



Nursing Education During the SARS-COVID-19 Pandemic: The Implementation of Information and Communication Technologies (ICT)

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Abstract

In the pandemic, nursing programs found a way to continue the training process through virtual classrooms and technological tools to support the teaching and learning process. The aim of the present research was to analyze the existing literature on the methodologies and technologies used in nursing education during the pandemic. Methods and results, in this context, were integrative review of the literature through the SciELO, PubMed, CUIDEN, Scopus, Web of Science, CINAHL (EBSCO), Redalyc, and Dialnet databases, by running a search on the use of the keywords “nursing students,” “new technology,” and “pandemic,” for literature published between 2020 and 2022. As a search strategy, the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) flowchart was used. Finally, the virtualization of nursing teaching has been positive in giving continuity to the training process, and student learning has been verified. However, there is evidence that some actions and skills are not possible at the moment with the available methodologies and tools and still require attendance for some practical activities.

Keywords Clinical students · New technology in education · Nursing students

Introduction

Due to the pandemic, institutions that impart university education worldwide quickly and massively implemented virtual education in order to maintain and fulfill their training processes and learning objectives and ensure the graduate profile of their students [1]. However, this was initially rudimentary, and the lack of knowledge on virtual platforms, whether free or paid, was one of the biggest gaps that needed to be resolved in the short term in academics [2]. This situation could be defined as emergency virtualized teaching, where in-person tasks had to be adapted to virtual methods with little time to process it and use it consistently [3]. This presented major challenges for institutions of higher education and their teachers, as they learned about the technologies needed for virtual teaching and moved from in-person teaching to virtual classrooms [4]. This is why universities encourage the use of different computer tools, known as ICTs (Information and Communication Technologies), to maintain a virtual space for synchronous teaching while ensuring they do not lose the connection, participation, and learning of the students and are thereby able to make up for the lack of mass attendance, never experienced before the pandemic [5].

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Within the educational context of the pandemic, one of the most commonly used elements was the virtual environment, which promotes communication, management, and interaction within a course [6]. Such is the case with virtual platforms or videoconference classes [7], which were adopted and modified, such as Zoom, Google Meet, and Microsoft Teams, to replicate in-person classes and function as tools that encourage participation and enable the implementation of methodologies that enhance learning [8]. These tools offer a robust videoconferencing system with support options such as chat and interaction through surveys, digital whiteboard, or the projection of a web browser to enhance the possibility to demonstrate in classes and interact with students [9]. In addition, the incorporation of external tools such as test development, collaborative walls, or gamified options have proven to be highly effective for the development of videoconferences in higher education [10]. However, the implementation of virtual environments came along with a host of problems related to the availability of Internet networks for students and academics and access to computer devices. During the pandemic, internet access worldwide was not constant. It is estimated that of young people between 15 and 24 years old, some 760 million worldwide, 63% did not have Internet access, hindering their access to education [11].

Although the efforts made it possible to give continuity to teaching at the most critical moments of the pandemic, it revealed the fragility of all university systems worldwide, closing infrastructure for nearly the entire academic year, and emphasized the need to continually reflect and learn about effective strategies for working virtually [12]. This study provides a systematic review of methodologies and technologies that were used in nursing programs in the 2020, 2021, and 2022 during COVID-19 pandemic. The primary aim was to examine the extant literature concerning the methodologies and technologies employed in nursing education throughout the pandemic.

Materials and Methods

Review Process

For systematic reviews, we followed a series of standardized stages based on Sánchez-Meca [13] and Siddaway et al. [14]. These stages involve (i) an explicit and defined research question, (ii) a broad and systematic search in different scientific databases defined in primary studies, (iii) an explicit and replicable process to systematize the data, and (iv) an analysis and interpretation of the results [15, 16]. The search was adapted to the quality standards of the Preferred Reporting

Table 1 Research question

Acronym	Definition	Description
P	Patient or problem	Nursing students
I	Intervention	Education methodologies with technology
C	Comparison	ICTs used during pandemic
O	Outcome or result	Experiences

Items for Systematic Reviews and Meta Analyzes (PRISMA) statement for systematic reviews, as seen in Table 1 [17].

