Review article

Online education in higher education: emerging solutions in crisis times☆

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ABSTRACT

The COVID-19 pandemic caused changes in higher education institutions, mainly due to the temporary closure of face-to-face activities in universities worldwide. The transformation from face-to-face to online education was one of the emerging solutions to this crisis. This research aims to analyse and describe the adaptation process from face-to-face to online education and the perceptions of faculty and students during the pandemic in a literature review study. We developed this study following the methodology supported by the PRISMA statement and the PICoS strategy, retrieving scientific literature from Web of Science, Scopus, ERIC and PsycINFO. Of the 241 studies that the search yielded, 29 have been included. The results showed that online education was an enabling alternative for the development of higher education, but numerous weaknesses in the transition to online education were identified. The study concludes that online learning is a future direction in higher education. Therefore, institutions should invest more in online education platforms and improve faculty training plans.

1. Introduction

With the emergence of COVID-19, the world faced one of the greatest challenges of the 21st century. COVID-19 burst into the lives of human beings, causing devastating effects on the health and lives of a large part of the world's population, affecting different social, economic and educational spheres of the planet. This problematic situation has spread across the earth like a great tsunami since the beginning of 2020: starting in Asia, specifically in Wuhan (China) and spreading across almost the whole world (Europe, Africa and America).

The impact on the education system began with the suspension of face-to-face educational activity in all levels of education in the global context. Taking into account different reports published by UNESCO, 166 countries had closed their schools and universities by March 2020. These measures affected 87% of students. Similarly, millions of teachers worldwide were affected (IESALC-UNESCO, 2020).

The impact of COVID-19 through the elimination of social contact has directly impacted teaching, preventing, among many other things, face-to-face meetings between students and teachers. Universities were forced to close their classrooms, but learning should not stop, forcing educational institutions to offer alternative delivery methods. The lockdown and closure of educational institutions necessitated the emergent

application of various digital platforms and tools as a necessary resource to ensure the continuity of education (Manrique Maldonado et al., 2021). Online education was the only option, but specialised training for both teachers and students was a significant concern for the proper development of the learning process.

Thus, the closure of universities and the shift to online education had different effects on education, as very few were prepared for this sudden decision. It also impacted less technologically literate teachers: for some, the novelty became a challenge and, for others, a nightmare (De Vincenzi, 2020). The transition to online education requires management systems to enable effective learning, videoconferencing facilities, and faculty experience in distance education (García-García, 2020). UNESCO (2020) also made proposals affecting universities in its communiqué of 6 March 2020 in "COVID-19: 10 recommendations to plan distance learning solutions", in which it proposed combining different assessment tests, adapting to the psychosocial situation of students, taking measures to ensure inclusion and selecting technologies that guarantee data protection.

The pandemic has confronted us with many challenges, such as paving the way for introducing smart technologies to ensure the continuity of education. This wave of digital transformation brings long-term benefits and goes beyond the mere growth of distance learning. This global scenario has also allowed us to reflect on the future of online

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education, among other issues. The key is to leave behind the rigid and inflexible classrooms of the lecture theatre and move on to open and flexible spaces. It is believed that online education opportunities, open educational resources, and other technologies can increase academic productivity. The previous aspects could accelerate the learning pace, reduce costs associated with instructional materials or programme delivery, and improve teacher time (US Department of Education, 2020).

In the face of the changes brought about by the pandemic in higher education, this study was conducted to analyse and describe the process of adapting to online learning and identify the benefits and weaknesses in terms of the development of online higher education. While institutions have made an effort to transition to online learning during the pandemic, this poses a challenge for educational institutions (Jeong and González, 2021). This study contributes to bridging that gap, stemming from the need to find innovative, evidence-based solutions to address the educational challenges students and faculty face due to the COVID-19 pandemic in higher education.

This study analyses the existing literature on online education during the pandemic in higher education institutions through a systematic literature review. To this end, three research questions (RQ) were identified to guide this study. These are:

RQ1. How has research on the impact of COVID-19 on higher education developed?

RQ2. What was the impact of this transformation on students and teachers in higher education?

RQ3. What are the lessons learned during the transition to online education?

This study aims to provide some ideas for improving the quality of online education and provide valuable guidance to assist both faculty and higher education institutions in making effective decisions to support online learning.

The literature review analysis focused on identifying "what we know" about online education in higher education. The results of our study will inform us about "what we need to know" and the implications for "what we can do".

2. Research on online education in higher education

2.1. What we know

Online higher education has been a growing reality (Dyment et al., 2018). New forms of access to knowledge and learning have burst into the traditional classroom to stay with a vengeance. This situation has already affected 33% of higher education globally (Allen et al., 2016).

Through digital platforms and under the umbrella of e-learning, online education has been recognised as an alternative method to face-to-face education and a suitable alternative to address the globalised world's challenges in continuing education and training (Pérez-Escoda et al., 2021).

