the educational impact of VP simulations on learning and user experience outcomes specifically among psychology students and clinicians. This meant that publications that utilised VP simulations in similar disciplines (e.g., psychiatry or psychiatric nursing, and social work) were excluded and thus narrowed the selection of simulations to review. Additionally, there was significant variety in the types of simulations and how the respective research teams measured their outcomes to assess effectiveness. Therefore, more experimental studies with standardised evaluations of VP use in psychology training will be required to inform firm recommendations on which types of simulations are the most effective at teaching psychology skills and knowledge.

### Conclusions

Notwithstanding the aforementioned limitations, this scoping review offers important preliminary direction on the use of VP simulations within psychology education and how they can be successfully incorporated into postgraduate programmes as a supplement to traditional methods of training. Following this review, the confirmed paucity of interventions examining psychology-specific VP simulations underscores the need for future research and investigations in this field. Despite the small pool of research and the drawbacks associated with these simulations, they can still present the potential for a low-stakes and low-risk option to uniquely prepare students for the specific challenges and complexities of clinical practice as a psychologist.

## Author contributions

**Author 1**: Investigation, Formal analysis, Writing – original draft; **Author 2**: Conceptualisation, Methodology, Investigation, Supervision, Writing – review and editing; **Author 3**: Conceptualisation, Supervision, Investigation, Methodology, Project Administration, Writing – review and editing.

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**Corresponding author**: Syeada Imam Hossain, syeada.imamhossain@mq.edu.au

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**Please cite as**: Imam Hossain, S., Kelson, J., & Morrison, B. (2024). The use of virtual patient simulations in psychology: A scoping review. *Australasian Journal of Educational Technology*, *40*(6), 76–91. https://doi.org/10.14742/ajet.9559