

Online Education During the Pandemic: A Systematic Literature Review

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Abstract—With the pandemic, there was an urgent transition to online education. In this process, challenges were experienced while benefiting from the opportunities of online education. This research aims to identify the existing literature on online education in higher education institutions during the pandemic and to highlight the opportunities and challenges reported in research in this process. The study was carried out as a systematic literature review. The results show that maintaining social distance and increased confidence in the effectiveness of e-learning are the main opportunities. The lack of practice, especially in medical applications, limited ICT resources, and pedagogical deficiencies in online environments are shown as challenges of online education during the pandemic. It is thought that this study will make significant contributions to the online education process post-pandemic. The results from this study reinforce previous study findings and identify research that will make the online learning process more effective. Based on the results obtained, suggestions are given for future online learning studies.

Keywords—opportunities, challenges, online education, pandemic, higher education

1 Introduction

Individuals worldwide continue to be significantly affected by the ongoing coronavirus disease[1]. It spreads mostly between individuals during close contact and results in death at a rate that cannot be underestimated[2]. On October 19, 2020, WHO reported 39,944,882 confirmed COVID-19 cases and 1,111,998 deaths globally [3]. The World Health Organization announced the spread of this virus as a pandemic. With the Coronavirus spreading rapidly, everything stopped globally. Projects were postponed; workplaces and educational institutions were closed for a long time [4]. During the pandemic, each country has followed policies on social distance rules. Individuals realize that social distance should continue for a long time after the epidemic has decreased [5].

UNESCO reported that approximately 264 children and adolescents did not attend school for different reasons in 2017 [6]With the COVID-19 Pandemic, this situation

has worsened with the indefinite education[2]. The education process is a process that must continue uninterruptedly, as the state has to offer it to all its citizens. Especially during the compulsory education period, different methods such as boarding school, bussed education, or online education are used when schools and universities are not opened face-to-face or individuals cannot go to the education environment. Among these options, the distance education model is the most suitable for the pandemic[7].

Additionally, research results showed that most Pandemic countries were transforming into smart cities using machine learning based on big data analytics [8]. However, Angdhiri, (2020) stated that many educational institutions are not ready to implement home learning programs during the pandemic. Considering that not all higher education institutions are ready, the availability of online learning platforms currently in use is a significant consideration, primarily due to the absence of physical classrooms[9] -[10]-[11]. Various stakeholders of education develop the online platforms and applications they use [12]. Also, they provide both material and training support to educators to effectively use these platforms. Besides, both government and non-governmental organizations and technology companies support the educational institution system's smooth transition to the digital environment [13]. E-Learning is a learning or teaching platform based on digital tools and technology rather than printed material and classroom teaching [14]-[15]. E-learning includes all kinds of digital communication used to share information-[16], [17], [18]. There is uncertainty about what subjects to teach, how to conduct, the workload of teachers and students, the teaching environment's design, and equity in education. With the continuation of the pandemic process, online learning has become the default in 2020. When online education started due to the pandemic, distance education was carried out in higher education institutions through Zoom and Google Meet classes. This method is slightly improved from video conferences [19]. However, MOOC platforms such as Coursera, EdX based on cloud computing, datasets, and artificial intelligence have been developed for online courses. Developed platforms can evaluate adaptive content and learning processes using machine learning [19] - [20].

Efforts emerge from using technology to support online learning during the pandemic[21]-[22]. Some negativities, such as the literature, the weakness of the online education infrastructure, the teachers' inexperience in the application dimension, uncertainty, complex living environment at home, etc., are stated[23] -[24]-[26]. According to Schleicher, (2020) this crisis has revealed many inadequacies and inequalities in the education system. Difficulties have been experienced, such as the inability to have broadband access, provide the environments, resources, and focus on computers and supportive learning. As the pandemic changes' individuals' habits, gaining an essential role in supporting remote work, e-learning, online collaboration, gaming, and video streaming via the Internet, these sudden changes create unprecedented stress on networks[28]. In the study conducted by Alqudah et al., (2020) to determine the e-learning experiences of medical students in the pandemic process, It has been determined that the majority of the students have difficulties in "the inadequacy of e-learning training courses" and "weak e-learning skills." Jæger & Blaabæk, (2020) reveals inequality of opportunity in the learning process of students versus better family opportunities in the literature. Hasan & Bao, (2020) stated in their studies

during the COVID-19 quarantine that students showed higher anxiety levels due to the online education crisis. The same study noted that this psychological distress was caused by the fear of academic year loss and their difficulties in the e-learning process.