Research Question and Search Criteria

The research question raised was “What technologies were used in nursing education during the pandemic?”, and this was developed with the PICO strategy [18]. For more details, see Table 1. To answer the research question, the Health Sciences (DeCS in Spanish) descriptors, (i) nursing students, (ii) new technology, and (iii) pandemic, were used, as well as their Spanish equivalents, (iv) estudiante de enfermería, (v) nueva tecnología, and (vi) pandemia, on the website <https://decs.bvsalud.org/E/homepagee.htm>. To do this, the Boolean operator “AND” was used in eight databases: SciELO, PubMed, CUIDEN, Scopus, Web Of Science (WOS), CINAHL (EBSCO), Redalyc, and Dialnet [19, 20].

The search included articles with (i) qualitative design, (ii) quantitative design, (iii) reflections, and (iv) literature reviews related to nursing education, selecting articles in Spanish, English, and Portuguese. In addition, a restriction was applied, searching only for publications from 2020 to 2022, due to the date of the COVID-19 pandemic.

For the selection of articles, the study used the PRISMA flowchart (Fig. 1).

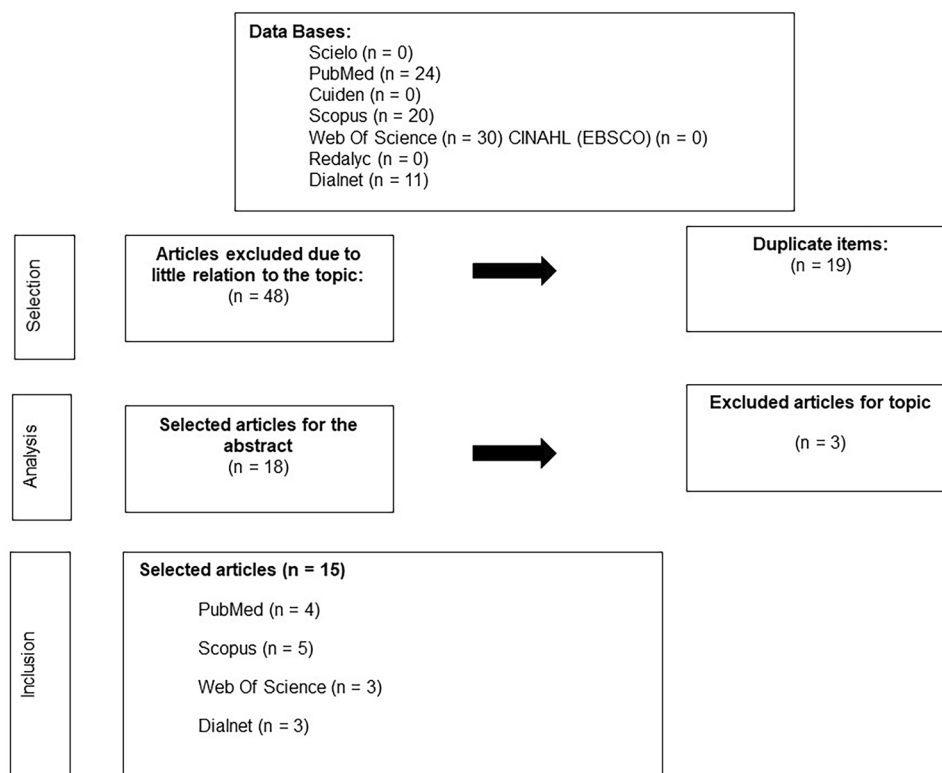
Exclusion criteria considered works published in languages other than English, Spanish, or Portuguese: studies not published in peer-reviewed journals (conference proceedings, books, book chapters, and other types of publication) and studies related to other areas of knowledge not related to higher education in nursing (Table 2).

Results

Assessment of Studies

A total of 85 records were found from the keywords established in the different databases, for a total of 37 records (48 deleted) and duplicate records in the databases included in the review (19 deleted), with a total of 18 selected, whose

Fig. 1 Flowchart for selection and inclusion of articles for review



full text was analyzed (Table 2; Fig. 1). Of these, 15 met the inclusion criteria established for this review and were analyzed based on the following categories: reported methodologies and technologies, contributions and/or achievements of pedagogical strategies with technology, disadvantages and/or difficulties of the pedagogical strategy with technology, and the main findings of the interventions carried out (Fig. 1).

