

# Simulation in Undergraduate Psychiatry: Exploring the Depth of Learner Engagement

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## Abstract

**Objectives** Simulation-based methodologies are increasingly used in undergraduate medical education to expand students' exposure to complex clinical scenarios. Engagement of students in these simulation-based methodologies is a key determinant of their success in learning. Thus, the authors conducted a systematic review to (1) identify simulation methods in use within the undergraduate psychiatry curriculum and (2) assess learner engagement using these methods.

**Methods** Following a PRISMA methodology, the authors searched MEDLINE, ERIC, and PsychINFO databases from 1977 to 2015. Studies applying simulation in undergraduate psychiatric education were reviewed. The depth of learner engagement was assessed using Kolb's four-stage learning cycle.

**Results** Of 371 publications identified, 63 met all the inclusion criteria: 48 used standardized patients and 16 used online or virtual learning case modules. Only one study used high fidelity mannequins. Three studies satisfied multiple stages in Kolb's Learning Cycle, including a single study that addressed all four domains.

**Conclusions** Despite the varied uses of simulation across other health disciplines, there were few novel or innovative uses of simulation in undergraduate psychiatric education since the last review in 2008. Expanding on the use of simulation to improve communication, build empathy, and decrease stigma in psychiatry is essential given the relevance to all facets of medical practice. Given the complexity of psychiatry,

simulation interventions should extend beyond communication scenarios. Medical students need more opportunities to reflect and debrief on simulation experiences and integrate learning into new contexts. Faculty development should focus on these novel approaches to simulation to deeply engage learners and enhance outcomes.

**Keywords** Psychiatry · Undergraduate · Medical student · Simulation

The use of simulation methodologies in medical education has greatly expanded in recent years [1, 2]. Psychiatry in particular is a discipline that stands to benefit from this expansion. Simulation is the promotion of understanding through doing and also offers the opportunity to merge theory with practice [3]. In order to master many of the complex scenarios that arise in psychiatry, the learner must be truly engaged in the process. Ideally, there should be carryover into future practice or a transformation in the learner rather than end at a concrete experience [2, 3].

One author raised the point that those conducting simulations need to understand what draws the learner to the simulation and what factors make it an unparalleled educational experience [3]. To this end, Clapper explored the various models of adult learning theory and how this can impact simulation methodology and learner engagement [3]. He also acknowledged the impracticality of exploring every learning theory that can impact simulation but highlighted some core concepts which should be captured to ensure the learner has an optimal or transformative experience [3]. These core concepts include a safe learning environment, promoting collaboration, and incorporating activities that encourage exploration of alternative personal perspectives and critical reflection [3]. Martimianakis and Albert argued the importance of

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incorporating theory in medical education research and using it to better understand educational phenomenon [4]. They highlighted that adopting a theory-based approach is key in connecting concepts with applications and challenging assumptions [4]. In order to enhance learner engagement in simulation, Clapper highlights the importance of incorporating experiential learning theory and the utility of Kolb's Cycle [3].

Within psychiatric education, simulation allows for exposure to a variety of patient cases and a broader range of psychopathology than would otherwise be consistently available. It also allows for observation and the honing of interviewing techniques and can be used to evaluate clinical skills. For example, there is evidence that the use of standardized patients (SP's) enables psychotherapy teaching [5, 6]. Standardized patients provide an opportunity for real-time feedback and for reflection on performance, which are not typically available to trainees after each patient interaction [2].

Undergraduate medical education in particular is increasing the use of simulation-based methodologies to expand students' exposure to complex clinical scenarios [7, 8]. As class size increases, this approach can facilitate large group sessions by allowing one patient encounter to be videotaped or observed from another room. It also mitigates potential harm arising from vulnerable patients interacting with an inexperienced student or large groups [9, 10]. In addition, many clinical clerkships in psychiatry offer a limited time frame and narrow scope of exposure to psychiatry in any given clinical setting [2]. The use of various simulation methodologies in the undergraduate setting can therefore facilitate exposure to a wide variety of patients in a short time span. It can also broaden the complexity of their case exposure which can serve to further enhance their clinical acumen [2]. There is also support for the use of simulation in teaching more specialized topics in psychiatry, such as diagnosis and management of substance abuse [11, 12].