Similarly, in the authors' reviews, it is stated that the students were stressed due to being alone during the lockdown process [32]. Moreover, according to Schleicher, this crisis has significantly affected international students' continuity of education, security, and legal status, and their perception of the value of studying abroad for their degrees. Looking from a different direction, Keskin and Kaya, (2020) stated in their study with students in the pandemic period that the time they spent using social media and watching television increased approximately twice. Keskin and Kaya, (2020) stated that the students studying online during the pandemic stated that e-learning was ineffective as in-class education and suggested e-learning could be an alternative. In addition, the students mentioned that they could not communicate easily with the educators during the online learning process, that although they had the opportunity to learn at their own pace, complete learning did not occur, and technical problems created the difficulties. Young people need to make decisions based on knowledge and skills in using digital technologies in meaningful ways in daily life. Young people need to adopt a critical and proactive stance towards digitization; that is, they should not only accept its current state but critically think and discuss how it could and should be [34].

Understanding students' challenges and preferences during their online education period, higher education institutions can develop strategies to help students in the third wave of Coronavirus or a transition to distance learning from different situations [35], [36]. There is no consensus on the critical challenges and factors that shape the successful use of the e-learning system during the COVID-19 Pandemic [37]; therefore, a clear gap has been identified in the knowledge about the critical challenges, possibilities, and factors of e-learning use during a pandemic. This process has excited us to research the newly formed literature in education, the effect of the pandemic process on the learning process, and highlight the reported opportunities and challenges. This paper can answer these fundamental research questions such as;

- What are the opportunities for learners and educators during the COVID-19 pandemic?
- What are the challenges during the pandemic?
- What are the recommendations for e-learning during pandemics proposed by the literature?

2 Methodology

This research conducts a systematic literature review to reflect the effectiveness of online education during this pandemic with the PRISMA. To achieve the aim, the PRISMA process is followed by a systematic literature review [38].

2.1 Search strategy

The materials used to identify the systematic literature review significant aspects were analyzed and sorted according to the proposed classification context. Researchers used certain keyword combinations. Different items were searched from Title search categories using the "AND" Boolean operator to retrieve related research. Similar terms are linked using the "OR" operator to achieve maximum coverage. Logically formula for search strategy (("online education" OR "e-learning") AND ("COVID-19" OR "Pandemic") AND ("higher education" OR "university") AND ("Opportunities" OR "challenges" OR "advantages")) to find published articles studying the challenges and opportunities of online education during the pandemic.

The systematic search was carried out in April 2022 in two popular scientific databases: Web of Science and SCOPUS databases were searched for this review.

2.2 Inclusion and exclusion criteria

Inclusion and exclusion criteria ensure that the searched articles are relevant to the research's purpose. The criteria determined are given in Table 1.

Table 1. Table 1 Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Articles were written in English.	Full text is not available online.
Articles with the research doing.	Any duplicated research articles.
Researches published between 2020-2022.	Review articles.
Available within the two databases, Web of Science and Scopus.	Procedia articles.
Open Access Articles.	

The article selection process was started with (1432) articles. Three hundred sixty-three articles were obtained in the first search from the Web of Science database and one thousand sixty-nine article hits in the Scopus database. After the Inclusion and Exclusion criteria were examined, 225 articles were accessed in the Web of Science database, and 360 articles were accessed in Scopus. Then the screening process started with eliminating 144 duplicated articles as they were duplicated among the two databases.

Both authors screened abstracts and titles against inclusion and exclusion criteria independently from each other. Two authors extracted data independently using a standard form for the risk of bias and applicability assessment. Concordance index between the authors (Cohen's kappa coefficient) 0.9 was achieved.

After that, the abstracts (n=441) have been screened to apply inclusion criteria. Two hundred fourteen articles have been eliminated since it was not appropriate with the topic. In addition to that after screening full papers, 133 articles have been excluded since it was not related directly to the topic and some of the studies given English

only in abstract level. Articles not directly related to the subject, whose full text could not be reached, and whose abstract is only in English were omitted.

