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PROTOCOL

Health professional students' experiences with virtual simulation: a scoping review protocol

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ABSTRACT

Introduction
Virtual simulation can have a positive impact on student outcomes; still, guidance from an educator and a reliable connection to the internet are cited as important factors for a positive learning experience. However, when students are asked to complete the simulation outside of class time, it remains unknown how their experience is impacted.

Objective
The objective of this scoping review is to answer the question: What are health professional student experiences with *virtual* simulation completed asynchronously outside of the physical or virtual classroom setting without a live facilitator?

Inclusion criteria
We will include published peer-reviewed evidence about any health professional student completing virtual simulation outside of a course context. To be included, the virtual simulation activity needs to be required as part of a course.

Methods
We will use the scoping review methodology from the Joanna Briggs Institute (JBI). Published literature will be located through Medline and Embase (via Ovid), CINAHL, Education Source Complete and ERIC (via Ebsco) and the Web of Science Core Collection. We will search for qualitative, quantitative and mixed-method studies written in English, French or Portuguese. No date limit will be applied. Two reviewers will independently screen articles in the Covidence systematic review management software. Data will be extracted and presented in a narrative summary with tables.

Unprecedented challenges stemming from increasing student numbers and decreasing clinical placements forced many health professional programs to shift program delivery strategies, which meant implementing clinical simulation [1–3]. Clinical simulation provides an interactive experience for health professional

students to enhance their knowledge, skills and attitudes as they care for standardized patients or mannequins within a risk-free, replicated practice setting [4]. Several studies have shown improvements in students' clinical judgment, self-efficacy and clinical skills after participating in clinical simulation [5–7]. More recently, as a result of COVID-19 restrictions, many health professional programs were forced to deliver all or most course content through online methods and platforms, including implementing virtual simulations [8]. Virtual simulation is an interactive computer-based educational approach used to ask students to make decisions about a clinical case and see the results of those decisions [9–11]. It often requires fewer resources and can be completed either within or outside the physical or virtual classroom [11].

In this review we focus on virtual simulations completed outside of a classroom setting. We define a classroom as a physical or virtual space where learning occurs (see Table 1). These in-class virtual simulations may be completed either synchronously or asynchronously and either independently or collaboratively. Virtual simulations completed outside of the classroom are asynchronous, meaning that no facilitator is present. They may be completed independently or in peer groups.

Even as health professional programs return to in-person learning, virtual simulation is increasingly being implemented in health professional programs as it is less expensive and resource-intensive than in-person simulation [12]. Learners make decisions, communicate with others, complete interventions and evaluate outcomes as the virtual simulation unfolds [13,14]. Virtual simulations should be designed, implemented and facilitated following the Healthcare Simulation Standards of Best Practice [8,15]. If proper instruction and technological requirements are unavailable, virtual simulation can be difficult to understand and navigate [16]. Several studies have demonstrated that completing virtual simulation within the physical classroom with a facilitator present improves knowledge retention, clinical reasoning, empathetic communication and understanding of interprofessional roles among health professional learners [17–19]. A consistent high-speed internet connection, computer, and mouse or keyboard are needed to engage in realistic clinical situations portrayed in videos, avatars or games [12,20]. Virtual simulations can be accessed in any space or time and for repeat interactions; however, it is often completed within a physical or virtual classroom environment where instructor support is readily available [21,22]. Further, within the physical classroom environment there is typically reliable internet infrastructure and equipment to facilitate learning [21,22].

Table 1: Options for delivering virtual simulations

	Classroom environment	Outside classroom environment
Environment	Physical or virtual	Virtual only
Facilitator present	Yes	No
Timing	Asynchronous or synchronous	Asynchronous only
Simulation completion	Independent or collaborative	Independent or collaborative

Note: In this table we are referring to the simulation completion stage. Prebriefing and debriefing may occur inside the classroom or asynchronously in either of these situations.

The effects of virtual simulation, when completed in the classroom, have been identified [23,24]; however, it is unclear what information is available about the implications when the virtual simulation is completed outside a physical or virtual classroom setting. A scoping review is needed to identify the key benefits, barriers and outcomes of completing virtual simulation asynchronously outside the classroom setting without an instructor present.

Review question

This review is designed to answer the following question: What are health professional student experiences with *virtual* simulation completed asynchronously outside of the physical or virtual classroom setting? The research question for this review was developed using the 'PCC' strategy as recommended by Joanna Briggs Institute (JBI) framework for scoping reviews [25], where the 'P' stands for participants and includes health professional students, the 'C' stands for concept, which is virtual simulation-based education and the 'C' stands for outside of a classroom environment as the context. Sub-questions for this review include:

1) What are the barriers (e.g. self-direction, poor internet connection) faced by healthcare students who are completing virtual simulations outside of the classroom setting?
2) What are the benefits (e.g. psychological safety, clear instructions) for healthcare students who are completing virtual simulations outside of the classroom setting?
3) What outcomes (e.g. satisfaction, learning, knowledge) do students describe obtaining when completing a virtual simulation outside of the classroom setting?

