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Literature Review

Using simulation to adapt nursing education to times of crisis: A scoping review during Covid-19 pandemic

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ABSTRACT

Objectives: During the COVID-19 pandemic, emergency pedagogical strategies, particularly distance learning, were crucial for ensuring continuous education. This study explores various simulation-based pedagogical interventions implemented for undergraduate nursing students during the pandemic.
Review methods and Design: This scoping review was conducted using the Joanna Briggs Institute (JBI) method. The research procedure was assessed using the PRISMA-ScR checklist.
Data sources: Ten databases were consulted, resulting in the inclusion of 37 relevant studies. A categorization of interventions followed by a thematic content analysis enabled the extraction of authors' conclusions regarding the implementation of their interventions.
Results: The research team identified five categories of simulation-based teaching: virtual simulation (*n*=16), telesimulation (*n*=12), simulation-based learning on campus (*n*=5), mixed online simulation (*n*=2), and guided home simulation (*n*=2). The adaptation of simulation-based education modes has helped foster student engagement, interaction, clinical practice, and self-confidence. The realism of the interventions, their high degree of interactivity, their adherence to best practice recommendations, and the teachers' awareness of the risk of a "digital divide" all contribute to these findings.
Conclusions: Teaching under constraints during the pandemic has fostered educators' creativity and adaptability. These skills should be promoted to maintain pedagogical continuity with resilient pedagogical interventions.

INTRODUCTION

The COVID-19 pandemic rapidly and globally disrupted the field of nursing education. In-person teaching often became impossible, in clinical learning on placement and theoretical learning at university (Smith & Farra, 2022). This crisis-induced stress and uncertainty regarding the ability to teach effectively in a period that drastically limited pedagogical options (Audétat & Nendaz, 2020). To ensure the continuity and quality of education, educational teams swiftly adapted to the new circumstances (Liesveld et al., 2023). During this period, several initiatives allowed for the replacement of initially planned teaching strategies while respecting health regulations and students' learning processes (Haslam, 2021; Picchiottino et al., 2020). Adaptation methods employed in health education have predominantly been based on online distance learning (Ho et al., 2021). The literature suggests that distance learning is associated with a lack of interaction, a loss of engagement, limited clinical practice, a lack of emotional experience, and feelings of fatigue and isolation among students (Li et al., 2021; Yip, 2023). New forms of simulation-based teaching methods have been proposed to reduce these negative impacts and promote active distance learning (Thomas et al., 2023). Several authors have recommended a distanced examination of the pedagogical offerings that involved simulation during the pandemic (Bejster et al., 2021; Valiga, 2021). A scoping review is needed to describe and explore the adaptation strategies related to simulation-based teaching during the COVID-19 pandemic.

Research Questions

The objective of this scoping review was to examine the various types of simulation-based pedagogical strategies that were

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implemented during the COVID-19 pandemic. Specifically, the aim was to address the following questions:

- What simulation-based teaching interventions were implemented, and what are their characteristics?
- What were the outcomes and observations from participants (both educators and students) regarding the implementation of the simulation-based intervention?

Inclusion Criteria

Population

For this review, all undergraduate nursing students from all countries, cultures, and genders were included. Interdisciplinary populations were considered if the target population was represented.

Concept

The concept of this scoping review refers to all pedagogical strategies based on the use of simulation in health education. Simulation-based education had to adhere to the following definition, regardless of its mode of implementation:

> "The term 'medical simulation' means the use of a device, such as a mannequin, a task trainer, virtual reality, or a standardized patient, to emulate a real device, patient, or patient care situation or environment to teach therapeutic and diagnostic procedures, processes, medical concepts, and decision-making to a health care professional."
>
> (H.R. 855, 111th Congress, 2009).

Context

The study's context was linked to the constraints imposed due to restrictions that affected education during the COVID-19 pandemic. The studies included in this review were limited to those conducted between January 2020 and October 2022 and had to describe the constraints affecting education clearly.

Type of study

This review, in accordance with Joanna Briggs Institute (JBI) recommendations for scoping reviews (Aromataris & Munn, 2020), encompassed all types of studies, methods, and designs. The study included grey literature, including articles, reports, professional reviews, and conference communications. Exclusions were limited to professional literary works and journalistic or recreational literature.

METHODOLOGY

Methods

The subject of this study, its specific context, its recent nature, and the research questions correspond to a methodological framework for a scoping review (Munn et al., 2022). The first author drafted a protocol in September 2022, prior to the study, which was unpublished but available on request. To verify the methodological quality of the study, the PRISMA-ScR checklist was used (Tricco et al., 2018; Appendix A).