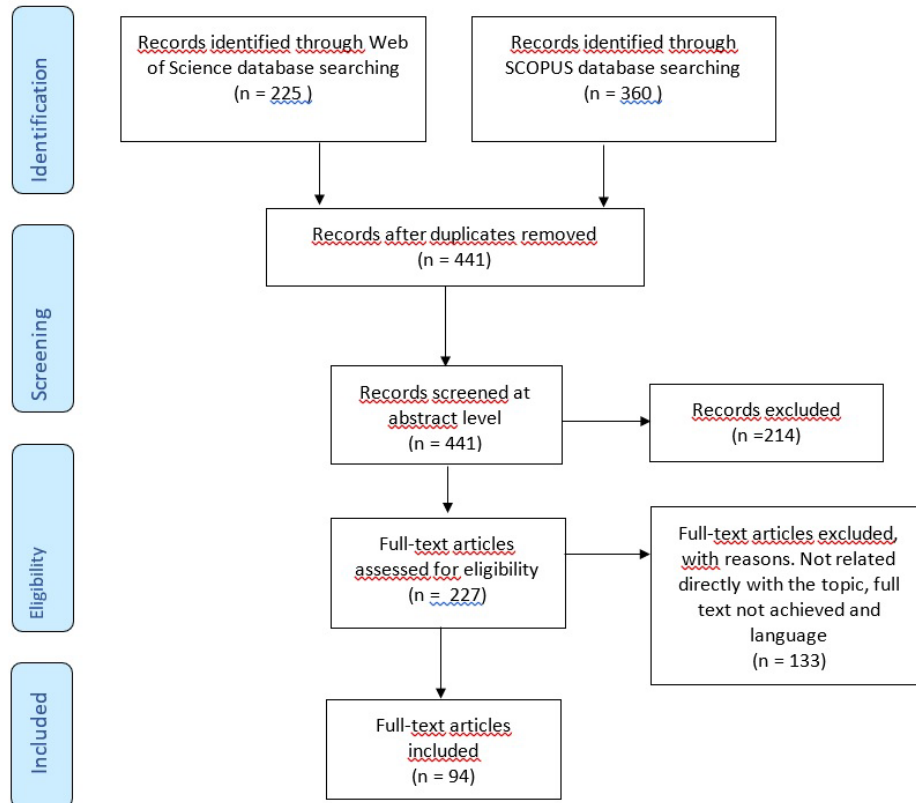


Fig. 1. The flow of information through the different phases of a systematic review

2.3 Descriptive analysis of articles

In Table 2, the critical results of the studies included in the research are summarized. The distribution of the studies included in the study by years is given in the Figure 2.

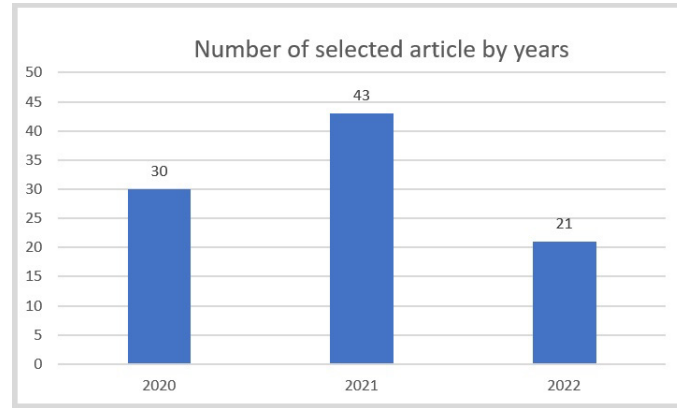


Fig. 2. Number of articles by years

As stated in Figure 2, the number of online education research during the COVID-19 process was 30 in 2020 by the inclusion and exclusion criteria, it was 43 in 2021 and 21 in the first half of 2022. It shows us that the work continues rapidly due to the ongoing pandemic. When the countries with the most studies were examined, it was determined that the most studies were Saudi Arabia ($f=14$), USA ($f=9$), India ($f=7$), and Australia ($f=6$).

As presented in Figure 3, previous researchers used quantitative, qualitative and mixed research methods to examine the opportunities and challenges of e-learning during COVID-19. Quantitative methods were used most frequently in studies. Also, surveys were used most frequently in primary studies to understand the effects of online learning during the pandemic, followed by the interview to understand the effects deeply. Researchers used survey and interview methods together with the mixed studies.