Although a number of review papers examine the use of simulation in undergraduate psychiatry, most focus exclusively on the use of standardized patients [1, 10].

Brenner and colleagues looked at the uses and limitations of incorporating SPs in psychiatric education [9]. They found that while SPs were thought to offer undisputed value in certain aspects of psychiatric education, challenges were also highlighted such as the inability to foster an empathic interaction and the failure to reproduce an interpersonal response that reflects all the idiosyncrasies of real patients. There may also be challenges to accessing an appropriate and skilled SP pool for psychiatric cases or economic barriers to using them beyond high-stakes assessments [2, 13].

McNaughton and colleagues conducted a review of the literature on psychiatric education and simulation in 2008. Their review focused on both postgraduate and undergraduate education but confined its scope to a detailed exploration of live simulation modalities such as role-play and standardized

patients. The authors discussed the use of these simulation approaches in teaching, objective structured clinical examinations, and high-stakes assessments and research. Areas of concern and ethical issues were also highlighted such as the negative impact of simulating a psychiatric condition on the actor and the importance of debriefing. This included reports of mental and physical exhaustion due to the repetitive nature of the work and to the blurring between the role assumed and the person's actual life. Conversely, there were also concerns that the use of SPs do not provide an authentic emotional depiction and can therefore inhibit the level of attention and empathy evoked in the student [1]. While the paper explored important considerations for using live simulation in psychiatric education, it was not a systematic review of the all the existing literature in undergraduate psychiatry simulation.

Given that McNaughton and colleagues' review was published in 2008, and that interest in simulation in medical education has continued to grow as reflected in the steady increase in published papers since then, the authors thought it was timely to conduct another review of the use of simulation in undergraduate psychiatry education. This review incorporates a novel focus on the ways in which learners are engaged through the simulation experience. Earlier in this section, the authors highlighted the various areas in which simulation-based education can be utilized in undergraduate medical education. Improving clinical acumen requires that the simulation intervention be of a high quality. This in turn can achieve a transformative learning experience that promotes deeper reflection and allows for future application to clinical practice. To this end, the authors were curious as to whether any of the papers reviewed also discussed adult learning theory or used it to guide the design of their simulation methodology.

We hypothesized that while the use of simulation in undergraduate education is widely used, namely to support summative evaluations, there is limited evidence supporting its ability to deeply engage the learner in an enduring way that extends beyond a concrete experience.

This paper will perform the following:

1. Systematically examine the existing literature on simulation methodologies used specifically within undergraduate psychiatry education and provide an overview of the most commonly used approaches to date.
2. Examine the quality of the simulation interventions used and its potential impact on learner engagement.

## Methods

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [14]. Keywords used for database searching included

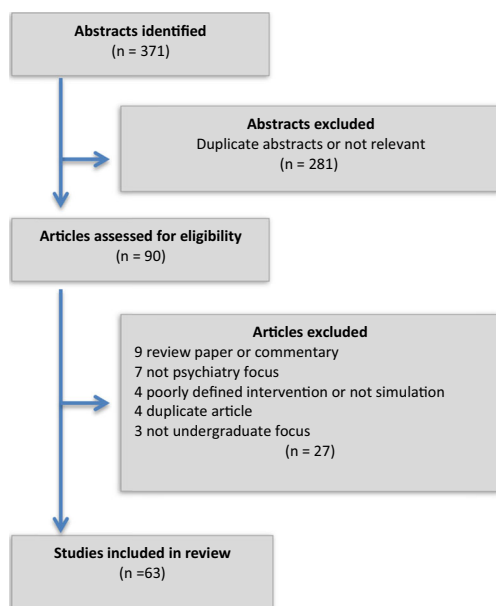
“psychiatry,” “undergraduate medical education,” “medical student,” “simulation,” “standardized patients,” “role play,” and “virtual reality.” Three databases were searched and were selected based upon their medical (i.e., MEDLINE), psychological (i.e., PsychINFO), and educational (i.e., ERIC) focus. The goal was to capture key aspects of simulation training in psychiatry. All database searches were limited to abstract-level, English language, peer-reviewed articles published from 1977 to 2015.

