

Evaluation of Online Education in the Era of COVID-19 Pandemic: A Review from Students, Parents, and Teachers' Perspectives

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ABSTRACT

Qualitative content analysis is used in this study to review related online education since the outbreak of COVID-19. The aim of this study was to summarize the impact of online teaching on the education industry during the pandemic, sum up the viewpoints of all kinds of people to draw conclusions, and conclude the practical countermeasures. Based on the result of the analysis, firstly, we think that students and teachers are satisfied with online education, but parents have expressed dissatisfaction with this kind of education. Secondly, this paper lists the advantages and common problems of online teaching during study at home from different aspects. According to deficits, we summarize the solutions from three aspects: network equipment, teaching, and self-adjustment. This research is of great significance. It is not only beneficial to the development of educational platforms and personalized teaching but also helps formulate education policy to reduce the burden of education.

Keywords: Online education, COVID- 19, qualitative content analysis, academic performance, countermeasures

INTRODUCTION

At the end of 2019, there was an outbreak of pneumonia of unknown cause in Wuhan, China, which was considered the most widespread epidemic in nearly 100 years (Kang et al., 2020; Lu et al., 2020). It was later confirmed that the disease was induced by SARS-COV-2, which belonged to the Beta coronavirus genus of the family Coronaviridae (To et al., 2021). It was a pleomorphic enveloped virus studded with distinctive spikes (Chan et al., 2020). The symptom of Coronavirus disease 2019 (COVID- 19) was not specific, including cough, fever, and difficulty breathing (Gao et al., 2021; Ilkhani et al., 2021). As the progressed, it turned out that the disease was

transmitted primarily through mucus secretions, droplets, and direct contact (Habas et al., 2020; Zhang et al., 2020). It could spread in other ways, such as, touching the objects with the virus and then touching their mouth, eyes, and nose (Rothe et al., 2020). There was a study that confirmed the presence of viruses in stool and blood swabs (Rothe et al., 2020). There has been a lot of vaccination (Ilkhani et al., 2021). But from the point of epidemiology, the effective ways to stop the spread of the virus were isolation, contact tracing, social distancing, ongoing testing, and awareness-raising (Adedoyin & Soykan, 2020; Habas et al., 2020; Ilkhani et al., 2021). The sudden outbreak of the COVID-19 has disrupted the pace of people's lives. In order to stop the spread of the COVID-19, people had to keep social distance and stay at home. Limited grouping made people turn traditional education into online education via the Internet to maintain the normal teaching process (Machado et al., 2020; Mumtaz et al., 2021; Wenceslao & Felisa 2021; Zhu et al., 2021).

Online learning referred to the use of the Internet and related technologies to develop and manage projects (Fry, 2001; Means et al., 2009). Usually, online learning included desktop computers, laptops, smartphones and other hardware as well as softwares such as email, video, video conference, learning management systems etc (Larreamendy-Joerns & Leinhardt, 2006; Wenceslao & Felisa 2021). Online education had a long history, originating in the United States in the 1800s (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). After the first World War, radio opened the door to distance education as a medium (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). In the late 1980s, due to the shortage of teachers, K-12 schools offered courses through satellite technology, stimulating the development of distance education (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). The emergence of world wide web was the milestone of online education (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). Technology innovation and the speed of the Internet make the use of online education higher and higher. As early as 2010, 89% of four-year colleges offered full online and blend programs, according to prior studies (Parker et al., 2013). 32% of students enrolled in high education in 2013 had taken at least one online course (Sun & Chen, 2016). Online education was rapidly sweeping the education market with its flexibility, customization, economy and accessibility (O'Donoghue et al., 2004; Palaigeorgiou & Papadopoulou, 2019; Smedley, 2010). But, Due to the rapid spread of the new coronavirus, the way of education changed overnight. People had to stay at home and took classes using online teaching and other methods via the Internet. This has also raised concerns about the quality of online teaching (Hodges et al., 2020).

Due to the massive use of online education during the pandemic, people were interested in the effect of online learning has become a heated topic of the society with numerous discussions around it. What was the academic performance of students undergoing online courses? What did teachers and parents think about the online education? What were the successes had been achieved and what were the mistakes had been made? Although there was much literature that had studied the satisfaction, teaching quality and grades in detail, there was no overall summaries and generalized these views. Thus, we took the lead in conducting a compressive review to answer the confusion about online education and to summarize some of the achievements and shortcomings of online education so far, dissecting the viewpoints of all sides, such as, students, teachers and parents. In addition, our articles also tried to put forward feasible suggestions based on existing problems. Subsequent teaching could be applied effectively and achieve remarkable results.