Search Strategy

A search strategy was used to find both published and unpublished studies. A 3-stage search strategy was developed and conducted in collaboration with a document librarian trained in the JBI method (third author). The first stage consisted of a limited initial search of MEDLINE via PubMed and CINAHL. An analysis was conducted on the keywords contained within their titles and abstracts, as well as the indexing terms used to describe them. The second stage involved a search using all the keywords and index terms identified in the following databases: MEDLINE via PubMed, CINAHL, Embase, LiSSa, ERIC, and Web of Science. Unpublished studies were searched using OpenGrey, ProQuest Dissertations and Theses, BASE, and Google Scholar. Studies published in English and French were included. The period considered was January 2020 to October 2022. The pandemic-related context of the study justifies this restrictive period. The complete search strategies are presented in Appendix B. In the third stage, additional studies were sought from the reports identified and the references in the articles selected.

Study Selection

Identified articles were collected and uploaded via Zotero citation management software (Mueen Ahmed & Dhubaib, 2011). In view of the limited number of articles remaining (n=129) and the difficulty of finding the precise definition of the inclusion criteria in the abstracts (context and concept), preselection by title and abstract was not carried out. The first and second authors directly reviewed and selected full texts in a double-blind, independent manner using Rayyan software (Ouzzani et al., 2016). Differences between the two reviewers were resolved by a consensus process based on the inclusion and exclusion criteria. The selection process appears in the PRISMA flow chart.

Data Extraction

The relevant extracted data included: author(s), year of publication, country of origin, design/methodology, study population, and sample size, aim, type of intervention, description of intervention, and significant findings related to research questions. Data was extracted to synthesize key information from the selected studies in a table (Appendix C), following the JBI method's recommendations (Aromataris & Munn, 2020).

RESULTS

Inclusion of studies

The search across 10 databases resulted in the selection of 187 studies (Fig. 1). After removing duplicates, 129 full texts were directly examined to apply the inclusion and exclusion criteria, resulting in the final selection of 37 studies.

(Abuatiq et al., 2022; Alshutwi et al., 2022; Arrogante et al., 2021; Badowski et al., 2021; Cook & Camp-Spivey, 2022; DeFoor et al., 2020; Dubovi & Adler, 2022; Egilsdottir et al., 2022; Fitria et al., 2021; Flo et al., 2021; Fung et al., 2021; Garat Escudero et al., 2022; Hosseini et al., 2022; Hudgins et al., 2021; Jeong et al., 2022; Jiménez-Rodríguez et al., 2020; Joung & Kang, 2022; Keller & Spangler, 2021; Kim et al., 2021; Luo et al., 2021; Marchionni et al., 2021; McDonall, 2020; Mestre et al., 2022; Palancia Esposito & Sullivan, 2020; Panepucci et al., 2022; Park & Kim, 2022; Perez et al., 2022; Reid-Searl et al., 2022; Schiavenato et al., 2022; Shea & Rovera, 2021; Shirey et al., 2022; Son, 2020, 2021; Stuart et al., 2021; Suematsu et al., 2021; Wands et al., 2020; Zaragoza-García et al., 2021)

Please refer to Appendices C, D, and E for a comprehensive citation of each individual result.

Characteristics of Selected Studies

Thirty-seven educational interventions utilizing simulation were selected and analyzed based on their characteristics. These interventions were implemented in 16 countries, with a predominant focus