Information Extraction

Of the fifteen articles selected for this review, seven correspond to qualitative studies (47%), two to quantitative studies (13%), two are reflections (13%), and four are scope reviews (27%). Of all articles, 6% were published in 2020, 50% in 2021, and 44% in the year 2022. Most are from the United States, and the rest are from Europe, Africa, Oceania, and South America (Table 2). The main methodologies used for the virtualization of teaching were virtual classes (56%), simulation through specific resources and platforms (13%), and the general integration of technology in teaching (13%). Among notable technologies were online clinical simulation through specialized platforms such as Vsim and telenursing with standardized patients. As a strategy, there is a tendency to combine systems and tools, and videoconferences are the most commonly used, together with virtual environments (29%), specific simulation platforms (13%), office automation tools (8%), email (8%), and forums and chats, graphic organizers, and digital whiteboard (4%).

Discussion

The analysis of the existing literature on the methodologies and technologies used in nursing education during the pandemic, evidenced four approaches of greater relevance in the application of the adaptations, which are (i) methodologies and technologies, (ii) contributions and/or achievements of the pedagogical strategies with technology, (iii) disadvantages and/or difficulties of the pedagogical strategy with technology, and (iv) the main findings of the interventions carried out.

Methodologies and Technologies

A methodological challenge that emerged in the studies was that teaching was virtualized without preparation, leading to problems and gaps in access to the internet network, computer devices, and technological knowledge [21]. Another challenge was encouraging participation and addressing demotivation [22], leading to the search for strategies for active participation and quality learning [23], highlighting the development of cumulative exams via technology combined with asynchronous activities such as video review and forums [24], collaborative presentations and digital whiteboards [25], or videoconferencing tools [26]. Classes were virtualized using programs to prepare presentations such as PowerPoint or Canvas, making them more engaging. In videoconferencing options, Zoom and Google Meet complemented with

Table 2 Result matrix

Authors, place, year	Study design	Objective	Results and conclusions
Li Sharpe [60] United States 2021	Qualitative and descriptive The simulation presented an authentic clinical scenario in practice, supporting the specific competencies of the specialty for neonatal nursing, obstetric nursing, and the basic competencies for interprofessional collaborative practice. The videoconferencing platform proves to be an effective strategy for simulation. Advanced practice nurses who develop individualized simulations through videoconferencing demonstrate the effectiveness of the strategy, considering the role and importance of telemedicine, which increasingly influences their future clinical practice.	Describe the redesign from face-to-face simulation to virtual simulation via Zoom.	The simulation presented an authentic clinical scenario in practice, supporting the specific competencies of the specialty for neonatal nursing, obstetric nursing, and the basic competencies for interprofessional collaborative practice. The videoconferencing platform proves to be an effective strategy for simulation. Advanced practice nurses who develop individualized simulations through videoconferencing demonstrate the effectiveness of the strategy, considering the role and importance of telemedicine, which increasingly influences their future clinical practice.
Bourgault [61] United States 2021	Qualitative and descriptive Number of participating students: 8 Number of participating teachers: 1 Type of institution: University of Connecticut (publica) Instruments used: Questionnaire, exam Study design: Evaluative Reflection	Apply a virtual environment for competency development as an effective replacement for traditional clinical experiences.	Virtual environments provide the opportunity to expand education and apply the clinical approach by providing students with virtual patients and cases. This allows addressing issues such as the lack of patients or those with specific health needs for nursing student simulation.
Haslam [24] Great Britain 2021		Reflect on the use of technologies in general and how they should be adapted to promote learning in nursing.	The implementation of online learning in nursing will depend on factors such as the training of educators in the adoption of current and emerging technologies, and the availability of open educational resources, and positive student response.
McKinlay [16] New Zealand 2021	Qualitative and descriptive. Number of participating students: No information Number of participating teachers: No information Type of institution: University of Otago (publica) Instruments used: Checklist, interview Study design: Evaluative	Describe the change in the face-to-face use of the interprofessional education initiative INVOLVE to a redesign to be delivered completely online by Zoom videoconference.	Working with platforms is positive in meeting the needs of students, and they respond by being resourceful, creative, adaptable to uncertainty and collaborating with each other. The combination of virtual and hybrid strategies proves to be effective and provides flexibility to the educational process.
Leaver [17] United States 2022	Revision of literature	Describe how the essential guidelines were applied and the articulation with the different North American associations.	The main guidelines that were successfully applied were to expand health content in nursing curricula, encourage academic-practical partnerships for telehealth, and provide the necessary resources for educators, students, and practicing nurses to optimize virtual environments to improve outcomes.