Technological implementation requires consideration of some key elements in online education, such as technical teacher training, an appropriate educational design adapted to virtual environments, didactic planning and an educational platform with resources and tools for assessment. In this sense, among the technological challenges identified in the scientific literature, we can highlight the need to provide adequate resources for teachers and students, appropriate teaching strategies, develop a suitable study environment, and manage virtual platforms and technological support (Picardo, 2020).

The international literature is evident when talking about the main benefits of this study method and that it also has a much wider audience than face-to-face study, as its positive aspects include the ability to combine personal, work and academic lives (Chau, 2010; García Soto et al., 2020). We must consider that many students would not be able to access higher education if it were not for this option (Lin et al., 2017; Racovita-Szilagyi et al., 2018), which also represents a measure of attention to the diversity of the student body.

Thus, learning based on e-learning principles plays a transcendental role in the context of online education. The work of Dyment et al. (2018), Garrison (2016), and Baum (2018) ratify the importance of this method, where there has been a shift from traditional didactic models to new interactive and active learning models focused on giving greater protagonism, participation and reflection to students (Cotán Fernández et al., 2019). Along these lines, the study by Dyment et al. (2018) emphasises the role of students as the centre of their learning, allowing new teaching methodologies and tools to contribute to the creation of more real learning experiences while at the same time developing active and reflective learning. However, more recent studies (Cabero and Llorente, 2020) highlight how online education has highlighted the enormous inequalities among the student population, which raise fears that the digital and education divide may continue to widen between rich and emerging countries.

On the one hand, as expressed by Domínguez et al. (2018), we know that online education encourages relationships between people who are miles apart. However, it can make this merely academic and formal, as inevitably, the richness of non-verbal language (gestures, looks and postures) is excluded, or else it is more difficult to transfer. A context characterised by the coldness conferred by screens. Despite this, many studies tell us that students experience personal well-being and attachment to where they spend a large part of their daily lives, which positively impacts their attention, motivation, and learning (Hopland and Nyhus, 2015). On the other hand, we also know that online education does not have the same capacity as face-to-face instruction to project the teacher's presence immediately and effectively (Reupert and Maybery, 2009). Hence, there has been an increase in research in the last decade to understand and determine what digital competencies online teachers should possess (Alamri and Tyler-Wood, 2017; Turula, 2017). The main goal was to create a model for evaluating teaching in virtual environments, allowing strengths to be reinforced and improvements to be implemented in the reality of higher education.

Online education research has been studied and evaluated through various approaches and instruments. Thus, many researchers have analysed the evolution and trends in online education by analysing national and international journals (Hranstinski and Keller, 2007; Ross et al., 2010). Other bodies and researchers have explored the evolution of distance education through the review and bibliometric indicators of a single journal specialising in this specific field (Rourke and Szabo, 2002). In this sense, bodies such as the Institute for Higher Education Policy published two reports to improve online higher education learning and provide a basis for future research and analysis of this way of learning.

The coronavirus pandemic forced faculty and students to quickly adapt to the online education format (Neuwirth et al., 2021). Thus, our study will focus on obtaining a synopsis of how higher education institutions are undergoing radical transformations with academics lacking digital competencies for online education (Neuwirth et al., 2021).

3. Methods

3.1. Characterisation of the research

The aim is to analyse online education during the COVID-19 pandemic through the research questions. In order to extract and analyse the most significant studies on the subject, the systematic literature review method was used, following the indications set out by Grant and Booth (2009) regarding the need to generate an exhaustive search and a corpus of documents to facilitate the review. To this end, an Excel database of the selected sample was created to facilitate the process of reducing and selecting information.

3.2. Search strategy

In order to guarantee an optimal search for scientific productions related to the subject to be analysed, different criteria were taken into account based on the PRISMA statement (Preferred Reporting Items for

Systematic reviews and Meta-Analysis). This process consists of the following stages: initial literature search, screening, eligibility and extraction of the resulting articles for review (Moher et al., 2015). To determine eligibility, inclusion and exclusion criteria were applied, duplication were eliminated and Boolean operators (AND/OR) were applied. The apply the aforementioned inclusion and exclusion criteria, the PICoS strategy was used: population, phenomenon of interest, context and study design (Pertegal-Vega et al., 2019).

Taking into account that therm population responds to the first search delimitation criterion: use in Spanish and English of the keywords "online education", "university", "higher education", "pandemic", and "COVID-19"; time frame (2020–2022); type of document (scientific article published in a peer-reviewed journal); language (English and Spanish) and area (social sciences/education). All the selected documents come from the databases: Web of Science, Scopus, ERIC and PsycINFO. These multidisciplinary databases were chosen for their international indexing in social sciences. We conduct the exploration in two steps: 1) search for relevant studies in digital databases and 2) references in the previous studies checked for additional studies. The research questions were used as a guide to identifying keywords. This search ended on 16 April 2022.