METHODOLOGY

Research Design

This study reviewed relevant studies on online education, including qualitative research, quantitative research and mixed research since the COVID-19 outbreak. The groups studied included students, teachers and parents. The research covers kindergarten, primary and secondary schools and universities, and it involves different disciplines. The online education defined a learning style in which learners did not need to learn in bricks-and-mortar classrooms. The terms online learning, online teaching, online education, online course could use interchangeably throughout the article.

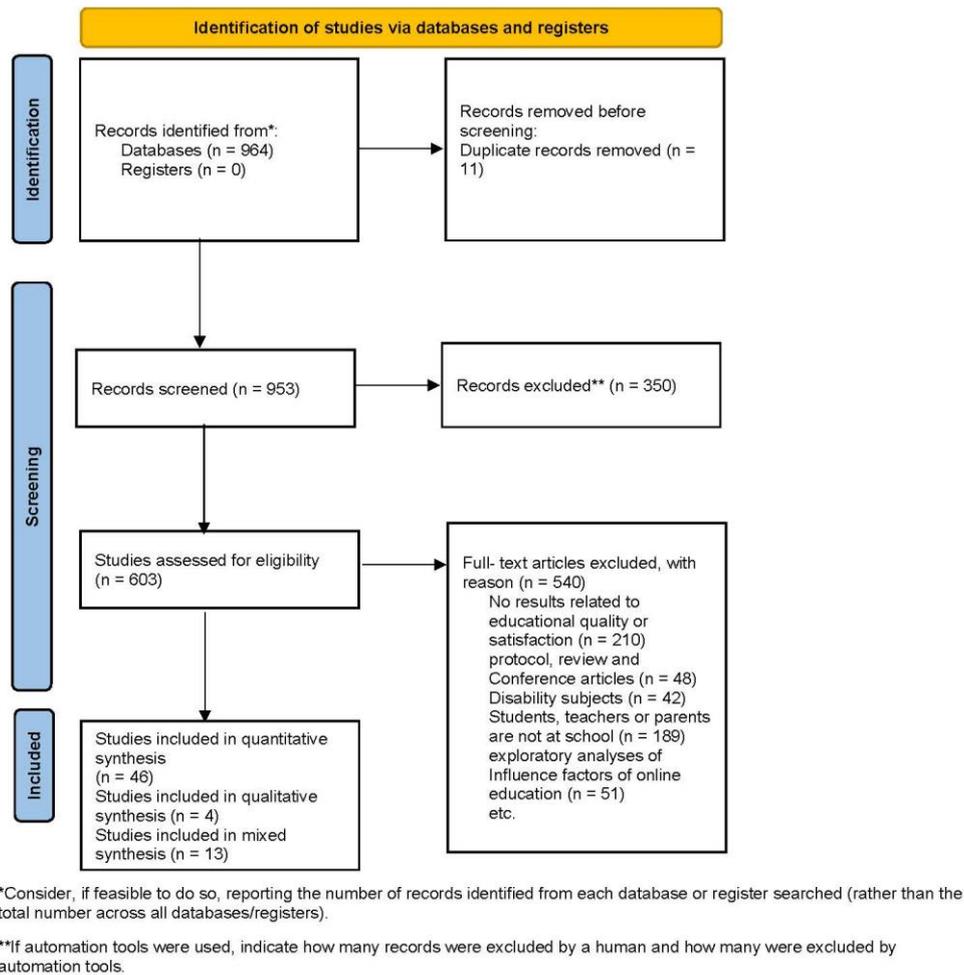
Study selection and research question

The sources of primary literature were full-text and journal articles. The purpose of the review was to summarize the influence of online learning strategies for academics and evaluate the effect of online education in the era of COVID-19 pandemic. We included articles since 2019. The primary literature was collected by online databases. The search databases, including Pubmed, Conchrane, Embase, Medline, Web of science, CNKI and WanFang, would be conducted. Each database used the same retrieval strategies and keywords "Online education" AND "COVID-19" were used as search terms.