Methodology

This proposed scoping review will be conducted following the JBI methodology for scoping reviews [25].

Inclusion criteria

Inclusion criteria used in this review are summarized in Table 2.

Participants

In this scoping review, we will consider studies that include health professional students as the population. The health professional students that we will consider are many, including, but not limited to: acupuncturist, audiologist, dentist, medicine, nursing, physiotherapist, pharmacist, psychologist, social worker and therapist. Determination of what constitutes a health professional program will be determined using international standards [26].

Concept

In this scoping review, we will consider empirical evidence on the use of virtual simulation. There are many terms

Table 2: Inclusion and exclusion criteria

	Inclusion	Exclusion
Participants	• Any healthcare student	• Non-healthcare students • Professional development courses provided by non-academic institutions
Concept	• Virtual simulation: Screen-based simulations (completed on a computer, tablet or smartphone) • Simulations are interactive, meaning that students receive immediate feedback on their decisions • Asynchronous: Simulation scenarios are completed with no facilitator present	• Computerized learning activities that are not interactive • Simulations that are completed synchronously with an instructor
Context	• Required or recommended as part of a course • Completed outside the physical or virtual classroom setting	• Completed in a physical or virtual computer lab or classroom setting • Completed during a synchronous online virtual conferencing session
Evidence Type	• All study types (e.g. qualitative, quantitative and mixed methods) • Peer-reviewed text and discussion papers • English, French or Portuguese	• Editorials • Commentaries • Grey literature • Systematic reviews • Conference abstracts

used to represent virtual simulation, which we define as an experience operated by a student on a computer screen [9]. Examples of terms that we consider relevant include clinical virtual simulation, computer simulation, computer-simulated case, computerized clinical simulation testing, online simulation, serious games, three-dimensional virtual world, interactive video patient scenario, virtual gaming simulation, virtual patient, virtual reality and web-based simulation. Other terms may be considered if the simulation is interactive and takes place on a computer.

Context

To be included in this review, the virtual simulation activity needs to be (1) required as part of a course in a health professional program for students and (2) explicitly stated that it was completed outside the classroom setting (e.g. students own home). If the simulation activity was performed in a computer lab, or classroom environment, then the report will be excluded.

Types of sources

This scoping review will include quantitative, qualitative and mixed methods studies of any nature as well as text and opinion papers. Grey literature, systematic reviews and conference abstracts will be excluded.

Search strategy

The search strategy for this scoping review is designed to locate peer-reviewed publications. A three-step search strategy will be used: (1) an initial search, (2) database searches and (3) reviewing reference lists of included studies. First, an initial limited search of MEDLINE, Web of Science and CINAHL was undertaken to identify potentially relevant articles related to our topic of interest and refine the keywords used in the search. After selecting potentially relevant studies, the words contained in the titles and abstracts, as well as the controlled database language used to describe articles were used to develop a full search strategy for MEDLINE (Appendix I) and Web of Science (Appendix II). The search strategy was reviewed by a librarian from Queen's University. During the search process, the initial search strategy and all identified keywords and index terms will be modified and adapted for each included database. This scoping review will consider reports published in English, French and Portuguese and on any date.

We will search Medline and Embase (via Ovid), CINAHL, Education Source Complete and ERIC (via Ebsco) and the Web of Science Core Collection. In addition, we will conduct a specific search of major simulation journals that are not indexed in these databases. These journals that are not indexed include the International Journal of Healthcare Simulation and Advances in Simulation.

Study/source of evidence selection

Search results will be imported into Covidence systematic review management software (Veritas Health Innovation, Melbourne, Australia) to automatically remove duplicates and facilitate article screening. Title and abstract screening by two independent reviewers will occur following pilot testing with the team of reviewers. Conflicts will be resolved by senior reviewers on the team. Then, two independent reviewers will conduct a full-text review following another round of pilot testing. Reasons that articles were excluded will be tracked in Covidence and reported with the final review. Disagreements will be resolved through a discussion involving at least one of the senior reviewers on the team. A Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRISMA-ScR) flow diagram illustrating this process and search results will be included in the final report [25,27].

Data extraction

Two independent reviewers will extract data from each article that meets the inclusion criteria. Extraction will occur verbatim using a common tool developed by the reviewers (see Appendix III). This tool will be piloted with the

extraction team and may be revised as needed during the data extraction process. Any modifications will be outlined in the final report. A third reviewer will compare, combine and check the accuracy of extraction from each data source. Disagreements between reviewers will be resolved through discussion with two or more team members. Quality appraisal will not be conducted. If appropriate, authors of papers will be contacted to request missing or additional data, where required.

Data analysis and presentation

Findings pertinent to the review questions will be summarized in tables, figures and/or using a narrative summary as appropriate. Quantitative data will be summarized using descriptive statistics (counts, percentages), and qualitative data will be summarized using content analysis.