Table 2 (continued)

Authors, place, year	Study design	Objective	Results and conclusions
Moreno-Sánchez [18] Spain 2022	Qualitative and descriptive Number of participating students: 400 Number of participating teachers: 0 Type of institution: Universities of Galicia, Canary Islands, Balearic Islands, Castile and León, La Rioja, Castilla-La Mancha, Community of Madrid, Extremadura, Asturias, Murcia, Navarra, Valencian Community, Cantabria, Basque Country, and Catalonia Instruments used: Survey Study design: Analytic	Evaluate the impact that telematic education had on nursing students who were in the last year of the program, which implies their imminent entry into the labor market.	Most students were unsatisfied with virtual education, due to access problems and the lack of information in times of uncertainty in the health crisis, considering that they were close to finishing their degree program.
Shindjabuluka [19] Africa 2022	Qualitative and descriptive Number of participating students: 0 Number of participating teachers: 18 Type of institution: University of Namibia (public) Instruments used: Semi-structured interviews Study design: Analytic	Explore how the experience of educating in a pandemic could serve as a facilitator for the improvement of online learning and teaching skills for nursing educators.	The study revealed three themes: Nursing educators' experiences with online learning, their role as a facilitator to enhance learning, and teaching skills and strategies for sustaining online learning.
Brown [20] United States 2022	Quantitative and transversal Number of participating students: 208 Number of participating teachers: 0 Type of institution: Johns Hopkins University (private) Instruments used: Assessment, survey Study design: Evaluative	Describe a roadmap on virtual simulation in nursing training.	Virtualization was effective. The students perceived the online simulation experience as similar to face-to-face and screen-based simulation and was considered successful y an effective method for practical training.
Conceição [21] Brazil 2020	Reflection	Reflect on remote teaching as a possibility for new experiences and challenges in times of the COVID-19 pandemic.	It is recommended that the teacher promote interactivity with the student through the tools in the virtual learning environment.
Seckman [22] United States 2020	Qualitative and descriptive Number of participating students: 163 Number of participating teachers: 0 Type of institution: University of Maryland (public) Instruments used: Questionnaire, assessment Study design: Evaluative Qualitative and descriptive Number of participating students: 12 Number of participating teachers: 0 Type of institution: Adelphi University (private) Instruments used: Open-ended survey Study design: Pilot	Explore digital health technologies in the healthcare setting through the use of mind and concept mapping tools in a graduate-level computer science practicum course.	The variety and creativity of the mind maps coupled with student feedback indicated their ability to apply critical thinking skills to the specific content and technologies that were examined during the nursing internship.

Table 2 (continued)