3.3. Eligibility criteria

This section summarises the eligibility criteria used in this review. The identification of eligibility criteria aimed to select the most relevant articles. The inclusion criteria used in the search for relevant studies were:

- Scientific article published in peer-reviewed journals.
- Article is written in English and Spanish.
- Search descriptors specified in the title and/or abstract.
- Addressing online education in higher education during the COVID-19 pandemic.

The following exclusion criteria were applied:

- Type of document: reviews, editorials, letters, books, opinions, conference abstracts.
- Studies on online education outside the university context.
- Only online education is mentioned, but it is not the article's focus.
- Not belonging to the March 2020–March 2022 threshold.

3.4. Selection of studies

Combining the descriptors yielded a total of 236 results in the different databases in a first initial search was found. The number is increasing daily due to the interest and relevance (69 in Web of Science, 58 in Scopus, 70 in ERIC and 39 in PsycINFO). The reference lists of the identified articles were also scanned for relevant articles, selecting 5 articles, thus compiling 241 papers. Duplications were eliminated (n = 64).

The identified papers were reviewed in the next phase, and articles that did not meet the inclusion criteria were discarded. Next, the full-text article were revised to restrict the educational context to higher education (Context), focus on online education during the pandemic (Phenomenon of interest) and restrict the type of research design (Study Design) by removing 27 studies. The study design prioritises quantitative and qualitative articles that analyse online education experiences during the pandemic in higher education. Finally, after checking the criteria, 29 studies were selected for review. Figure 1 shows the search and selection process flow chart to ensure transparency and clarity.

3.5. Process of data collection and data analysis

After filtering the criteria explained above, the final sample was 29 documents. In the last phase, the results were analysed based on quantitative and qualitative representations of the sample analysed.
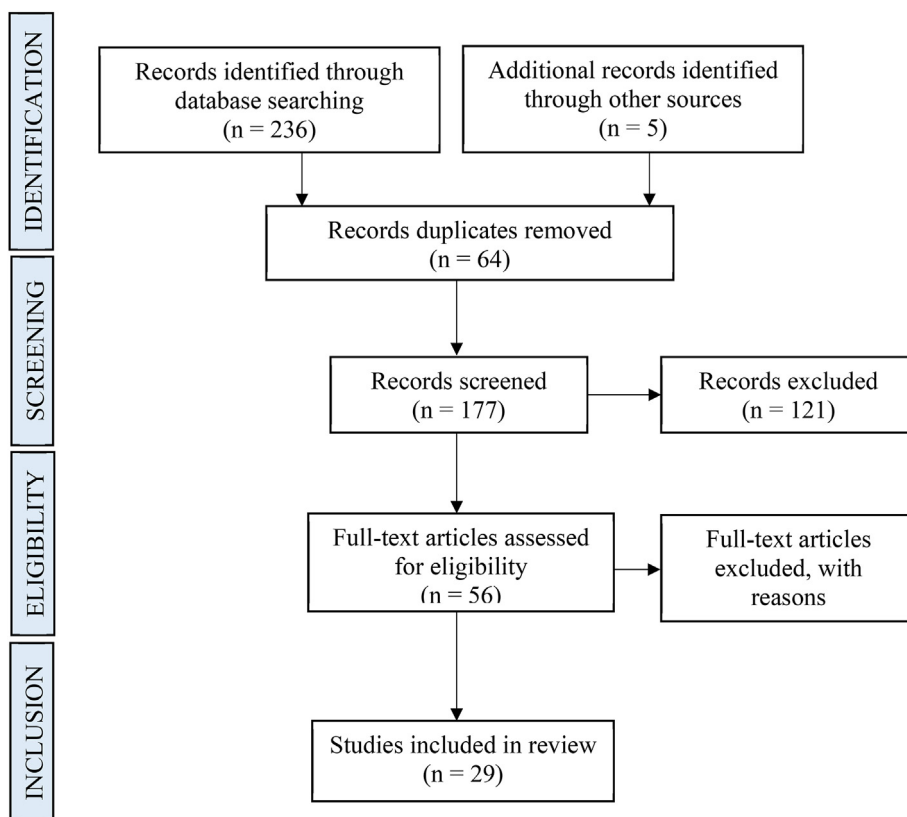

Figure 1. PRISMA flow chart for the study.

The following information was extracted from each of the studies, including author, date of publication, country, methodology, type of online platform used and principal conclusions. A detailed description of the 29 articles, ordered alphabetically, can be found in Table 1.

The manuscripts were synthesised quantitatively and qualitatively according to the three research questions. After, a bibliometric keyword analysis (Bhattacharya et al., 2003) was conducted to focus on co-occurrence analysis within the specific research domain of online technology. Also, it was used a graphical representation of the keywords using VOSviewer software version 1.6.7 (Centre for Science and Technology, Leiden University, Leiden, The Netherlands).