The process of selecting studies was presented in flowchart (Fig. 1). The search yielded 964 records. Eleven articles were excluded because of duplication. Three hundred and fifty articles were excluded because they did not meet the inclusion criteria after screening the title and abstract. Six hundred and three articles were assessed for

eligibility through full-text screening, and sixty-three records were further analyzed at last. The reasons for excluding the rest of the articles were as follow: 210 articles did not report the results related to educational quality and satisfaction, 48 studies including protocol, review and conference articles were eliminated, 42 studies were conducted with the disabled, 189 studies did not include the students, teachers, parents at school, 51 studies were exploratory analyses of influence factors of online education.

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only



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Fig. 1 flow diagram depicting article selection.

According to the selection criteria, we included sixty-three articles to answer our questions (Table 1): (1) What is the impact of online learning strategies on academic performance? (2) What are the advantages or disadvantages

of online education? (3) What measures can be taken to address the adverse effects of online education?

Data analysis

The qualitative content analysis approach was applied to analyze data in this article (Cavanagh, 1997), and the result of research was organized into three important topics for answering questions, including the academic performance of online learning, the advantages or disadvantages of online education, and coping strategies.

RESULTS

RQ1. What is the impact of online learning strategies on academic performance?

The attitudes of students toward online education

Overall, students were satisfied with online learning by reviewing relevant literature. They thought online learning strategies were effective to make up for the lack of traditional learning strategies during home quarantine (Adarsh, 2020; Chung & Choi, 2021; Dana, 2021; Lan et al., 2021; Wang et al., 2021a; Wang et al., 2021b; Xiaoying & Qilan, 2020). Students reported that they could learn new knowledge and acquired new skills regardless of the way was educated (De la Fuente et al., 2021). Besides, students also said the quality of teaching did not deteriorate because faculty prepared lessons carefully even during distance teaching (Dana., 2021). Some researchers measured the academic performance of students and they found students' test scores did not go down even some got higher scores than the traditional teaching (Alabdulwahhab et al., 2021; Gopalan et al., 2021; Mahabubul & Morsheda, 2021; Manna et al., 2021; Mortezaei et al., 2021). Thus, somebody said online learning was an excellent way to replace the teaching in bricks-and-mortar classrooms (Generali et al., 2021; Lan et al., 2021). In addition, due to the impact of epidemic, the assessments of teaching results were carried out online, basically. Students praised it for being efficient, accurate and a good reflection of their levels (Cernicova-Buca & Dragomir, 2021; Xiaoying & Qilan, 2020).

However, there was still some disagreements about online courses (Baltà-Salvador et al., 2021; Generali et al., 2021; Wenceslao & Felisa, 2021; Zhongren & Sakinah, 2021). A small number of students showed dissatisfaction with online learning, and they thought this way was less beneficial to study, especially, in laboratory courses and clinical skills training in medical profession (Dietrich et al., 2020). The reasons might be that the learning process was hindered because they had no chance to take part in the experiments and practices (Fazean et al., 2021; Wang et al., 2021a). Studies found that seniors were also affected. On the one hand, they have lacked practice courses leading to lower scores (Osamudiamen et al., 2021). On the other hand, the lack of this part was a disadvantage for them to find a job (Mahabubul & Morsheda, 2021; Susan et al., 2021). In addition, students reported that lower motivation and lack of interaction with teachers and students all contributed to the decline in academic performance (Asgari et al., 2021; Damijana et al., 2021).

The attitudes of teachers toward online education

Upon investigation, it was found teachers' satisfaction with network teaching is a medium level (Chung & Choi, 2021). They reported that they improved their ability to operate the computer, learned the new teaching technique, broadened the horizon, improved the quality of teaching, enhanced the learning experience, raised the level of innovation through online teaching (Fazean et al., 2021; Karla et al., 2021). Besides, teachers said they gained higher motivation for career and self-confidence (Denisova et al., 2020). Researches had been done and found the instructors were satisfying with online courses than students (Osamudiamen et al., 2021; Yang et al., 2020).