Authors, place, year	Study design	Objective	Results and conclusions
Abram [23] Spain 2021	Qualitative and descriptive Number of participating students: 163 Number of participating teachers: 0 Type of institution: University of Maryland (public) Instruments used: Questionnaire, assessment Study design: Evaluative Qualitative and descriptive Number of participating students: 12 Number of participating teachers: 0 Type of institution: Adelphi University (private) Instruments used: Open-ended survey Study design: Pilot	Explore students' perceptions of the use of telehealth technology.	In terms of simulation, nursing students expressed greater openness, interest, and confidence in the use of telemedicine for the management of psychiatric patients, demonstrating that it can improve the comfort of nursing students and the future use of telemedicine for the treatment of psychiatric patients.
Sormunen [24] Finland 2022	Scope review	Examine current evidence related to the effects of the use of digital technologies on learning.	The results of the interventions were mainly positive. The increase in professional knowledge, skills, and attitudes reflects the advancement of professional competence, concluding that technology has the potential to improve learning.
Agu [25] Jamaica 2021	Reflection	Describe the effect of COVID-19 on nursing education in developing countries.	Online learning has become the solution to complete the curriculum, although it does not address the clinical practice component. Virtual simulations and high-fidelity simulation equipment are not ubiquitous in developing countries, as there are challenges related to access and cost.
Coffre [26] Ecuador 2021	Review of literature	Determine the virtual educational strategies that were most used in nursing careers in the world, during the worldwide mandatory lockdowns imposed on institutions of higher education.	There is distrust from teachers and students regarding effective learning. There are technological and economic limitations in the acquisition of devices. Developed countries and institutions of higher education that already had the simulation infrastructure were able to implement this remotely, with very positive effects on the participating students. Conclusions are that teaching cannot be only virtual.
Valenzuela [27] Chile 2021	Qualitative and descriptive Number of participating students: 48 Number of participating teachers: 6 Type of institution: Universidad de Las Américas (private) Instruments used: Focus groups Study design: Descriptive	Evaluate the suitability of the simulated teleconsultation methodology as a tool for the teaching-learning process in the nursing program, as reported by teachers and students.	Simulated teleconsultations constitute a useful methodology in the training of future nursing professionals, but they are not capable of substituting face-to-face treatment in some cases, raising concerns about the student evaluation process.

LMS (learning management system), such as Moodle, Blackboard, or Google Classroom, stand out, as well as the use of Teams as a hybrid between both options. Zoom is the predominant platform due to its ease of use and intuitive interface [7]. The use of LMS provides an asynchronous meeting point that facilitates the transmission of information, collaboration, and interaction [27]. For synchronous classes, they were conducted through platforms that allowed videoconferencing, with Zoom standing out for its intuitive interface, versatility, enabling class recording, small group sessions, scheduling activities, and easy access from any email account, among other features not available when using other platforms such as Google Meet or Teams. These latest platforms were dependent on emails belonging to free or institutional accounts, but under the wing of their companies. However, the contribution made by Google Meet, by making all its functions and associated applications freely available during the pandemic, facilitated teaching without the need to download additional programs, and with just two clicks, one could join a video call or videoconference [28]. This facilitated inclusion and access when transitioning to more robust, paid, and specialized platforms like Zoom, except for the clinic [7, 29].

The clinical simulation was digitalized with the emergence of software and hardware for replicating certain actions that were previously developed in person [30]. One notable instance is the UK's utilization of CAPSULE (Clinical and Professional Studies Unique Learning Environment) as a digital learning tool featuring case-based scenarios and multiple-choice questions. This platform facilitated the comprehensive coverage of all undergraduate medical specialties, supported by a pan-specialty editorial board, since May 2020. With over 41,000 health students and 3200 registered professors as users, it standardized basic knowledge education across various health schools in the UK. This initiative directly addressed geographic barriers to knowledge access for UK nursing students. Importantly, the effectiveness of such platforms hinges not only on the fidelity of simulation but also on teacher guidance, clinical guidelines, and checklists for assessment [31]. Collaborative experiences yield even better results [32].

As for improvements in access, these were addressed through the provision of devices such as computers or tablets, as well as Internet access accounts, expanding access for students with financial constraints, from government policies or higher education institutions [33]. However, in some areas where this measure was insufficient due to distance, geographical dispersion, and weather conditions, classes were adapted by recording sessions so that students could access the content asynchronously.

Contributions and/or Achievements of Pedagogical Strategies with Technology

Of the studies reviewed, 62% mention an improvement in results and 38% refer to the contribution of technologies, highlighting online clinical simulation and virtual classes. However, one study indicates that there are no improvements and mentions that virtualization makes it possible to achieve the expected results, especially in students in their final year of the program where activities are mainly practical.