4. Results

4.1. What we need to know

This section presents the findings of the selected articles. The twenty-nine articles included in this review have addressed the impact of online education in higher education during the pandemic. Numerous researchers worldwide have shared their work on the emerging migration to digital education as a solution for continuing education in higher education during the pandemic, as we can see in Figure 2 below.

Figure 3 shows the publication period of the selected documents. The most significant number of relevant papers for this review was produced in 2020, i.e. just after online education was implemented in many institutions worldwide.

The impact of online education during the pandemic has been studied mainly through quantitative studies (68.97%). Qualitative (20.29%) and mixed studies are fewer (10.34%).

Although not all articles specified the methods or digital platforms used, the Zoom application stands out as one of the primary means of conducting classes in higher education (40.63%), followed by Moodle (21.88%) (Figure 4).

The 29 papers assessed the impact of the pandemic on online education. From the analysis, it is possible to state that the studies describe the challenges that the emerging migration to online education has created. Among the main limitations described in the studies are the following (Table 2):

Teacher training in teaching platforms stands out as one of the main barriers. Eleven studies addressed this aspect, i.e. how teachers' lack of digital skills influences the development of the virtual classroom. Ten studies addressed problems of access to the Internet or technical aspects. Five articles discussed the availability of resources and differences in educational progress in digital learning and how the pandemic further exacerbated the differences between the populations.

However, despite the difficulties mentioned, online education has many advantages in higher education (Table 3). Among the main benefits addressed in the study was the flexibility to deliver virtual classes, autonomous and distance learning, and the ease of using the platforms by learners. One article pointed to social distancing as a beneficial aspect of slowing the spread of the virus.

Finally, the network map of the keywords of the studies analysed reflects the relationships between them (Figure 5). The size of the

Table 1. Characteristics of included studies.

Study	Date	Method	Online platform	Findings	Country
Abbasi et al., 2020	Jul. 2020	Quantitative	Zoom	1, 5	Pakistan
Achmad Syam and Achmad, 2022	Jan. 2022	Quantitative	G. Meet, Zoom	3, 7, 8, 13	Indonesia
Adeyeye et al., 2022	Jan. 2022	Quantitative	Zoom, Moodle	9, 10, 11, 15	Nigeria
Aguilera-Hermida, 2020	Dec. 2020	Mixed	Zoom	7, 12	USA
Ansar et al., 2020	Nov. 2020	Quantitative	Zoom	4, 6	Pakistan
Area-Moreira et al., 2020	Oct. 2020	Quantitative	Moodle	11, 12, 13	Spain
Ashri et al., 2020	Oct. 2020	Quantitative	G. Meet, Zoom, MS Teams, Skype	1, 2, 7, 8,	India
Bao, 2020	Apr. 2020	Qualitative	WeChat	7, 12	China
Besser et al., 2020	Jun. 2020	Quantitative	-	2	USA
Coman et al., 2020	Dec. 2020	Quantitative	Blackboard	3, 6, 8	Romania
Dost et al., 2020	Nov. 2020	Quantitative	Zoom	7, 8	UK
Elfirdoussi et al., 2020	Dec. 2020	Qualitative	Zoom, Google Meet	1, 3, 8	Morocco
Fawaz and Samaha, 2021	Jan. 2021	Quantitative	Zoom, Blackboard	2, 5	Lebanon
Gómez-Hurtado et al., 2020	Dec. 2020	Qualitative	Moodle, Zoom, Skype	2, 3, 5, 7	Spain
Ho et al., 2021	Apr. 2021	Quantitative	Moodle, MS Team	4, 5, 13	Hong Kong
Ismaili, 2021	Jan. 2021	Quantitative	MS Team, Zoom	11, 15	Hungary
Jiang et al., 2021	Mar. 2021	Quantitative	Moodle	12, 15	China
Lapitan et al., 2021	Apr. 2021	Qualitative	Google Meet, Zoom	3, 8, 6, 7	Philippines
Lassoued et al., 2020	Sep. 2020	Quantitative	Moodle	7, 8, 9, 11	Algeria
Miguel Román, 2020	Sep. 2020	Mixed	Meet	1, 3, 5	Mexico
Mpungose, 2020	Oct. 2020	Qualitative	Zoom, Moodle	1	South Africa
Muflih et al., 2020	Jul. 2020	Quantitative	Zoom	3	Jordan
Mukhtar et al., 2020	May. 2020	Qualitative	Zoom	3, 10, 11, 12	Pakistan
Nuñez-Canal et al., 2022	Jan. 2022	Quantitative	–		Spain
Obeidat et al., 2020	Apr. 2020	Quantitative	Microsoft Team	1, 8	Jordan
Pérez López et al., 2021	Jan. 2021	Mixed	Moodle	3, 5, 7	Spain
Pramana et al., 2020	Jun. 2020	Quantitative	Zoom	8	Indonesia
Sindiani et al., 2020	Dec. 2020	Quantitative	Zoom	14	Jordan
Zina and Ahlem, 2021	Mar. 2021	Quantitative	Zoom, Moodle	3, 6, 8	Algeria