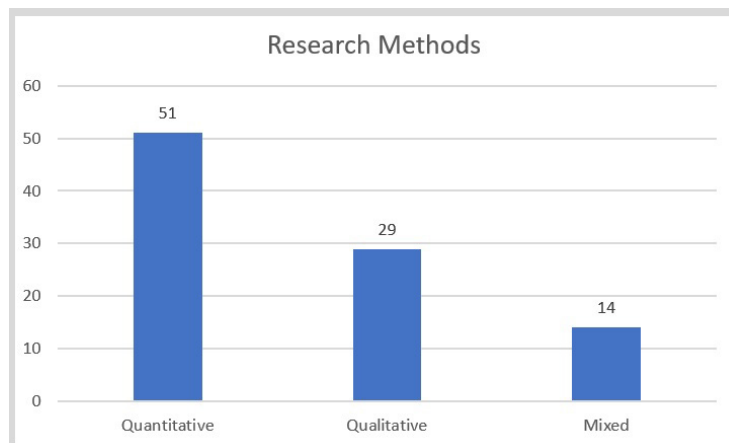


Fig. 3. Research method distribution

Table 2. Key findings of studies

No.	Ref.	Key Finding(s)
1	[39]	Participants believed that the difficulty with internet access and network challenges would negatively affect the outcomes.
2	[40]	Easily communicate through e-learning
3	[41]	If necessary, opportunities are provided, and students can work efficiently even in distance education.
4	[42]	Most of the participants stated that they prefer blended learning in the future.
5	[43]	Many students participating in the study found that they had an excellent online learning experience and that the academic sustainability plans implemented by the universities were effective.
6	[44]	Challenges are lack of digital literacy, lack of time for self-education, electronic educational materials, etc.
7	[45]	Teachers and students stated that they believed the epidemic increased their confidence in the effectiveness of e-learning.
8	[46]	educators who train teachers in the faculty of education do not have homogeneous views on rearranging the evaluation of teaching practices during the pandemic process and favor school-oriented evaluations.
9	[47]	The results show that teachers' and students' development is towards the technical direction and lacks the learning environment's pedagogical strategies
10	[48]	The study showed that Ukrainian educators had no online training experience, but they responded quickly and adapted to changes.
11	[49]	Difficulties both students and teachers face in the online education process; more tasks, changing working hours with the fulfillment of other duties in the family, the obligation to participate in the training adaptation process, and uncertainty in individuals.
12	[50]	It has been stated that one of the most critical difficulties experienced in the study is access to digital books. University failure to provide digital textbooks was shown as a challenge
13	[51]	It was stated that online education is a weak application in Ghana due to the lack of technical knowledge and technological tools used and the high costs of the internet infrastructure.
14	[52]	In the study, workload, role changes, home life changes, and project-specific delays were cited as problems.
15	[53]	Academicians believed that achieving the course objectives was challenging due to practical laboratory work and information exchange in applied courses.
16	[54]	For digital transformation to occur, it has been determined that digital readiness levels should be increased, and a culture of openness is required.
17	[55]	It has been determined that students are primarily ready for digital learning, but students need support from a socio-emotional perspective
18	[56]	face-to-face methods used for learning have shifted to the online world, and so have been inconvenienced.
19	[57]	While it was stated that the advantage of online education is the protection of social distance, poor technical setup and lack of accurate clinical access were fundamental problems for students.
20	[58]	Students were most affected psychologically
21	[59]	Internet streaming quality and coverage was the challenge that was reported by more than half of the students
22	[60]	Excess of activities and works proposed, Lack of concentration
23	[61]	Familiarity with e-learning, quality of internet connection, and physical conditions were cited as barriers to online education

24	[62]	Online learning provides flexibility and time-saving
25	[63]	The high level of e-learning readiness played a significant role in accelerating the education process.
26	[64]	Students did not feel confident enough to take the final exams after the e-learning sessions.
27	[65]	Problems with the Internet connection and lack of face-to-face communication
28	[66]	Satisfied with the online teaching regarding the theoretical courses. however, they had difficulties in design classes
29	[67]	E-learning was a more complicated process for older students, rural residents, family responsibilities, and people with limited electronic resources.
30	[68]	Educators find that online education results in more academic dishonesty and lack of emotion and is difficult to manage in terms of technology.
31	[69]	It demonstrates that it encounters various difficulties related to online presentation, assessment, examination, and problems related to the supervision of the thesis.
32	[70]	Academic transparency-integrity concerns and technical issues were cited as major challenges
33	[71]	Challenges with Virtual Learning Environment
34	[72]	The student's academic expertise had significant relationships with their perceptions of the effectiveness of e-learning.
35	[73]	Most of the learners agreed that online education deducted the quality of information attained and is not an efficient method of learning.
36	[74]	Students' attitudes towards using e-learning systems beforehand have a significant relationship with the use of the e-learning system during the pandemic.
37	[75]	Clinicians stated that they found synchronous training more effective than asynchronous training.
38	[76]	Difficulties were determined as non-compliance with the virtual classroom rules, insufficient interaction, negativities caused by time limitations, and infrastructure problems.
39	[77]	It saves travel time and helps to maintain social distance
40	[78]	Less instructor support and classmate interaction
41	[79]	Internet connections have been indicated as the main challenge.
42	[80]	Extended time spent in front of the computer
43	[81]	The majority of Dentistry Students state that dental courses in laboratory format should be in face-to-face settings.
44	[82]	Teachers stated that they felt uncomfortable with technical and psychological factors.
45	[83]	Readiness and experience are important factors
46	[84]	Opportunity to collaborate, discuss and think about their professional development
47	[85]	Lack of social interaction
48	[86]	"time efficiency" and "lack of interaction"
49	[87]	Confidence, Saving effort, money, and time, quick feedback
50	[88]	The lack of motivation, low level of interaction
51	[89]	New teaching approaches with online learning
52	[90]	Teaching methods, social aspects, infrastructure, computer skills, assessment methods, motivation, and willingness
53	[91]	Students have difficulties in their self-learning activities. They still prefer direct lessons to understand the materials during e-learning.
54	[92]	The highest barriers to e-learning were insufficient technological infrastructure
55	[93]	Flexible programs and explanatory videos are effective