In general, the articles communicate positive results in virtual class methodologies, due to the flexibility, the combination of synchronous and asynchronous classes, and the development of digital skills, among others [34]. An example of this, when discussing online clinical simulation proposals via programs and platforms, as well as telenursing via videoconference, a notable aspect is the emphasis on patient protection in the practical realm, given its virtual nature [35], and not the feasibility of using virtual platforms for teaching. However, it's worth noting that online clinical simulation programs do not substitute for the crucial mediating role of the overseeing teacher [36]. Despite this, the measures taken to address the lack of access to clinical practices, crucial in the curriculum of students in the healthcare field, were extensively tackled with the use of virtual clinical simulation, which allowed students to prepare prior to entering hospital internships. Unfortunately, most of the discipline's procedures cannot be virtualized, posing a challenge for future students. For example, strategies had to be employed for the development of practical skills, such as providing kits with supplies and phantoms so that they could practice from their homes [37].

As the pandemic progressed, there was a gradual reopening of higher education institutions' infrastructure with sanitary precautions in place, prioritizing only practical activities and internships [38]. To ensure the health and safety of students and teachers, measures were implemented for the development of practical activities, such as reducing teaching time for practical activities (by implementing protocols for ventilation of physical spaces) and enforcing maximum occupancy limits per classroom (without physical contact and maintaining preventive distancing), all supported by virtual theoretical classes [39].

Disadvantages and/or Difficulties of the Pedagogical Strategy with Technology

The difficulties described in the articles reviewed are associated with problems of connectivity and access to technology, with a greater gap in developing countries because these new teaching methodologies imply higher costs than in-person

methodologies [26]. Virtualization became a challenge for teachers who had to quickly update and adapt their courses [2]. The primary challenge that significantly impacted students was the inability to access practical content in the traditional manner, both in in-person clinical simulation and clinical practices, due to the constraints imposed by COVID-19, particularly affecting students in their final years of the program [40]. Likewise, they also recognize the lack of face-to-face contact [41], as well as the need to address the gaps caused by the lack of praxis [42]. In the case of face-to-face contact, social and physical isolation increased levels of anxiety, stress, feelings of loneliness, fear of contagion for oneself or one's family, depression, sadness, vulnerability, and feelings of helplessness among nursing students [43]. Additionally, interruptions due to waves of COVID-19 contagion disrupted the learning processes of infected students and due to the symptoms of the disease. Moreover, the lack of practical experience resulted in the need for post-pandemic leveling practices in pre-clinical internship institutions or consecutive subjects within the curriculum of the nursing degree [44]. This point gains relevance when the nursing profession emphasizes the professional-patient relationship as a key aspect for graduating students [45].

Another important aspect was reported by Franco-Coffré et al. [46] who acknowledges the effectiveness of virtualization; however, it underscores that without addressing the social and economic disparities among teachers and students, as well as issues with technology access, the process cannot yield positive results. This sentiment is echoed in the analysis by Brown et al. [47], which suggests that higher education institutions, while focused on ensuring continuity in the training process, failed to adequately address associated challenges such as economic disparities and deficiencies in technology access and digital literacy, which in turn impact the teaching-learning process. It is important to note that while the objectives of the teaching-learning process were increasingly addressed during the development of the pandemic, the social and economic reality of the students was indeed a determining factor in acquiring the technical knowledge for the use of educational technology [48]. Factors such as the technology available in homes, often shared with other family members, as well as infrastructure conditions, living arrangements, and caregiving roles in households, directly influenced the adaptation and learning curve of technological and disciplinary knowledge among nursing students [49]. For this, it is imperative to consider the obstacles related to technology access and connectivity, which are particularly pronounced in developing countries [26]. The most critical case was that of nursing educators belonging to the "Generation X" (born between 1965 and 1981), considered "Internet immigrants," who exhibited the most pronounced literacy gaps and the slowest learning curve in ICT [50]. In parallel, there was evidence of low digital literacy

in ICT among the "Generation Z (Gen Z)" considered "digital natives" (born between 1995 and 2012), although they simultaneously showed great adaptability in using a variety of digital technologies effectively and critically for virtual education [50]. Therefore, one of the greatest challenges facing online nursing education is overcoming the digital divide between Generation X and Generation Z [50]. To address this need, both the teaching staff and students were trained in the use of technologies, simultaneously learning from any mistakes made, thus making the teaching-learning process increasingly user-friendly, which in turn generated greater motivation.