1- Availability of resources; 2- Mental health; 3- Digital training; 4- Evaluation; 5- Work management; 6- Communication; 7- Motivation; 8- Technical aspects; 9- Funding; 10- Experience; 11- Flexibility; 12- Self-efficacy; 13- Remote learning; 14- Social distance; 15- Ease of use of technologies.
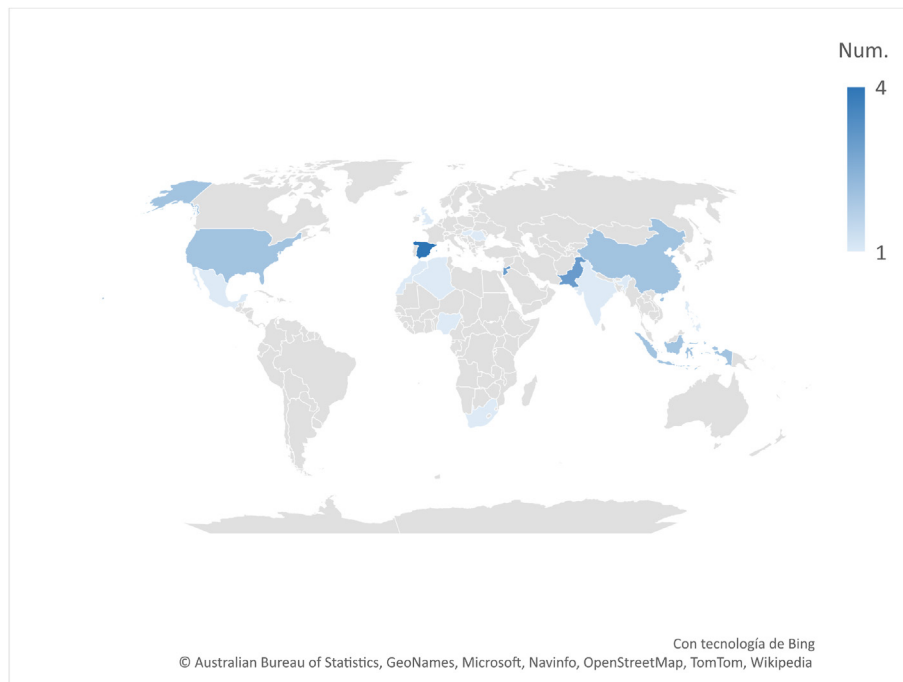
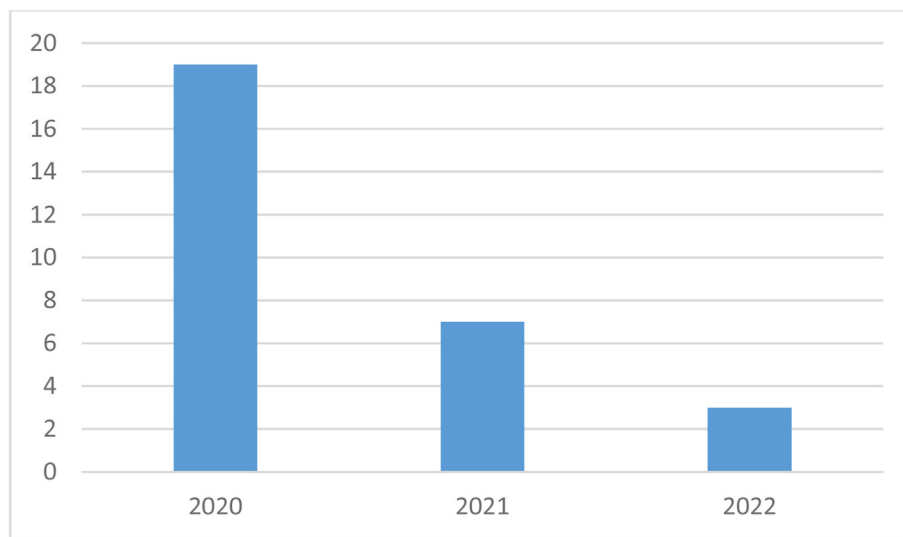**Figure 2.** Productivity by country of publication.

Figure 3. Number of articles selected per year.

keywords indicates the frequency of occurrence and the colour (red, blue and green) of the different topics addressed. Thus, the red group, with the descriptors "teacher", "training", and "anxiety", reflects the perception of teachers in the migration to online education during the pandemic. The blue group, led by the descriptors "student", "learning", and "opportunity", reflects the perception of students. Moreover finally, the green group, led by descriptors such as "university", "pandemic", and "technology", describes the impact the pandemic has had on higher.