### Study Inclusion Criteria

Three inclusion criteria were used to narrow the search. First, studies had to be in the area of psychiatry and secondly within undergraduate education. Thirdly, studies had to describe an educational intervention using a simulation methodology.

Abstracts of the 371 identified articles were reviewed by two of the researchers (PA, LN) to determine whether the articles met inclusion criteria. Of these, 281 were excluded for the following reasons: duplicate article (e.g., same authors, same study, different journal in which published), not undergraduate focus, not psychiatry focus, or not describing a simulation.

A manual-refined search was then conducted of the selected articles. Of these 90 articles, 27 were further excluded for the following reasons: not undergraduate focus ( $n=3$ ), not psychiatry focus ( $n=7$ ), duplicate article ( $n=4$ ), poorly defined intervention or not simulation ( $n=4$ ), review paper or commentary ( $n=9$ ) (Fig. 1).



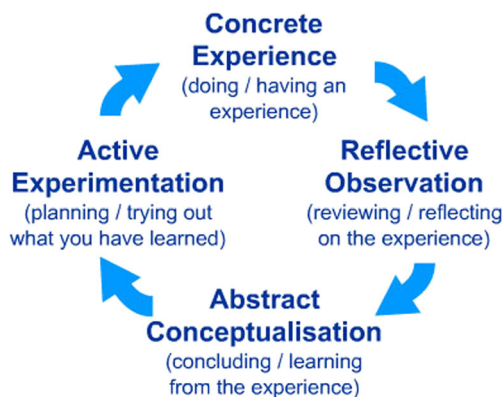
**Fig. 1** PRISMA flow diagram

### Analysis

Full texts of the final 63 articles were reviewed to determine the depth of learner engagement during the simulation intervention by applying Kolb’s Learning Cycle. The authors examined papers that described their simulation methodology to see how well it aligned itself or corresponded with each of the four stages of Kolb’s Cycle. This widely referenced and easily understood adult learning model captures the goals and elements of a well-designed simulation learning activity [15, 16]. The authors are aware that there are many learning theories that could be applied to simulation learning, however given the experiential and simplistic nature of Kolb’s Cycle it has particular appeal. Simulation-based education is rarely just a passive or concrete experience and therefore should encompass multiple facets of learning in order to be transformative. Reflection is thought to be an integral part of the transformative learning process as is the ability to allow the new knowledge or experience to guide future actions and change practice [3] (Fig. 2).

### Results

Standardized patients were the most common simulation method used in undergraduate medical education ( $n=48$  articles) [10, 17–63]. Sixteen of the papers made use of virtual or online learning case modules for simulated experiences [13, 17–19, 21, 63–73]. Virtual patients (VP) technology is a computer-based approach that is defined as “an interactive computer simulation of real-life clinical scenarios for the purposes of health care and medical training, education, or assessment” [74]. VPs are seen as a valuable educational simulation tool in promoting clinical reasoning and can facilitate an important aspect of clinical learning [75]. Nine of the subset of 16 papers utilized virtual patients [13, 63–70]. Another small subset of articles reviewed ( $n=2$ ) simulation using audio



**Fig. 2** Kolb’s Learning Cycle. McLeod, S. A. (2013). Kolb - Learning Styles. Retrieved from [www.simplypsychology.org/learning-kolb.html](http://www.simplypsychology.org/learning-kolb.html)

sensory experiences (e.g., experiencing hallucinations and its impact on learner empathy) [52, 76]. Five of the articles reviewed simulated a psychiatric condition using role play [22, 23, 77–79].

Two researchers examined the final set of 63 papers in order to determine the depth of learner engagement. Simulation is used in a myriad number of ways in psychiatric education to cover complex scenarios and to develop specialized competencies. It was surprising to the authors that none of the papers reviewed examined the impact of the simulation intervention on the depth of learner engagement. Furthermore, there was no mention made in any papers reviewed of adult learning theory explicitly applied to understanding the impact of the simulated learning experience. Students who were asked to provide feedback on the simulation modality used did not actually reflect on their own performance in the simulation or how it facilitated their learning [59, 70].