But others reported that it was not certain that online education was an effective and feasible way (Osamudiamen et al., 2021; Rome & Ryan, 2020). Firstly, they often had problem on operating software of teaching, and which made them annoyed (Armon et al., 2021; Asgari et al., 2021). Secondly, teachers could not percept students' ability of learning accurately and not sure online courses leading to the decline in academic performance in order to make an unbiased assessment (Chung & Choi, 2021; Dietrich et al., 2020; Osamudiamen et al., 2021). Thirdly, teachers agreed that online education was more effective for non-practical courses which were same with the students' point of view (Osamudiamen et al., 2021). Because students could not get skills and decrease their practical ability. Finally, they feedbacked that they had more works to do when preparing for online courses (Chung & Choi, 2021; Dietrich et al., 2020; Fazean et al., 2021).

The attitudes of parents toward online education

Parents had negative attitudes toward online education basically (ZhongRen et al., 2021). They believed that their children could not get a good education, especially for children at young school age (Fontenelle-Tereshchuk, 2021). Primarily, students had difficulty in concentrating and parents were not capable of teaching (Fontenelle-Tereshchuk, 2021). Posteriorly, parents needed to raise their families so that so they could not give their children enough emotional supports and it was difficult of switching roles between the career and mentoring their kids (Fontenelle-Tereshchuk, 2021). In addition, the teaching time was too short and they lacked of effective communication with teachers were also an annoyance (ZhongRen et al., 2021).

RQ2. What are the advantages or disadvantages of online education?

The advantages of online education

- Through investigating different population via surveys, the advantages of saving time and cost, and people with poor health getting same education (Alamer & Alharbi, 2021; Arshad et al., 2021).
- Learning materials could be obtained quickly (Cioruța et al., 2021).
- Arranged their time freely, had time to exercises and accompanied their families (Fazean et al., 2021).
- Teaching methods were living, interesting and attractive (Mishra et al., 2020).
- Video and courseware could be watched repeatedly (Mishra et al., 2020).
- Developed the ability to teach themselves and plan their studies at their own pace (Mahdy, 2020).
- Prepared courses with ample time and developed technique literacy (Fazean et al., 2021).

The disadvantages of online education

Through primary literature, common drawbacks of online education were as follows:

- Working in front of the computers was bad for health (Mahdy, 2020; Arshad et al., 2021; Francisco et al., 2021).
- Cheating on exams was on raise (Osamudiamen et al., 2021; Rome & Ryan, 2020).
- Had higher level of stress and even symptoms of depression and anxiety (Denisova et al., 2020; Loda et al., 2020; Zhongren et al., 2021).
- Lacked interaction with teachers to get feedback about academic performance slowly (Arshad et al., 2021; Yang et al., 2020).
- Due to the phenomenon of a digital gap, not everyone had good electronics (Pesha & Kamarova, 2020).
- Networks failures and technique difficulties caused disruption of courses (Asgari et al., 2021; Giulia & Amin, 2021; Muflih & Abuhammad 2020; Wang et al., 2021a).
- Lacked clinical teaching and practical teaching (Mishra et al., 2020).
- Reduced the time of study, and video or audio was played only to copy with attendances (Ji & DoHwan, 2021).
- Information was uncertain and scarce (Loda et al., 2020).
- The time of examinations being too short and the types of examinations being limit would cause panic (Mahdy, 2020; Wenceslao & Felisa, 2021).
- Teachers did not know if students were working hard (Rome & Ryan, 2020).
- Students had difficulties to manage their time (Giulia & Amin, 2021).
- The discussions among students were impersonal and feelingless (Rome & Ryan, 2020).
- It was difficult to find teachers and teaching assistants (Giulia & Amin, 2021).

RQ3. What measures can be taken to address the adverse effects of online education?

Countermeasures from the aspects of equipment

Firstly, schools can buy a batch of computers and rent them out to students at low prices (Asgari et al., 2021; Baltà-Salvador et al., 2021; Mahdy, 2020;). Some schools are already doing this to help students from poor families finish their courses on time. Secondly, schools can provide the wireless internet at low prices or free in order to provide supports of network to online education (Asgari et al., 2021; Cernicova-Buca & Dragomir, 2021; Mahdy, 2020). These measures can reduce the negative impact caused by the digital gap which is the most important obstacle in online education (Chand et al., 2021; Harum et al, 2004). And they prevent students who cannot afford internet fees losing the opportunity of education. In addition, it is important to choose suitable software that is well received and widely used for live broadcast or recording, such as, Zoom, Massive Open Online Courses (MOOCs), Tencent meeting, etc (Cioruța et al., 2021). This can prevent network outages or software glitches from delaying education. Creating shared web platform is also important, in which students can send and receive materials timely, make examinations easily, watch courses repeatedly and communicate with their classmates and teachers conveniently (Cioruța et al., 2021).