Declarations

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Authors' contributions

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Availability of data and materials

None declared.

Ethics approval and consent to participate

None declared.

Competing interests

We are all members of the Canadian Alliance of Nurse Educators using Simulation (CAN-Sim). Dr. Luctkar-Flude and Dr. Tyerman are co-presidents of CAN-Sim.

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APPENDIX I: MEDLINE SEARCH STRATEGY

Concept	#	Query	Results from 9 June 2022
Participant Role (Student)	1	exp Students/	155,018
	2	Student*.mp.	368,161
	3	Learner*.mp.	19,861
	4	Traine*.mp.	193,176
	5	1 or 2 or 3 or 4	558,136
Participant Discipline	6	exp Education, Professional/	321,962
	7	(Healthcare student* or Health care student* or Medic* or Nurs* or Physiother* or Physical therap* or Occupational Therap* or Podiatr* or Orthoti* or Speech therap* or Speech patholog* or Audiolog* or Prostheti* or Social work* or Paramedic* or Opthalmolog* or Dieteti* or Nutrition* or Psycholog* or Midwif* or Optometr* or Radio* or Pharmac* or Kinesiolog* or Physical education*).mp.	10,762,674
	8	6 or 7	10,802,871
Concept of Virtual Simulation	9	exp Computer Simulation/	277,604
	10	exp Virtual Reality/	4,518
	11	(Clinical virtual simulation* or Computer simulation* or computer-simulated case or Computerized Clinical Simulation Test* or Online simulat* or Serious game* or Three-dimensional virtual world or Video patient scenario or Virtual gaming simulat* or Virtual patient* simulat* or Virtual simulat* or Web-based simulat*).mp.	221,944
	12	9 or 10 or 11	293,650
Concept of Experience	13	(Attitude* or belief* or experience* or feeling* or Impression* or opinion* or perception* or perspective* or Student Experiences or thought* or view*).mp.	3,141,731
Concept	14	12 and 13	27,956
Context of Outside the Classroom	15	(home* or asynchron* or distance or remote or online education or independent stud*).mp.	1,060,900
Concept and Context	16	14 and 15	1,943
Participant	17	5 or 8	11,008,967
Concept and Participant	18	14 and 17	10,358
Context, Concept and Participant	19	15 and 18	750

mp = title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms.

APPENDIX II: WEB OF SCIENCE SEARCH STRATEGY

PCC	Search	Search query and results	Results
Concept, Context and Participant	9	#8 AND #3	1,670
Concept and Context	8	#7 AND #6	22,543
Concept	7	#4 AND #5	105,486
Context of Outside the Classroom	6	ALL=(home* OR asynchron* OR distance OR remote OR online OR independent)	4,602,179
Concept of Experience	5	ALL=(Attitude* OR belief* OR Experience* OR feel* OR Impression* OR opinion* OR Percept* OR perspective* OR thought* OR View*)	6,514,022
Concept of Virtual Simulation	4	ALL=(Clinical virtual simulation* OR Computer simulation* OR computer-simulated case OR Computerized Clinical Simulation Test* OR Online simulat* OR Serious game* OR Three-dimensional virtual world OR Video patient scenario OR Virtual gaming simulat* OR Virtual patient* simulat* OR Virtual reality OR Virtual simulat* OR Web-based simulat*)	806,056
Participant	3	#2 AND #1	574,963
Participant Discipline	2	ALL=("Health profession*" OR "Health science*" OR "Allied health" OR Medic* OR Nurs* OR Physiother* OR "Physical therap*" OR "Occupational Therap*" OR Podiatr* OR Orthoti* OR "Speech therap*" OR "Speech patholog*" OR Audiolog* OR Prostheti* OR "Social work*" OR Paramedic* OR Opthalmolog* OR Dieteti* OR Nutrition* OR Psycholog* OR Midwif* OR Optometr* OR Radio* OR Pharmac* OR Kinesiolog* OR Physical education*)	16,112,903
Participant Role (Student)	1	Student* OR Learner* OR Traine* (All Fields)	1,647,235

APPENDIX III: DATA EXTRACTION INSTRUMENT

Characteristics
Authors
Year of publication
Title of the report
Type of publication (e.g. editorial, manuscript, webpage)
Methods and Procedures
Design (e.g. qualitative descriptive)
Country of publication
Sample/Population (e.g. nursing students)
Procedures (e.g. semi-structured interview guide)
Study Data
Aim/Purpose
Participants
Concept – Describe the simulation
Context – Where were simulations completed?
What are health professional student **experiences** with virtual simulation outside of the classroom setting?
What are the **barriers** (e.g. self-direction, poor internet connection) faced by healthcare students who are completing virtual simulations outside of the classroom setting?
What are the **benefits** (e.g. psychological safety, clear instructions) for healthcare students who are completing virtual simulations outside of the classroom setting?
What **outcomes** (e.g. satisfaction, learning) do students describe obtaining when completing a virtual simulation outside of the classroom setting?
Other notes