5. Discussion

The pandemic has affected many educational institutions worldwide, forced to transform their traditional educational model to online education. In order to assess the impact on higher education, this review has analysed a total of 29 articles using the eligibility criteria mentioned above. The research questions posed are developed below:

5.1. RQ1. How has research on the impact of COVID-19 on higher education developed?

This section addresses the first research question (RQ1), which aims to determine how research on online education in higher education has been addressed during the pandemic. The 29 studies were reviewed to analyse the consequences of the emerging migration from traditional to technology-based learning.

According to the results, research in this field mainly occurred during the 2020s. Despite this, given that the phenomenon is still relatively recent, there is a lack of research discussing the pros and cons and future implications of the digital transformation in higher education caused by the pandemic (Abu Talib et al., 2021). The research on online education in the aftermath of the pandemic is expected to increase. The results corroborate that many institutions worldwide were not prepared for online education. This situation is reflected as numerous countries have
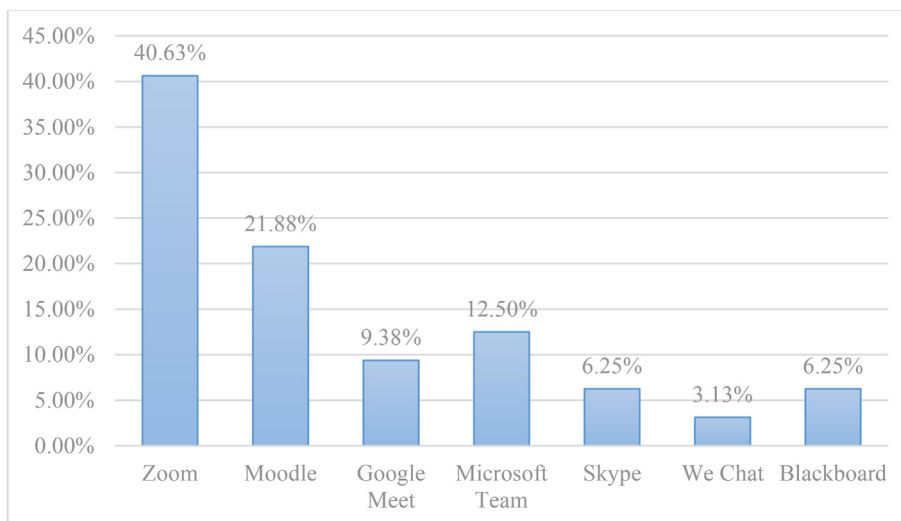
Figure 4. Digital platforms used.

Table 2. Limitations of online education in higher education.

Limitations	Frequency	Percentage
Lack of resources	5	10.42%
Mental health	4	8.33%
Teacher training: digital literacy	9	18.75%
Students assessment (evaluation)	2	4.17%
Workload	5	10.42%
Communication quality	4	8.33%
Student engagement and motivation	8	16.67%
Technical aspects	9	18.75%
Financial aspects	1	2.08%
Lack of experience	1	2.08%

Table 3. Benefits of online education in higher education.

Benefits	Frequency	Percentage
Flexibility	4	33.33%
Self-efficacy	3	25%
Remote learning	2	16.67%
Social distance	1	8.33%
Easy to use	2	16.67%

published on the problems encountered. These studies have mainly been conducted using quantitative methods (68.97%) through questionnaires to students and university teachers.

This review shows that different platforms have been used for digital education; however, the results support that the most used platform is Zoom, followed by the Moodle platform, which is consistent with previous studies (Turnbull et al., 2021a, 2021b). This situation may be due to Zoom's association with videoconferencing and Moodle's association with online teaching and its ease of use (Muflih et al., 2020; Turnbull et al., 2021a, 2021b; Jiang et al., 2021).

5.2. RQ2. What was the impact of this transformation on students and teachers in higher education?

This section addresses the second research question (RQ2), which summarises the impact of continuing online education in higher education during the pandemic.

Most university institutions adopted online education to continue teaching during the pandemic. However, the review finds that the adoption of online education had several limitations. Among the main limitations of online education in higher education, we can classify them as follows:

Digital competence: The emerging migration to digital education revealed that university institutions and faculty were unprepared for online-only education (Coman et al., 2020). The lack of digital training on the teaching staff was one of the main obstacles, which negatively affected the development of lectures, making them lecture-like and dull.

Digital divide: Unequal access to the Internet is one of the main problems that higher education institutions worldwide have faced. The pandemic further exacerbated the differences between populations (Mpungose, 2020; Pramana et al., 2020; Pérez-Escoda et al., 2021), as students from more disadvantaged families have fewer opportunities to use technologies. Also, the most significant challenges were related to technical aspects, such as the stability of the Internet connection (Obeidat et al., 2020; Lapitan et al., 2021). Similarly, another constraint has been the lack of resources and support. Higher institutions face various obstacles such as limited resources, lack of funding and organisational barriers to effective digital education (Lassoued et al., 2020), further increased by the pandemic (Miguel Román, 2020).