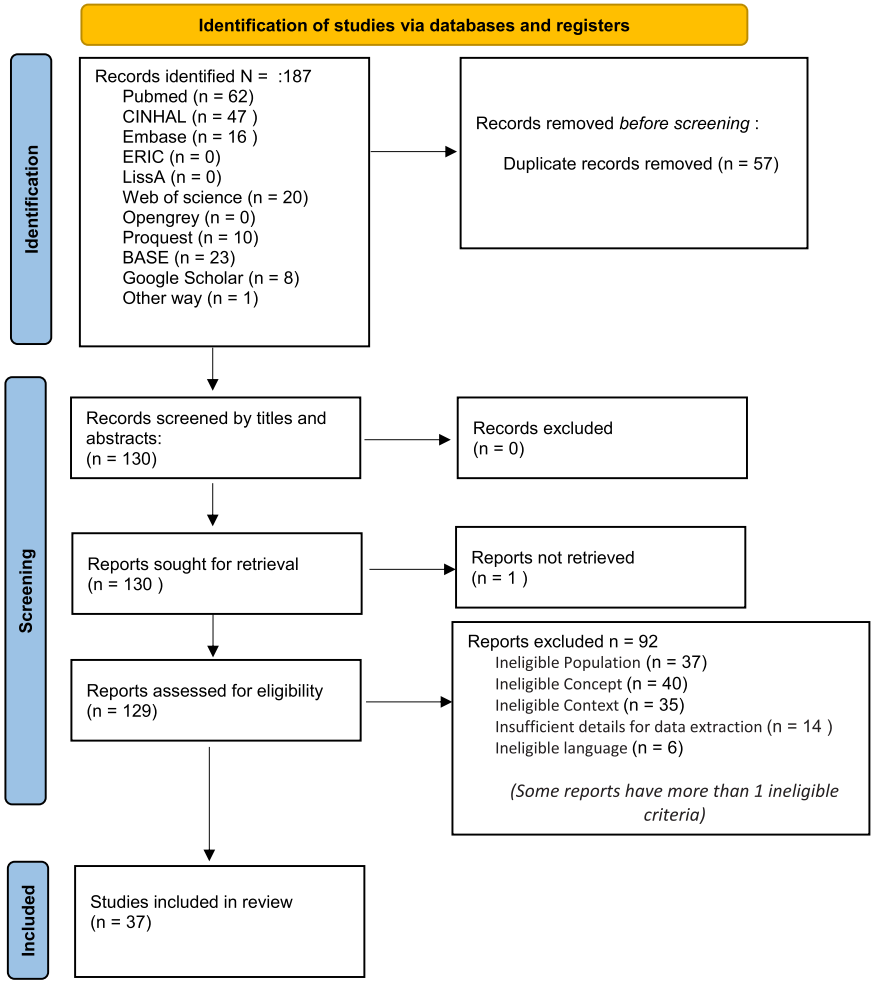

Fig. 1. PRISMA flow chart: study selection process.Note. Adapted from "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews," by M. Page et al., 2021, BMJ;372:n71. https://doi.org/10.1136/bmj.n71.

on the United States (n=16), Asia (n=10), and Europe (n=5). All studies involved undergraduate nursing students. Only two studies included an interprofessional population where the target population was represented (Son, 2021; Suematsu et al., 2021). The selected studies were mainly cross-sectional (*n*=18) and quasi-experimental (*n*=10).

Types of Interventions

A thematic content analysis of the studies allowed us to categorize the identified interventions based on their characteristics. Interventions were grouped into five categories (Fig. 2, Appendix E): virtual simulation (VS), telesimulation (TLS), simulation-based learning on campus (SBL-C), mixed online simulation (MOS), and guided home simulation (GHS).

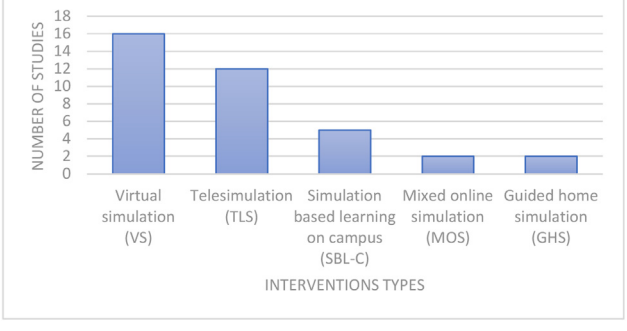

Fig. 2. Categorization of interventions.

VS (*n*=16) engaged nursing students in a virtual care environment remotely using specialized simulation software or scenarios created by instructors. Ten VS were conducted asynchronously, four synchronously, and two utilized a combination of synchronous and asynchronous modalities.

TLS (*n*=12) enabled students to continue their learning through supervised clinical examinations, which were conducted remotely on standardized patients (*n*=11) or among peers (*n*=1).

However, some teaching teams have maintained face-to-face teaching (SBL-C) (*n*=5) despite health restrictions. These teams have implemented strategies to meet the health challenges and limitations inherent in the restricted environment (social distancing, absenteeism, students', and educators' quarantines). The authors employed various approaches, including the use of telepresence robots at the university for students and teachers in quarantine (Abuatiq et al., 2022), the use of virtual reality simulation to reduce physical contact (Jeong et al., 2022), and the implementation of specific health protocols tailored to the teaching environment (McDonall, 2020; Son, 2020, 2021).

MOS were also identified, which combined VS and TLS in various modalities (*n*=2; Alshutwi et al., 2022; Shea & Rovera, 2021).

Two interventions included GHS (*n*=2). Students received "practice kits" and instructions in their homes, allowing them to practice

technical and manual skills such as vascular access (Marchionni et al., 2021), or to practice clinical assessment on equipment or people present in their homes (Cook & Camp-Spivey, 2022). These modalities also allowed for the assessment of students' clinical skills because they were required to film their practices and submit them to instructors.