56	[94]	The challenges experienced in e-learning are such as the integration of online technology, which has been selected from beginning to end to engage students deeply.
57	[95]	Students emphasized that the most important characteristics that lecturers should have in these extraordinary situations in e-learning are knowledgeable, friendly, and patient individuals.
58	[96]	Being able to use technical tools was cited as one of the biggest challenges in implementing online teaching.
59	[97]	It has been observed that Web 2.0 technologies have a high effect on reducing negative emotions and increasing participation in online education.
60	[98]	Students stated that online learning difficulties were related to adapting to online education, especially deaf students, lack of interaction and motivation, data privacy, and security.
61	[99]	Self-regulation, Technological literacy, and student isolation are challenges during e-learning
62	[100]	E-learning offers a useful alternative during the pandemic, including in regions with limited experience.
63	[101]	Exam fraud appears to be one of the biggest challenges in the distance learning process.
64	[102]	The behavioral intention has been expressed as one of the most critical factors for distance education system use and acceptance.
65	[26]	A theoretical model of the hybrid education system based on student perception is proposed.
66	[103]	Students felt that the lack of face-to-face interaction in the transition to online education was destructive and caused communication problems.
67	[104]	Access to registered courses, faster communication via email, and extended office hours were identified as some benefits to student performance.
68	[105]	Scarcity of resources, unequal access, and opportunities are challenges in online education.
69	[106]	The biggest challenge is facing the network connection and electricity in South Africa.
70	[87]	Many elements that helped academics adopt e-assessments were identified as usefulness, exam preparation, cost, ease of use, and increase satisfaction.
71	[107]	It has been shown that the use of e-learning systems plays a leading role in increasing students' intention to participate in e-learning.
72	[108]	The fact that the self-organization level of the learners is not sufficient for online education is seen as the main risk in online education.
73	[109]	It has been observed that the negative anxiety experienced by the learners during the pandemic process also negatively affects their e-learning processes.
74	[110]	Online learning is more flexible, efficient and more effective in terms of cost and energy as well as time usage.
75	[111]	It is stated that with online education, students can improve themselves through self-learning.
76	[112]	While saving time and flexibility are stated as opportunities; technical problems and lack of digital skills were cited as challenges.
77	[113]	Learners think that the biggest disadvantage of e-learning is that it reduces the workload of the instructors and increases the pressure on the students.
78	[114]	In the study, it was stated that learners felt less difficulty and lower pressure in online exams compared to regular exams.
79	[94]	Online workshops and formative feedback by teachers helped learners improve their learning experience
80	[115]	Difficulty in practical work, difficulty in monitoring students, and insufficient feedback
81	[116]	Strategies such as debating and brainstorming sessions are recommended to maintain students' attention online.

82	[117]	The main obstacle in the practical lessons was the lack of body language.
83	[118]	The main challenges include a lack of digital skills and a lack of technological support.
84	[119]	It has addressed that one of the most important benefits of e-learning is self-centered flexible learning.
85	[120]	During the pandemic, online education has created an opportunity to improve computer skills and gain new knowledge about learning platforms.
86	[121]	Online informal formative assessment provides opportunities for undergraduate students to participate in instructor-student argumentative interaction.
87	[122]	Students stated that they received faster feedback in online education supported by Telegram.
88	[123]	Students especially found the physical education lesson more attractive than their online education.
89	[124]	In online education, four main barriers have been identified financial, insufficient institutional support, technological, and individual.
90	[125]	Educators and students prefer a model that blends a flexible model rather than sticking to any of the face-to-face and e-learning techniques.
91	[126]	Students find online platforms more efficient and more functional to organize their work.
92	[127]	It was determined that open sources, leverage to remain motivated, working together, reflection, feedback, and evaluation have a positive effect on online education.
93	[128]	Students expressed negative attitudes towards information overload, technical factors, and asynchronous course formats.
94	[129]	e-portfolio allowed students to adapt their learning.

3 Results

This study aimed to identify online education's opportunities and challenges and the researchers suggest that affect online education during the COVID-19 pandemic. Results obtained to achieve this purpose were answered under the following titles. This study was based on three research questions to examine articles that are relevant to the research topic. According to researchers [130], preparing results using research questions helps synthesize results from previous studies. For this reason, the findings are titled appropriately to the research questions and provide a detailed discussion of each.

3.1 Opportunities

According to [131], this Pandemic has accelerated the technology integration process in higher education in an unprecedented way. It remains unclear whether distance learning can mitigate the opportunities lost from face-to-face interactions. Teachers and students stated that they believed the epidemic increased their confidence in the effectiveness of e-learning [45]. According to the studies' results, educators and students stated that distance education is the best alternative [39], [132].

Students and academics think the pandemic has opened the door to new teaching approaches with online learning [89]. Hybrid design education methods are seen as the most suitable teaching and learning methods in the design studio. The pandemic has accelerated these approaches' recognition and forced educators to design studio

structures [41]. According to researchers, online studios' most benefits are digital tools in the Architecture and design field. However, in the study conducted during the pandemic process in the Faculty of Architecture and Design in Jordan, both faculty members and students stated that they were satisfied with the online teaching regarding the theoretical courses. However, both groups indicated that they had difficulties in design classes. While students reported technical problems, educators stated that they were uncomfortable with long working hours and a lack of privacy[66].