Quality of communication: maintaining contact and rapport with students and teachers became more complicated, as did the lack of face-to-face contact. The lack of interaction between teacher-student and peers led to a lack of feelings toward face-to-face learning. Most of the time, teachers had to deal with their classes in front of a screen without students' faces, not knowing if they were behind the screen (Moura Vieira et al., 2021).

Mental health: The emerging transition to online education or lock-in due to the pandemic affected students and teachers, increasing their stress and anxiety levels (Besser et al., 2020). The difficulty of adapting to the new situation was overwhelming to the teacher and students due to the workload required (Fawaz and Samaha, 2021) and modifying their teaching and assessment procedures to a digital format.

Workload: Teachers have had to make an effort to adapt their face-to-face teaching to an online format in an emergent way (Gómez-Hurtado et al., 2020), which meant dealing with an overload of work, in addition to their low level of digital competence.

Student assessment: Professors and students have expressed concerns about appropriate online assessment methods and efficient courses (Sindiani et al., 2020). Participants expressed concerns about their future and mainly about assessment. Students have been unhappy due to increased difficulty with the assessment tools used during online
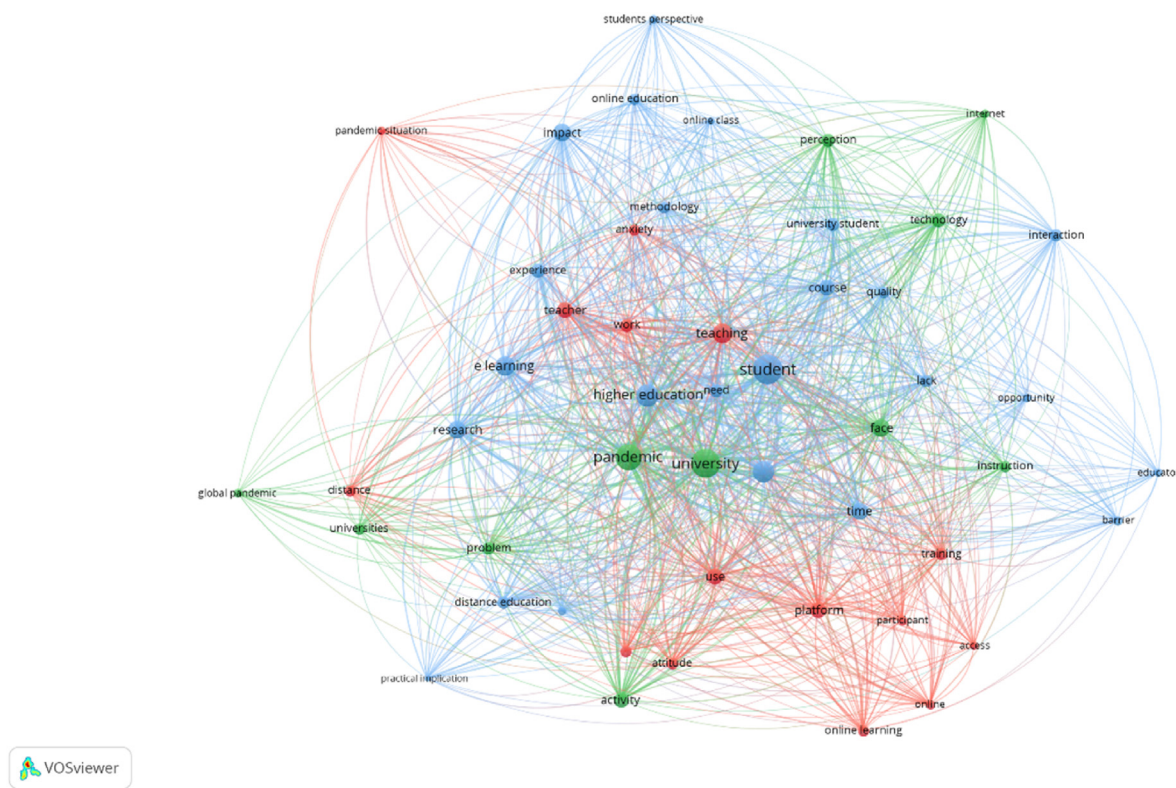
Figure 5. Keyword network map.

education (Ismaili, 2021). The unprecedented situation of the pandemic required urgent and sudden changes to assessments, particularly to bring them to a digital format in the form of synchronous tools such as video conferencing and live chat into online assessment strategies (Turnbull et al., 2021a, 2021b). Furthermore, online assessments can be supported by using other digital supportive technologies, such as text and video annotations, online rubrics and web-based tests (García-Morales et al., 2021).

Despite the many limitations, the results also support the advantages and opportunities offered by online education. These can be summarised as follows:

Flexibility: online education is a flexible source of learning in time and location, as it allows them to access and continue classes easily from their own homes (Dost et al., 2020; Mukhtar et al., 2020), thus encouraging remote learning.