Kolb's Learning Cycle (1984) was used to examine the studies meeting the inclusion criteria. The vast majority of papers reviewed ( $n=63$ ) provided concrete experiences, with 19 papers going one step further to include opportunities for reflective observation [13, 17, 24–26, 41, 43, 48, 52, 54, 58, 64–66, 71, 72, 76, 78, 79]. Two papers designed protocols that allowed learners to engage in the third stage of Kolb's Learning Cycle, abstract conceptualization [60, 61].

Three studies met the required inclusion criteria and satisfied multiple stages in Kolb's Learning Cycle (1, 2, 3, and/or 4) in its design and execution. The final 63 papers were summarized in Table 1 according to which stages of Kolb's Cycle they satisfied and the area of psychiatry in which the simulation intervention was focused.

One study was highlighted in the results since it encompassed all four of the key stages of Kolb's Learning Cycle [62]. This paper compared the use of iterative hypothesis testing (IHT) in psychiatric education to teaching as usual. In the IHT group, learners' concrete experiences (Kolb's stage 1) were reinforced through video films of simulated patients. Learners were then asked to repeatedly refine their hypothesis through new data presented through additional video cases (Kolb's stage 2, reflective observation, and stage 3, abstract conceptualization). Participants were then assessed based on an application of their learning through two cases using two simulated patients represented by professional actors (Kolb's stage 4, active experimentation, and stage 1, concrete experience). Findings of this study suggest that teaching IHT to medical students in psychiatry may enhance their clinical ability to recognize complex disease patterns within a short time frame [62]. This could be integrated into recognized models of teaching, such as simulation-based approaches. Kahl and colleagues did not specifically reference any

adult learning model (including Kolb's Learning Cycle) in their study's design or analysis of their results [62].

## Discussion

Despite the surge in interest in simulation in medical education, there was a paucity of novel or innovative approaches implemented since the review by McNaughton and colleagues in 2008. While other medical specialties have expanded their use of technologies and medical simulation devices to train students, psychiatry continues to maintain its tradition of communication-oriented scenarios using live SP simulation. There is an increased awareness for the need to educate physicians on how to better integrate mental and physical health to improve patient care [80]. It appears though that this has not extended into the area of simulation-based medical education since only one study utilized high-fidelity mannequins to teach undergraduate students how to manage a patient who presented with an altered mental status after overdosing on medications and alcohol [43]. Apart from fostering a better understanding of the overlap between medical and psychiatric conditions, high fidelity simulation could be used to demystify psychiatric procedures such as electroconvulsive therapy, which might not be available at all training sites.

Virtual patients, whether in the form of live simulation, computer-programmed avatars, or video cases were the second most prevalent simulation intervention in this systematic review. Virtual patient cases can be used to simulate complex clinical scenarios that medical students may not otherwise have the opportunity to encounter. However, in 2005, only 26 of 108 USA and Canadian medical schools used virtual patients [81]. This is partly due to the high costs associated with it [81], and to a limited understanding by faculty of how to best use this technology [75, 82, 83]. This highlights a need to educate faculty on the optimal use of new simulation-based technologies, which can enrich the learning environment for the medical student.

A unique contribution of this systematic review was its emphasis on identifying the depth of learner engagement as a critical issue in the simulation experience. Well-designed simulations extend beyond the concrete experience and engage learners through reflective observation, abstract conceptualization (typically through a debriefing process), and active experimentation (i.e., application to future practice). The finding that only one of the papers reviewed met all four of the stages of Kolb's Learning Cycle further underscores that true, multi-faceted simulation is not as well developed as it should be [62]. Contemporary summative evaluation of undergraduate psychiatry students often utilizes standardized patients to enhance the fidelity of a clinical encounter. These