Students who are not very confident and shy can easily communicate through e-learning platforms [132]. Another result is that if students are provided with the necessary equipment and opportunity to improve themselves, they can work efficiently in online environments during the Pandemic[41]. In training held on Moodle in Ukraine, the students stated that the Interactive "Forum" and "Dictionary" modules improved their collaboration skills [65]. Portuguese students stated that the most crucial advantage of online education applied during the pandemic is time and location flexibility [60]. In a study conducted in Albania, students stated that e-learning applications helped them improve their ICT skills during the pandemic process, they were less costly than traditional learning, and they had the opportunity to study more comfortably [88]. Salmani et al.,(2022) has addressed that one of the most important benefits of e-learning is self-centered flexible learning. It is stated that with online education, students can improve themselves through self-learning [111]. Medical students from Pakistan stated that distance education provides flexibility in the learning process and saves time [62]. Another study with medical students stated that the essential opportunities of e-learning are that it saves travel time and helps maintain social distance without compromising the learning process [77] . In another study, medical students stated that they have opportunities such as attitudes towards adaptability, preventing learners from leaving the learning environment, documenting and monitoring the learning process, controlling their learning, and improving perceived usefulness in the e-learning process [133].

3.2 Challenges

In addition to opportunities provided by online education during the pandemic process, there were also challenges for educators and students in higher education. Almazova et al., (2020), the study on identifying teachers' difficulties, determined that they have problems organizing productive interaction with students in the online environment and using active and collaborative teaching methods. Similarly, a study conducted in Turkey determined that there is less teacher support, peer interaction, and cooperation when e-learning is compared with traditional learning [78]. The teachers also emphasized that preparing online educational material was twice as long as designing traditional educational materials.

In many studies, the main difficulties during e-learning were cited as access to ICT resources, Cost, Network, and internet connectivity [39], [79], [134]. Also, medical staff stated that the highest obstacles in the e-learning process are an insufficient internet connection and technological infrastructure [135]. Apart from these, the student and teacher's prior knowledge is indicated among the main difficulties in e-learning

[39], [49]. Some results show that teachers' and students' development is towards the technical direction and lacks the pedagogical strategies' learning environment [47], [136]. According to the results of the Adom, (2020) study, it was stated that online education is a weak application in Ghana due to the lack of technical knowledge and technological tools used and the high costs of the internet infrastructure. One of the most critical difficulties experienced in the [50] study is access to digital books. University failure to provide digital textbooks was shown as a challenge. Besides, in a study carried out by Alturise, (2020), students think it is challenging to have discussions with their friends during the problem-solving activities carried out in the online lesson.

Apart from the technical and pedagogical deficiencies, when the other difficulties mentioned are examined, it is seen that the education ministries have limited guidelines for practitioners. In the study conducted in Portugal, students stated that excess activities and works proposed, lack of concentration, lack of student interaction, and difficulty in time management were obstacles to the learning process [60]. Similarly, in Romania [80], the university students noted the challenges of online education as the long time spent in front of the computer participating in teaching activities and solving given tasks. In Adams et al., (2021)'s study, it was revealed that students had difficulties due to insufficient self-directed learning skills during online learning. Malik et al., (2021) study supports these results and they agree Self-regulation is a challenge during e-learning. They still prefer direct lessons to understand the materials during e-learning. Also, in Jordan [98] particularly, hearing impaired students stated that they experienced difficulties in the online learning process in terms of lack of motivation, interaction, data privacy, and security.

Rasiah et al., (2020b) showed technological challenges such as poor internet connections and personal concerns about academic ability and time management skills. In Nogales-Delgado et al., (2020) both students and teachers face difficulties in the online education process; more tasks, changing working hours with the fulfillment of other duties in the family, the obligation to participate in the training adaptation process, and the feeling of uncertainty in individuals. Similarly, in the [52] study, workload, role changes, and changes in home life were shown as the main problems for teachers. However, students think that the biggest disadvantage of online education is that it reduces the workload of the instructors and increases the pressure on the students [113].

Zimbabwe's teachers state that the richness of classroom learning cannot be achieved through online education [46]. Also, Moyo noted that educators who train teachers in the education faculty do not have homogeneous views on rearranging the evaluation of teaching practices during the pandemic process and favor school-oriented evaluations.

Another study stated teaching methods, social aspects, infrastructure, computer skills, assessment methods, motivation, and the difficulties of online education [90]. Some studies state that it is difficult to make individual evaluations because there is no prior experience in online assessment [40], [45]. However, in the study by Bisht et al., (2022) it was stated that learners felt less difficulty and lower pressure in online exams compared to regular exams. In [40]'s study, it is stated that students easily

copy and paste from the internet environment in distance education. For these reasons, students' problem-solving skills may be negatively affected. Also, students did not feel confident enough to take the final exams after the e-learning sessions [64].