Main Findings of the Interventions and Perspectives

The articles reviewed integrate new methodologies and tools to virtualize teaching, such as videoconference options that enable theoretical classes and virtual clinical simulation platforms that provide the opportunity to recreate clinical practice environments [48]. This study's findings revealed that virtualization should be planned, teacher training and communication with students should be improved, and a model should be designed to guide the planning and development of online learning [2]. Recent experience has shown the importance of encouraging student participation in classes and in their training process [51].

It is important to highlight nursing students, while they were able to continue their educational process; the lack of access to in-person clinical practices and clinical simulation was notable in clinical settings, resulting in students being less prepared and more insecure. During clinical practices conducted amid the pandemic, they expressed overall satisfaction with the support from their universities and healthcare teams in hospital settings. However, despite these positive efforts, they reported experiencing confusion, including practical concerns, diminished learning opportunities, and fundamental doubts about their professional calling [52]. Despite this, they were able to respond to and pass the subjects specific to the discipline, as described in the study by Venise et al., where it is highlighted that students reported being effectively prepared for clinical practice through online learning and their quality of life improved as students achieved academic success and developed self-efficacy to become nurses [53]. Likewise, some were able to navigate by adapting and modifying their mental perspective or environment (work/school schedules), while others experienced disruptions in their planned academic performance and/or progression [54]. Besides, in a study conducted in Chile, it is highlighted that the perceptions of nursing students regarding learning and their quality of life during the COVID-19 pandemic were influenced by political, health, academic, and social factors [55].

During the global pandemic, there was an increase in demand for entry into the nursing profession, where there

was also observed an increase in deferments, requests for freezing, and dropout rates. One out of every three nursing students in the UK has not completed their degree programs within 3 years, and in Australia, the reported annual dropout rate was 17% [56]. In the United States, it was reported that 31.5% of the 168 students who participated in clinical rotations during the spring and early summer semesters were forced to suspend them due to pandemic-related restrictions for students at clinical sites, affecting progress in the career program [57]. Another study highlights that the COVID-19 pandemic had a negative impact on nursing students' approval grades compared to the pre-pandemic period [58]. Despite the multiple challenges faced by most students during the pandemic, many of them were able to adapt and successfully complete their undergraduate studies. Finally, it is important to mention that the pandemic-related restrictions provided new learning opportunities, such as the flexibility offered by distance learning classes and the development of digital skills, and revealed the fundamental role of academia in providing psychological and technological support to undergraduate nursing students during the health crisis [59].

Conclusions

The most utilized methodologies in higher education for nursing students included (i) synchronous and asynchronous virtual classes via platforms like Zoom or Google Meet, (ii) online clinical simulation through specialized platforms such as Vsim, and (iii) telenursing with standardized patients.

Among the introduced methodological strategies, classes associated with the discipline yielded better results when conducted synchronously, as it allowed students to address doubts immediately. Furthermore, recording and uploading classes onto various platforms like Moodle, uCampus, and Edmodo, among others, were adopted, turning them into study materials and providing access to information for students facing connectivity issues.

The virtualization of clinical simulation was a significant contribution facilitated by the introduction of technologies, largely compensating for the lack of access to clinical practices. Additionally, simulated patient care allowed students to develop and enhance soft skills inherent to nursing care, such as patient interaction.

The primary difficulties arising from the integration of technologies are related to Internet access, which must be considered when planning the methodological strategy. Educators should be prepared to address potential challenges, offering alternatives for students who may face connectivity issues due to various circumstances. However, distance teaching methodologies cannot fully replace in-person clinical practices. This is because the therapeutic relationship and

the application of discipline-specific procedures can only be fully learned by students through direct patient care. This disadvantage poses a challenge, but one that can be mitigated to a large extent through the use of virtual clinical simulation and simulated patient care. Ultimately, these methods can help students complete their professional training successfully when they gain access to in-person clinical practices.

Finally, in the medium and long time, advancements in artificial intelligence (AI) and education-related platforms could enhance the learning experience for students. For instance, this could be applied to improving the interface of nursing education platforms by simulating a virtual user (healthcare students) through holographic designs or 3D glasses + AI, with different cases preloaded with multiple-choice responses. However, there will still be gaps in technology access and generational knowledge between faculty and students.

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Declarations

Competing Interests The authors declare no competing interests.

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