Countermeasures from the aspects of teaching

According to the inadaptation to online education reported by students and teachers, we put forward some countermeasures in terms of teaching. It is necessary to conduct uniform training and discussion for teachers (Chung & Choi, 2021; Muhterem et al., 2021). The training should include the use of software, troubleshooting network faults, methods of online teaching and basic quality of education. The choice of teaching method is crucial (Baltà-Salvador et al., 2021). Correct teaching methods can fully stimulate the enthusiasm of teachers and students, for example, in flipped classroom where students prepare the courses and teach by themselves (Gopalan et al., 2021). The methods that are interesting and live can reduce pressures on teachers to prepare lessons and immerse students in learning.

Teachers can adapt flexible assessments to evaluate the ability of learning. It might be a good idea to replace traditional closed-book examinations with open-book examinations (Osamudiamen et al., 2021). Firstly, using flexible test questions, such as essays or short answer questions rather than fill-in-the-blank or multiple-choice questions which there are a lot of cheating on this kind of problems (Osamudiamen et al., 2021). Secondly, quizzes can be used instead of final exams (Chung & Choi, 2021). In this way, students can be assessed at any time and teachers can percept the learning ability of students clearly. At the same time, it effectively puts an end to students' s distraction in remote teaching.

Solving the problem of online education without practical learning is difficult. Medical students, for example, are unable to perform surgery. This may induce a negative impact in their future work. So, schools can use the technique called virtual reality to simulate surgery if they can (Cabassa & Haas, 2020; Mahdy, 2020; Nicolas Dietrich et al., 2019; Xu et al., 2020). In this way, students can master the operating process, experience the process of practice and reduce the inconvenience to the maximum extent. This also lays foundation for future offline teaching.

In the post-epidemic era when many schools have resumed offline learning gradually, schoolers tried to adopt a mixed approach that combined face-to-face education and online education in order to achieve better effect. And they tested results that students had higher satisfaction and better scores of final examinations than traditional and online teachings (Mahabubul & Morsheda, 2021; Nathaniel et al., 2021; Wen et al., 2021).

Countermeasures from the aspects of psychological problems

Because of the panic caused by the COVID-19 and the long period of home quarantine, people's psychological burden become heavier and heavier, and even symptoms of depression and anxiety appear. Some research show that unhealthy mental state will lead to the decline of learning efficiency (Kimura et al., 2020; Zhang et al., 2020). Therefore, we should pay attention not only to academic performance but to mental health. The follow suggestions seem to be helpful to deal with the current difficulties encountered.

For schools, online courses include not merely specialized courses but also mental health courses. Such courses can teach students some knowledge about psychology, identify different mental states and offer advices on prevention (Nicholas et al., 2021). In the meanwhile, school's mental health center should open the online counselling channels (Nicholas et al., 2021). Through the network appointment way, teachers and students can carry out psychological counselling at home. Counselling can be a way to work through their negative emotions and explore themselves.

For themselves, they need to stay healthy. Moderate exercises and careful diet are closely related to keeping pleasant mood and healthy body (Carvalho & Gois, 2020; Dwyer et al., 2020; Lee et al., 2020). Some researches show that dopamine is released after exercise, which is essential for boosting happiness effectively (Chaouloff, 1989; Marques et al., 2021; Meeusen, 2005). Furthermore, mindfulness and meditation are also helpful for relaxation (Behan et al., 2020; Luberto et al., 2020; Matiz et al., 2020). Some apps offer meditation features that people can practice on command. In the end, social support is the best way to help people out (Elmer et al., 2020). So, trying to communicate and share life with families and friends to maintain health is critical.

DISCUSSION AND CONCLUSION

Our research has made important contributions to the field of online education during the epidemic. Online education has been grown and got mature driven by the Internet, science and market. Especially, during the COVID-19 pandemic, its usefulness is growing because home isolation leads to school interruptions. Due to the flexibility, accessibility and affordability, online teaching seems become the best alternative plan. In the future, it will continue to grow, and its influences will continue to expand. At present, the epidemic is still raging and there is still a need for distance education. Therefore, schools and teachers should fully consider the ideas in this paper when developing teaching strategies to avoid difficulties in adapting to campus life and losing the ability to learn independently when switching to offline teaching. In addition, parents' views are also crucial and should be fully taken into account in terms of their work and life pressures. And course schedule should be as flexible as possible. Through the full cooperation of all parties, the best teaching effect can be achieved.