Intervention Features

All intervention characteristics (Appendix D) were identified and synthesized.

Twelve interventions involved the collaboration of standardized patients. The interventions were overwhelmingly implemented in a remote mode (n=33). However, despite the context, some interventions were conducted on-site at universities using mannequin simulation techniques (n=3), high-fidelity simulation (n=1), or virtual reality simulation (n=1). Despite the restrictive clinical context, specific teaching strategies helped develop manual skills. Only guided home simulations (n=2) and some face-to-face university simulations (n=3) have been able to achieve this objective.

Interventions Findings

The main findings and their frequencies were reported in Appendix E and summarized in Fig. 3.

All studies considered their intervention to have enabled effective learning and/or assessments in the context of COVID-19 pandemic-related restrictions.

Interventions promoted students' engagement and/or satisfaction with their learning experiences (n=21). In particular, these pedagogical modalities based on simulation during the COVID-19 period have been reported to enhance nursing students' self-confidence (n=16). It is also mentioned that the opportunity for students to repeat certain lessons several times, mainly with VS, helps improve their skills (n=7).

Despite these positive findings, some limitations or difficulties have been identified. Specifically, the remote modality has been characterized as less efficacious than the initially envisaged in-person modality (n=11). Additionally, communication through digital interfaces may have encountered impediments compared to face-to-face interactions (n=10). Certain skills were identified as difficult to acquire in a distance-learning context. Emotional and psychological skills (n = 4), critical-analysis skills (n=4), and manual technical skills (n=6) have been identified as more difficult to acquire in distance learning, regardless of the simulation modality. Furthermore, several authors offered recommendations based on their experience in this constrained teaching context. Ensuring access and training for all participants in the use of digital technologies prior to the intervention (n=8), the need to offer simulation content that is as realistic as possible (n=10), and the need for a high degree of human interaction, whether among students or with teachers (n=17), have been identified as essential elements for the interventions proposed in this context.

Finally, despite the speed of implementation in the emergency context and the digitization of most interventions, the majority of studies insist on the need for teaching scenarios to comply with good practice recommendations linked to simulation (n=20), particularly by following the entire process and the stages necessary for student safety and skill integration: pre-briefing, fictional contract, briefing, simulation, and debriefing.

DISCUSSION

This scoping review reports the findings from 37 publications exploring pedagogical adaptation strategies based on simulations that were implemented during the COVID-19 pandemic's health-related restrictions. The insights derived from these interventions are valuable not only in the context of pandemic-induced challenges but also offer broader considerations for pedagogical adaptations, especially during crises or periods of unforeseen disruptions.

Evolution and Hybridization of Simulation-Based Teaching

The first research question focused on the types of simulation-based pedagogical interventions implemented and their characteristics. To address this question, we extracted the interventions' characteristics and grouped them into five categories (VS, TLS, SBL-C, MOS, and GHS). These interventions display substantial heterogeneity as well as hybridization between the types of simulation used. This finding is supported by the existing literature, highlighting the steady increase in diversity and hybridization of simulation-based pedagogical interventions (Jeffries et al., 2022; Kawasaki et al., 2021). Conventional classifications of simulations by technology (human, synthetic, or electronic) now inadequately appear to represent a more complex and less dichotomous pedagogical practice. This hybridization phenomenon has been described for several years in the literature (Amerjee et al., 2018) but has likely been accelerated by the pandemic context (O'Brien et al., 2022). Simulation tools' flexibility and adaptability have certainly played a major role in meeting the challenge of rapidly adapting educational content in a crisis or emergency

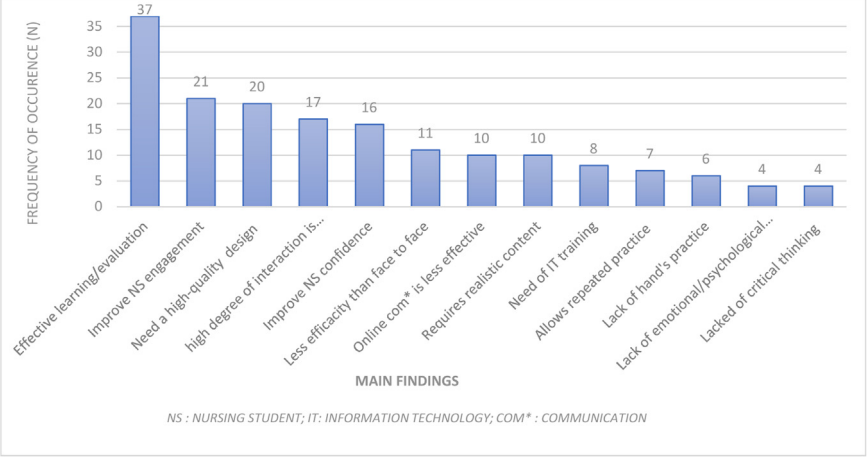

Fig. 3. Main findings.