Self-regulation: allows students to self-regulate their learning, developing their autonomy in completing assignments and responsibilities (Area-Moreira et al., 2020).

Exposure to technology. Incorporating these tools in education helps students improve their technological literacy, preparing students for an increasingly digitalised world. However, the amount, duration and difficulty of online education must be adapted to the level of learners. Long online lectures can affect students' motivation and fatigue from prolonged staring at screens (Bao, 2020; Ansar et al., 2020; Aguilera-Hermida, 2020).

Social distance: During the pandemic, social distancing was seen to be an effective weapon in curbing the spread of the virus. Similarly, social distancing measures also play an important role in educational institutions to ensure the continuity of studies (Dinh and Nguyen, 2020; Zina and Ahlem, 2021).

In conclusion, it can be mentioned that the COVID-19 pandemic created challenges and opportunities within the higher education system. However, despite the numerous limitations found in the studies, these generate opportunities for reinvention and contribute to improving the quality of higher education.

5.3. RQ3. What are the lessons learned during the transition to online education?

This third research question (RQ3) addresses the response to lessons learned during the transition to online education in higher education.

From the systematic review in question, it emerges that it is not the format of the teaching-learning process, face-to-face or online, that is decisive for its success, but that it depends on other factors such as the level of teacher training, in line with other studies (Gontijo da Matta and da Matta Felisberto, 2022).

The results showed that online education is an alternative for the development of higher education, but numerous weaknesses in the transition to online education were identified. Since online learning is a future direction in higher education, the study concludes that institutions should invest more in online education platforms and improve faculty training plans.

We can state that although some studies express a preference for face-to-face learning (Ho et al., 2021), online education can be just as successful and efficient in higher education. The experiences of students and faculty during the pandemic cannot be thoroughly compared to online education in the future because it was an emergent experience and was not adequately planned (Ashri et al., 2020). However, given that online learning is a future direction in higher education, it is suggested that higher education institutions should invest more in online education platforms and improve faculty training plans. Implementing online education provides innovative and equally effective learning experiences as traditional learning without moving to another location (Elfirdoussi et al., 2020).

6. Conclusion

The study has identified the impact of online education in higher education during the pandemic regarding what we know, what we need to know and what we can do. The results of this manuscript are intended to offer guidance to researchers and instructors in higher education in order to improve the effectiveness of e-learning.

Firstly, *what we know*, the COVID-19 pandemic has significantly impacted society, and education has been no exception. This review has aimed to assess the impact of research on online education in higher education caused by COVID-19 through 29 articles in high-impact journals.

Secondly, *what we need to know*, the results show that university institutions were unprepared for the emerging digital learning migration. This uncovered gaps in online education: issues of inequality, lack of access and lack of faculty skills. However, while most expressed doubts about the effectiveness, health consequences, or uncertainty of online education, the transformation to online education will effectively enable the development of more innovative and quality education.

And thirdly, *what we can do*, there is still a long way to go. Thus, the findings make us reflect on what we can do and some significant challenges for teachers and students for digital learning in the future (implications for the practice):

Related to the implications for teachers we need to: (1) Improve the level of digital literacy of teachers. Teachers need to be trained and prepared to deal with technical problems during their online classes and acquire strategies to boost and maintain students' motivation through digital education. (2) To reduce teachers' difficulties and insecurities generated by implementing such an educational model. In relation to the implications for students, it is necessary to: (1) Promote digital learning to correct negative emotions and conceptions of this educational model. And in relation to the implications for education and research, it is necessary to: (1) Provide institutions with accessible, user-friendly and high-quality online learning platforms. (2) Research the effectiveness and explore the differences between traditional and online education to help teachers improve digital education techniques and development.

6.1. Limitations of the study and future lines of research

The systematic review may have some limitations. The databases and the inclusion and exclusion criteria selected limited the search for papers. However, these criteria were selected based on previous studies to ensure the quality of the studies. Despite the limitations, this review provides valuable information for quality improvement in online education to higher education institutions and practitioners by synthesising and mapping the literature.

Furthermore, the results of this review may help reflect on the development of educational policies aimed at improving digital learning in higher education institutions.

This review has served to identify relevant lines of research taking into account the needs marked by the pandemic in higher education. In this way, two relevant areas have been detected that must be addressed urgently. Firstly, it is necessary to develop a line of research whose central axis is the training of university teaching staff in digital competences, which is fundamental for the successful implementation of e-learning. In this sense, it is necessary that educational institutions support this training, as well as improve their infrastructures and financial contribution. Secondly, we consider it relevant to create a line of research focused on the study of teachers' mental health. Teachers have faced different situations that have reduced their mental health due to crisis situation. We therefore believe that this line of research should be cultivated.

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Data availability statement

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Declaration of interests statement

The authors declare no conflict of interest.

Additional information

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