In the study by Hayat et al., (2021b), during the medical education process, the difficulties were determined as non-compliance with the virtual classroom rules, insufficient interaction, negativities caused by time limitations, and infrastructure problems. Reported challenges with online medical education included “communication”, “online assessment”, “web tools”, “e-learning experience”, “pandemic-related anxiety or stress”, “time management”, and “technophobia” [45], [133]. Also, clinicians found synchronous training more effective than asynchronous training [75]. Similarly, in a different study, it was determined that students had negative attitudes towards asynchronous learning [128]. In addition to global uncertainty that can cause anxiety, depression, and stress, especially for students, prolonging the exam duration can also cause low motivation [49]. While it was stated that the advantage of online education is the protection of social distance, poor technical setup and lack of actual clinical access were significant problems for medical students [57]. A study with clinicians revealed that the difficulty and relevance of learning content and hardware limitations were critical barriers to successful e-learning [75]. Similarly, in the research conducted by [53], [81], it was determined that the majority of the academicians and students believed that achieving the course objectives was challenging due to the lack of practical laboratory work and information exchange in applied courses.

A study conducted with dentistry students stated that students were most affected psychologically because they were not exposed to social isolation before, and distance education activities were an alternative. It has been determined that the use of streaming media has increased except for distance education activities [58]. [55] investigated how ready students are for emergency distance education due to the pandemic and how this affects their socio-emotional perceptions; It has been determined that students are mainly ready for digital learning, but students need support from a socio-emotional perspective, that is, coping with anxiety, tension, joy, and overload.

3.3 Proposed recommendations for e-learning

ICT integration policies that consider students' needs in rural and urban areas should be planned to ensure effective online learning [39].

Faculty members and students can be trained to use online applications interactively and develop a lesson plan with a reduced cognitive load to improve efficiency [40]. [139] suggest that the curriculum be organized so that students take an active role in online education. Besides, they indicate that the university administration should ensure that students' and lecturers' satisfaction in the online education organization is continuously monitored to accumulate statistical data in dynamics.

Rajab et al., (2020) suggests combining online with face-to-face instruction to increase practical processes' effectiveness, especially in medical education. Blended learning is recommended in the studies, and students also recommend that the theoretical lessons are online and the practical lessons face-to-face [93]. Combining exams and quizzes was the most preferred method of assessment, with the least preferred

submission of reports or short written assignments [101]. As a suggestion, the researchers suggested that making a formative assessment in the e-learning process may be more effective for both students and educators [133]. In a study, authors find that online workshops and formative feedback from teachers helped learners improve their learning experience [94]. Accordingly, it can be said that formative assessment and formative feedback have a significant impact on online education. In a study conducted in 2022, it was revealed that online informal formative assessment provides opportunities for undergraduate students to participate in instructor-student argumentative interaction [121]. In another study conducted in Turkey, university students suggested that the materials and methods used in the evaluation should be developed suitable with e-learning for a better evaluation process [78]. In the study in which e-portfolios were recommended as an alternative assessment tool in the online education process, it was stated that the e-portfolio received positive feedback as it allowed students to adapt their learning [129].

Agasisti et al., (2020) stated in their study that two conditions are necessary to state the importance of digital innovations. The first element is digital readiness levels, and the other reason is that a culture of openness should be strengthened by academic and administrative staff. [63] indicated that the high level of e-learning readiness plays a significant role in accelerating the education process. The digital competencies of teachers, students, and even other stakeholders need to be evaluated. The assessment of digital competencies can be done not by simple self-assessment testing but by using other activity-based tools based on real scenarios [140]. Also, Adams et al., (2021) stated that lecturers should first improve students' self-directed learning skills to increase the effectiveness of online learning.

Bergdahl & Nouri, (2021) made some suggestions in their work in Sweden. Their first suggestion is to ensure that students and educators have a device to conduct their education. Second, considering that students will not be with their friends in the school environment, the risk of distress and depression should be considered. Third, the conditions of students with special needs and strategies for solving the problems experienced should be provided. The last suggestion is that when the transition to face-to-face education is made, plans should include digital environments used in distance education. Besides, these activities should be evaluated by educational technology experts. Also, it is recommended to go beyond fixed pedagogical frameworks to exploit the productive capacities of adaptive teaching [141].

Pazos et al., (2020) in their research at universities in Spain, instead of developing a teaching methodology that can take advantage of all the advantages of virtual learning due to immediate transformation, standard methods used for face-to-face learning have been shifted to the online world, and therefore difficulties have been experienced. The researchers mentioned that the teacher should be more active in conveying information in such cases and be more active and support the student to attract the student's attention. Anwar et al., (2020) indicate that medical students believe that frequent and active participation in learning activities is critical to succeeding in distance education. Tuma et al., (2021) recommend adequate preparation and use of quality audio-visual materials and environments to increase the quality of the online learning process and student engagement. Also, Saha et al., (2022) stated that difficul-

ty in practical work, difficulty in monitoring students, and insufficient feedback were cited as difficulties of online education. Accordingly, it is recommended to switch to the blended learning model instead of online education.