context. Describing and classifying types of simulation-based teaching is essential to having standardized assessments of these educational tools. However, it is important not to reduce simulation to a dichotomy between these characteristics but to consider it as a continuum. This continuum should employ all types of interventions, tools, and degrees of fidelity to meet specific and contextualized educational objectives precisely and skillfully.

Remain attentive to recommendations and the digital divide

The second research question focused on outcomes and participants' observations (educators and students) regarding the implementation of the intervention. Therefore, a high degree of interactivity and realism in simulation-based teaching is important. These criteria, widely studied in the literature (Musa et al., 2023) and relayed in best practice recommendations (INACLS committee et al., 2021) support this observation. The period of remote learning during the pandemic-related lockdowns led to boredom, stress, isolation, a loss of motivation, and a loss of engagement for some students (Wallace et al., 2021). Simulation, even at a distance, with its realistic and interactive aspects, therefore, seems to be a promising approach for keeping students engaged and motivated in such a challenging educational context.

The results highlight the importance of access and training prior to teaching via digital interfaces. The COVID-19 pandemic has brought to light issues of digital precarity and the digital divide. Recent publications have addressed these issues (Kormos & Wisdom, 2023) and raised questions of ethics and equal opportunity in the acquisition of knowledge. Although many universities now offer students IT facilities, the pandemic emergency has starkly revealed these challenges. This study encourages teachers to anticipate these issues and incorporate them into their teaching.

This study underscores the need to adhere to international best-practice guidelines for simulation-based education, such as the “Healthcare Simulation Standards of Best Practice Simulation Design” (INACLS committee et al., 2021) to ensure students’ psychological safety and effective skill integration. Some interventions examined in this study do not consistently meet these standards due to missing or weak elements such as pre-briefing, briefing, debriefing, and measurable pedagogical objectives. The rapid shift from in-person to remote teaching during the crisis may account for these limitations. Educators must remain vigilant, demonstrating creativity, flexibility, adaptability, and efficiency while following established recommendations.

Limitations

The population, key elements, countries, and providers were heterogeneous and should be considered as such. Even if the pandemic was global and international, the health regulations, degree of restrictions, and resources available to each educational team were different. Therefore, the results can only be descriptive and represent the range of evidence available on this subject.

Considering the pandemic context, we restricted the selection of publications to the period from January 2020 to October 2022, focusing on English and French literature. Other studies published after the search date are not considered in the review. Due to the methodology inherent in scoping reviews (Aromataris & Munn, 2020), the quality or level of evidence of the included studies was not assessed, and the effectiveness of interventions was not reported.

CONCLUSION

This scoping review provides the current state of available evidence on adaptive teaching strategies that involved simulation during the constraints imposed by the COVID-19 pandemic.

Application in the practice of teaching

Identifying a variety of structured pedagogical options during crises enables educators to adapt more efficiently within available resources. Simulation-based education strategies, initially designed for pandemic challenges, provide insights for broader pedagogical adaptations in various crises. Beyond the Covid-19 pandemic, this study suggests adapting to new crises (such as climate, political, social, etc.) that could result in campus shutdowns. For instance, simulation exercises that immerse health professionals in managing sudden disease outbreaks, coordinating care in unexpected resource-limited settings, or navigating mass casualty incidents prepare them for swift, effective decision-making and high-standard care delivery in diverse emergency situations.

In the complex context of hybridization and rapid technological evolution in simulation-based education, factors such as realism, a high degree of interactivity, adherence to best-practice guidelines, and raising awareness among educators about the risk of the "digital divide" should remain key factors in pedagogical strategies.

Application for research

As a catalyst for future research, this study sets the stage for targeted investigations. For instance, a quantitative inquiry could be designed to rigorously compare the effectiveness of specific teaching options identified in this review. Concurrently, a qualitative exploration might unveil nuanced aspects of students' or teachers' experiences, shedding light on the intricacies of implementing simulation-based pedagogical strategies during crisis situations.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used Chatgpt3.5 and Grammarly to improve language, translation, and readability. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

Declaration of competing interest

The authors confirm that there is no competing conflict of interest.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.teln.2024.03.003.

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