**Table 1** Summary data from final 63 papers that satisfied multiple stages in Kolb's Learning Cycle

Author/year	Study title	Setting	Simulation intervention	Stage of Kolb's Learning Cycle
Bunn et al. (2009)	Cultivating empathy for the mentally ill using simulated auditory hallucinations	Psychosis	Audio	Stages 1 and 2
Metcalf et al. (2008)	An iGen approach to teaching medical students	Addiction Psychiatry	e-learning and SP	Stage 1
Lee et al. (2008)	Working with patients with Alcohol Problems: A controlled trial of the impact of a rich media web module on medical student performance	Addiction psychiatry	e-learning and SP	Stage 1
Lanken et al. (2015)	Efficacy of an internet-based learning module and small-group debriefing on trainees' attitudes and communication skills toward patients with substance use disorders: results of a cluster randomized controlled trial	Addiction Psychiatry	e-learning and SP	Stages 1 and 2
Duque et al. (2008)	Learning while having fun: the use of video gaming to teach geriatric house calls to medical students	Geriatric Psychiatry/Geriatric Medicine	e-learning video game	Stages 1 and 2
Foster et al. (2015)	Student assessment of psychiatry clinical simulation teaching modules.	General Psychiatry	Online	Stage 1, 2
Jachna et al. (1993)	Teaching consultation psychiatry through computerized case simulation	Consultation-Liaison Psychiatry	Online case based	Stage 1
Smith (2011)	Cultural competence clinic: An online interactive, Simulation for working effectively with Arab American Muslim patients	Cultural Psychiatry	Online SP	Stage 1
Melding et al. (2002)	A "fair play"? Comparison of an OSCE of final year medical students training in psychiatry and their supervisor's appraisals	General Psychiatry	OSCE/SP	Stage 1
Martin et al. (1995)	Medical students as role playing patients. A model for teaching personality styles in the medical setting	Personality Disorders	Role play	Stage 1
Behr (1977)	Introducing medical students to family therapy using simulated family interviews	Psychotherapy	Role play	Stages 1 and 2
King et al. (2015)	All the world's a stage: evaluating psychiatry role-play based learning for medical students	General Psychiatry	Role play	Stages 1 and 2
Kahan et al. (2003)	Randomized Control trial on the effects of a skills-based workshop on medical students' management of problem drinking and alcohol dependence	Addiction Psychiatry	Role play and SP	Stage 1
Haynes-Roth et al. (2010)	Automating individualized coaching and authentic role play practice for brief intervention training	Addiction Psychiatry	Role Play/SP	Stage 1
Hall et al. (2004)	Use of standardized patients to enhance a psychiatry clerkship	General Psychiatry	SP	Stage 1, 2, 3
Farrell (2012)	Review of "depression in the elderly- simulated patient small group activity."	Geriatric Psychiatry	SP	Stages 1, 2, 3
Wundrich et al. (2008)		General Psychiatry	SP	Stages 1 and 2



**Table 1** (continued)

Author/year	Study title	Setting	Simulation intervention	Stage of Kolb's Learning Cycle
Fritzsche et al. (2008)	Clinical teaching with simulated patients in psychiatry and psychotherapy. A controlled pilot study	General Psychiatry	SP	Stages 1 and 2
Brown et al. (2005)	Curriculum psychosomatic medicine and psychotherapy in medical education-concept, implementation, evaluation	Child Psychiatry	SP	Stages 1 and 2
Matthews et al. (2002)	Using children as Simulated Patients in Communication Training for Residents and Medical Students: A pilot Program	Addiction Psychiatry	SP	Stage 1
Hanson et al. (1998)	The impact of a brief Inter-clerkship about Substance Abuse on Medical Students' Skills	Child psychiatry	SP	Stage 1
Hodges et al. (1997)	The integration of child psychiatry into a psychiatry clerkship OSCE	General Psychiatry/Assessment	SP	Stage 1
Muskin et al. (1997)	An objective structured clinical examination for evaluating psychiatric clinical clerks	Consultation-Liaison Psychiatry	SP	Stage 1
Schafer et al. (2007)	The multi-site field trial of the consultation-liaison psychiatry assessment instrument	General Psychiatry	SP	Stage 1
Eyler et al. (1997)	Experience with new teaching methods and testing in psychiatric training	Addiction Psychiatry	SP	Stage 1
Bardes et al. (1996)	Teaching smoking cessation counseling to medical students using simulated patients	General psychiatry	SP	Stage 1
Roche et al. (1997)	Validity of standardized patient examinations scores as an indicator of faculty observer ratings	Addiction Psychiatry	SP	Stage 1
West et al. (1987)	A controlled trial of educational strategies to teach medical students brief intervention skills for alcohol problems	Interviewing skills	SP	Stage 1
Pohl et al. (1982)	Problem based learning of psychopathology in a traditional curriculum using multiple conceptual models	General Psychiatry	SP	Stage 1
Rubenstein et al. (1979)	Teaching the mental status examination: comparison of three methods	General Psychiatry	SP	Stage 1
Wang et al. (2011)	The use of live simulation in teaching the mental status examination to medical students	General Psychiatry	SP	Stage 1
Haeseler et al. (2011)	Using multiple assessments to evaluate medical students' clinical ability in psychiatric clerkships	Addiction Psychiatry	SP	Stage 1
Issacson et al. (2011)	Assessment of a motivational interviewing curriculum for year 3 medical students using a standardized patient case	Geriatric Psychiatry/Dementia	SP	Stage 1
	Effectiveness of a modified continuum curriculum for medical students: a randomized trial			