4 Discussion and conclusion

The e-learning approach is seen as an opportunity to protect the health of teachers, students, and other stakeholders during the pandemic process. Successful implementation of the e-learning process relies on understanding the current e-learning adoption factors and the key opportunities and challenges faced in the e-learning process. However, little effort has been made to summarize and synthesize these results found in the literature. In this research, a systematic literature review was applied to synthesize the opportunities, challenges, and researcher suggestions of online education during the COVID-19. A total of 94 journal articles were identified by following the steps of the systematic procedure. It has been observed that the number of articles suitable for the determined subject has increased day by day. Figure 4 shows a summary of the results obtained.

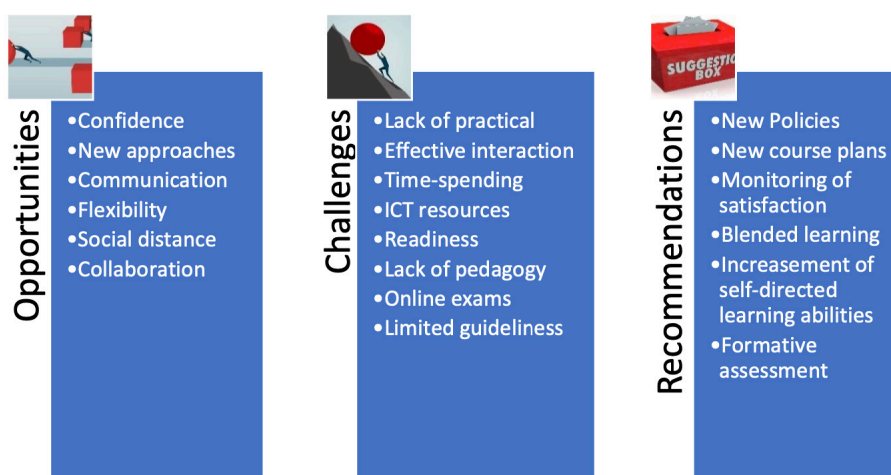


Fig. 4. Summary of results

It is stated in the studies conducted that online education is the best alternative, and thus education can be continued without interruption. It provides sustainability of education through online education platforms. According to the results obtained from the reviewed studies, mainly when the opportunities created by distance education are evaluated, it has been revealed that maintaining social distance, increased confidence in the effectiveness of e-learning, easy way of communication with lecturers, new teaching approaches, time and location flexibility, the collaboration between students and monitoring the education through documentation, taking control of their learning processes. However, in studies conducted in 2022, educators and students prefer a

model that blends a flexible model rather than sticking to any of the face-to-face and e-learning techniques [125]. Also, in a study conducted in 2022, a different perspective was put forward. Researchers have proposed Open Education Practices as an alternative based on students' participation in crowd-based collaborative learning communities [142].

The challenges are leading higher education institutions to adapt to changing conditions without reducing their quality, and this will support economic growth with low education costs in the future. As a result of the studies examined, the difficulties experienced in e-learning applications applied during the pandemic process; the lack of practice, especially in medical applications, the inability to establish effective interaction between students and the educator, the long time to prepare the material and environment to be used in online education, limited ICT resources, pedagogical deficiencies in online environments, the negativities in online exams and limited guidelines for educators and learners.

According to the results obtained from the study, the necessity of developing ICT integration policies and creating lesson plans with reduced cognitive load to increase the effectiveness of the online learning process comes to the fore. In addition, measures should be taken to monitor the student's and educator's satisfaction in the online education process and increase their satisfaction; it is recommended to use formative assessment methods, especially in evaluation processes in the online learning process. Project-based projects can be carried out with students for formative assessment, and the electronic portfolio process can be supported. In addition, it is recommended to carry out studies to increase self-directed learning skills since students can work in their environment and there is no teacher supervision in online education. In addition, blended learning can be designed by adjusting face-to-face practice hours, especially in medical education.

This systematic literature review has some limitations; the most critical concern is the included article types to review in the research. Only open-access journal articles were included in the study. It should be underlined that knowing the opportunities and challenges for learners and educators is very important when implementing online education. If the learners and teachers know these, they can deal with these challenges and opportunities. Further research should deal with books, chapters, and conference papers' data.

In conclusion, researchers agreed that e-learning in the next normal post-pandemic would play a significant role. So it is recommended that universities consider these results and recommendations to be sustainable in their plans for this process. Also, the obligatory transition to online education can be the catalyst to create a new and more effective blended model in the future. New models can be designed by considering the challenges, opportunities, and suggestions specified in this study.

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