The aim of this research is to clarify what people think about online education. At first, we discuss the satisfaction with online education of students, teachers and parents, evaluate the quality of online teaching and feasibility of online courses. In the second pace, we have listed the advantages and disadvantages of online education, not only in terms of academics, teaching and learning, but also in terms of the ease and inconvenience it brings to life, as well as its psychological and health effects. At last, based on the shortcomings of online teaching that have been summarized so far, we proposed targeted and constructive suggestions to achieve the most ideal solutions to the

educational effect.

IMPLICATIONS AND LIMITATION

This is the first comprehensive review that summarizes the impact of online education in the COVID-19 era. As we all know, education is not something that can be done alone. It requires the cooperation of diverse groups in different industries, and positive interaction between teachers, students and parents. Teachers need to prepare teaching content, organize teaching framework, and make assessment in time. Students are the receptions of education who need accepting knowledge and use it flexibility. Parents provide supervision, feedback and guidance. The great advantages of this article are attracting the attention from diverse groups and no limitations to one aspect. This will attract more attention and importance to online education, which is conducive to the future development of online teaching. Besides, we find the diverse needs for online teaching and learning, which are conducive to development of educational platforms and making personalized teaching services in order to ensure the right and equity of education during the COVID- 19. And for policy makers, it is important to be references in policy making to reduce the burden on country, which is caused by education at the time of crisis. The government can focus on prevention and vaccine development.

However, there are still some deficits in this research. At first, this is only a qualitative study without quantitative analysis. Therefore, we lack data to support our view of point, which may lead to skepticism. In the second place, although this article summarizes the current situation of education in different countries, we do not break it down by race, by gender, by educational level. These factors may lead to different views, but we do not take into account in the literature. At last, disable people must have more difficulties and problems to solve than normal people in receiving knowledge during the epidemic. However, we exclude the studies because of the complexity of the analysis. In further, research can focus on the comparing the difference in viewpoints and demands of race, educational level and gender. It is necessary to conduct an in-depth study on educational situation of the disabled. It is also important to understand the perceptions of people with disabilities about online education and its impact on their education during the period of segregation. As for research method, scholars can adopt the method that try to combine qualitative analysis with quantitative analysis in order to make research more scientific and less skeptical, which not only synthesis the views of all side but also provide evidence of causation. Finally, we have not mentioned in this article how learning of student, teaching conditions of teacher, and attitudes of parents have changed subsequently in the post-epidemic era, following changes in teaching methods. In the current social context, the prevention and control of the new epidemic is a constant battle, so it is necessary to continue to follow up and update this topic.

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Table 1 Basic information of reviewed articles

Author	country	Major	Education levels	Research method	Participants type	Software	Brief summary
Alghamdi 2021	Saudi Arabia	pharmacy	college	quantitative	students	Rafid	The evaluation of technology access and online skill; the compare between The effect of online and offline teaching; how about the motivation for students
Ali Alamer 2021	Saudi Arabia	radiology	college	quantitative	students	Blackboard Collaboration, zoom	Assess the effectiveness of teaching radiology; exploring students' perceived satisfaction and concerns. Students'; attendance, grades, and frequency of technical difficulties.
Ali 2020	Saudi Arabia	pharmacy	college	qualitative	students	Twitter chat	Pharmacy students' perspective on its impact on their learning.
Armon 2021	Israel	ObGyn	college	quantitative	students and teachers	Zoom, Kahoot	Identify effective pedagogical modalities as well as obstacles to online learning.
Baltà-Salvador 2021	Spain	engineering	college	qualitative	students	NR	Engineering undergraduate students 's attitude toward quality of online classes, adaptation of the course, workspace conditions, emotion and the relationship between the contact and study and emotion at two points.
Banovac 2021	Croatia	anatomy	college	quantitative	students	NR	Compare the efficacy between different components of online and contact anatomy classes as perceived by medical students.
Boca 2021	Romania	economics	college	quantitative	students	edu.utcluj.ro, ZOOM, Microsoft Team	Determine the influencing factors of students' online education behavior; detect the attitude and satisfaction for quality of teaching.