**Table 1** (continued)

Author/year	Study title	Setting	Simulation intervention	Stage of Kolb's Learning Cycle
Doering et al. (2010)	Evaluation of the clinical course Psychosomatics and Psychotherapy employing standardized patients	General Psychiatry	SP	Stages 1 and 2
Sperling et al. (2013)	Teaching medical students a clinical approach to altered mental status: simulation enhances traditional curriculum	Emergency Psychiatry	SP	Stages 1 and 2
Prochaska et al. (2011)	Medical Students' Attention to multiple risk behaviors: A standardized Patient examination	Addiction Psychiatry	SP	Stage 1
Mortisier et al. (2012)	Implementation of the interdisciplinary Curriculum teaching and Assessing Communicative Competence in the fourth academic year or medical studies	Communication Skills	SP	Stage 1
Lampen-Impkamp et al. (2012)	Training in iterative hypothesis testing as part of psychiatric education. A randomized study	General Psychiatry	SP	Stage 1
Morley et al. (2011)	Pilot evaluation of a biopsychosocial integrated standardized patient examination in a family medicine clerkship	Communication skills	SP	Stage 1
Fiedorowicz (2013)	A medical interviewing curriculum intervention for medical students' assessment of suicide risk	Suicide risk	SP	Stages 1 and 2
Gay et al. (2002)	Enhanced ambulatory experience for the clerkship: Curriculum Innovation at the University of Michigan	Ambulatory Psychiatry	SP	Stage 1
Mc Lay et al. (2002)	Simulating a full-length psychiatric interview with a Complex patient	General Psychiatry	SP	Stage 1
Birndorf et al. (2002)	Teaching the mental status examination to medical students by using a standardized patient in a large group setting	General Psychiatry	SP	Stage 1
Bennett et al. (2006)	Use of Standardized Patients during a Psychiatry Clerkship	General Psychiatry	SP	Stage 1
Krahn et al. (2002)	The Challenge of Empathy: A pilot study of the use of standardized patients to teach introductory psychopathology to medical students	General Psychiatry	SP	Stage 1
Eagles et al. (2001)	Using Simulated Patients in Education about Alcohol Misuse	Addiction Psychiatry	SP	Stage 1
O'Connor et al. (2014)	Clinical examiners, simulated patients, and student self-assessed empathy in medical students during a psychiatry objective structured clinical examination	General Psychiatry	SP	Stage 1
Kahl et al. (2010)	A randomized study of iterative hypothesis testing in undergraduate psychiatric education	General Psychiatry	Video of SP and SP Interaction	Stages 1, 2, 3, 4
Galletly et al. (2011)	Improving Medical student attitudes towards people with Schizophrenia	Psychosis	Video of SP and Audio of AH	Stages 1 and 2

**Table 1** (continued)

Author/year	Study title	Setting	Simulation intervention	Stage of Kolb's Learning Cycle
Ekblad et al. (2004)	The use of international videoconferencing as a Strategy for teaching Medical Students about transcultural psychiatry	Transcultural Psychiatry	Video SP	Stages 1 and 2
Curran et al. (2012)	An approach to integrating inter-professional education in Collaborative Mental Health Care Ratings of Videotaped Simulated Patient Interviews and four other methods of evaluating a Psychiatry Clerkship	Collaborative Care	Video SP	Stage 1
Mumford et al. (1987)	Comparison of methods for teaching clinical skills in assessing and managing drug seeking patients	General Psychiatry	Video SP	Stage 1
Taverner et al. (2000)	Communicating about sexuality: an initiative across the core clerkships	Addiction Psychiatry	Video with actors, OSCE with SP	Stage 1
Sack et al. (2002)	Virtual Justice: A PTSD Virtual patient for clinical classroom training	Communication Skills	Videotape and SP	Stages 1 and 2
Kenny et al. (2008)	Web-based SBIRT Skills training for health Professional Students and Primary care providers	Anxiety Disorders	VP	Stages 1 and 2
Tanner et al. (2012)	Use of an online virtual environment in psychiatric problem-based learning	Addiction Psychiatry	VP	Stages 1 and 2
Rampling et al. (2012)	Visual interviews for students interacting online for psychiatry (VISION): a novel resource for learning clinical interview skills.	General Psychiatry	VP	Stage 1
Fitzmaurice et al. (2007)	Interactive Virtual Patient scenarios: An evolving tool in psychiatric education.	General Psychiatry	VP	Stages 1 and 2
Shah et al. (2012)	Virtual Patients as novel teaching tools in psychiatry.	General Psychiatry	VP	Stage 1
Pataki et al. (2012)	Using virtual worlds for role-play simulation in child and adolescent psychiatry: An evaluation study.	Child Psychiatry	VP	Stages 1 and 2
Vallance et al. (2014)	Virtual humans and formative assessment to train diagnostic skills in bulimia nervosa.	Eating Disorders	VP	Stage 1
Gutierrez-Maldonado et al. (2014)	Virtual Reality Skills Training for Health Care Professionals in Alcohol Screening and brief Intervention	Addiction Psychiatry	VP and SP	Stage 1



experiences can be resource intensive and it is therefore crucial to ensure their full educational benefits are realized. After careful review of the 63 articles, it appears that the majority of learners engaged in simulation or formative learning activities were not afforded the opportunity to review their performance or participate in an inter-professional team debrief on a scenario. These steps are crucial to process key learning outcomes. Learners, furthermore, are not given opportunities to apply their newly acquired knowledge to real-life clinical situations as part of the design of a simulation-based experience. These abstractions and experimentations are not typically seen as activities for faculty to follow-up on from the original simulation experience. This systematic review highlights an opportunity for faculty to broaden their approach to simulation design to derive greater benefits from these educational opportunities.

There are several limitations to this review. This systematic review captured only published studies. Novel, emerging uses of simulation may be found in industry reports or in gray literature and therefore our results may reflect a publication bias. Our review was limited by the great variability in the descriptions of simulation designs. Some methods used in the studies were described in detail, while others required more inference as to whether a true simulation experience was involved. Some of the studies reviewed did not discuss in great depth the simulation design employed or explicitly mention if an adult learning theory framework was applied. If the use of a debrief, for example, was not explicitly mentioned, we did not credit the study with achieving stage 2 (reflective observation) of Kolb's Learning Cycle. Therefore it was at times difficult to determine the degree to which learners' were engaged in the simulation-based learning intervention. Only one study met all stages of Kolb's Cycle from our analysis of their study, but the researchers did not explicitly frame their study design around intent to deepen student engagement or apply Kolb's Cycle, which was our focus for analysis [62]. As a result, this review may under-represent some of the stages of Kolb's Cycle that were met if authors did not provide expanded descriptions around the learners' processes of engagement within their studies' designs.

In summary, the literature review on simulation approaches within undergraduate psychiatry suggests a continued emphasis on live simulation using SPs. The latter are often used to provide a clinical experience for learners, in most cases, for assessment purposes. Our review suggests that simulation in undergraduate psychiatry education is beneficial for learners, and can further be enhanced by examining how to deepen and extend learning beyond the actual simulated experience. New technologies such as virtual patient video cases and virtual reality simulations may offer new opportunities to expand simulation-based formative learning experiences to more

aspects of the undergraduate psychiatry curriculum. More emphasis should be placed on preparing faculty to use these new simulation approaches to enhance learner outcomes.

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