Bogdan-Vasile 2021	Romania	different subjects	college	qualitative	students	NR	463 students are asked to answer three question: (1) describe online education; (2) like/dislike about online education; (3) propose for online education. And students are asked to have free discussion.
Cernicova-Buca 2021	Romania	different subjects	college	mixed	students	Zoom	Collecting data and discussing and interpreting results to evaluate the satisfaction and factor about online education
Chandrasinghe 2020	Sri Lanka	surgery	college	quantitative	students	Zoom	Investigate the effect of a new study methods learning outcomes and interest
Chung 2021	Korean	English language	college	mixed	students and teachers	PLC	Investigate how the sudden transition to online language teaching has influenced language instructors' teaching and assessment practice. Including questionnaire and discuss
Conway 2021	American	medical	college	quantitative	students and teachers	Zoom	Comparing the grades of two group (group A experience offline education in 2023; group B experience online education in 2020) by exam and fill the questionnaire about satisfaction
Cygan 2021	Chicago	nursing	college	quantitative	students and teachers	NR	The pandemic-enforced transition from face-to-face to remote learning impacts student
Daniela 2021	Canada	French language programs	elementary school	qualitative	parents	NR	Investigate attitude of ten parents whose children were at elementary school study French and disadvantages for them
De la Fuente 2021	Brazil	programming course	college	quantitative	students	Zoom	The research reported the teaching outcome of online programming course and given some recommendation

Dietrich 2020	Russia	Environment and Chemical Engineering	college	quantitative	students	Moodle	The aim of this research was to determine the effect of online education, including course and lab practice for students and teachers
Dindar 2021	Finland	NR	K-12 school	quantitative	teachers	Qridi LMS	Explore the factors facilitating online teaching technology and compare performance expectancy, effort expectancy, LMS self-efficacy and satisfaction between two group (experience and inexperience). Teachers and students in five college were surveyed to study virtual classrooms, course learning outcomes, alternative method of assessment, impact of online teaching and satisfaction.
Ebohon 2021	Nigeria	NR	college	quantitative	Students and teachers	NR	The attitude of learner toward online education; the acceptance of online learning only as a supporting tool to regular learning instead of as a substitute of the regular learning mode on the basis of various factors. Compare the performance of academic and job-readiness two groups of graduates.
Garg 2020	India	management and engineering disciplines	college	quantitative	students	NR	Impact of COVID-19 toward academic career, risk of injection and the substitution of online education for traditional education of students in dentist subject.
Gazi Mahabubul Alam 2021	Malaysia	Computer Science Application and Electrical and Electronics Communication	college	quantitative	students	NR	Adopt a mixed analysis to study students' performance in MOOC
Generali 2021	Italy	Dentistry	college	quantitative	students	NR	
Gómez Gómez 2021	Spain	Social Work, Social Education, Criminology, and Legal Sciences and Public Administration	college	mixed	students	MOOC	

Gopalan 2021	American	physiology course	college	quantitative	students	Zoom (Virtual flipped teaching)	Evaluate the effect of FT in satisfaction, grades, adjusting and discussion in course.
Mortezaei Haftador 2021	Iran	BSc nursing	college	quantitative	students	"synchronous online class/combination	Compare the effect of two teaching strategy (synchronous online class/combination of flipped and jigsaw methods) in nurse subject.
Hattar 2021	Jordan	Dentistry	college	quantitative	students	NR	Investigate online education experience, and the level of self-perceived preparedness for a range of cognitive, communication and professional skills.
Herr 2021	korean	Dentistry	college	quantitative	students	NR	Investigate the satisfaction and effect of online education toward the students learning dentistry
Idris 2021	Brunei Darussalam	health science	college	quantitative	students and teachers	Canvas, Microsoft Teams, Google Meet, Skype, Zoom	Investigate the learning experience for students and mental health and the teaching experience, mental health for teachers
Ishimaru 2021	Japan	NR	college	quantitative	students	NR	Evaluate the impressions of online education, study engagement, mental health, and lifestyle habits of students
Jiang 2021	China	pharmacy	college	quantitative	students	rain class and tencent meeting	Compare the satisfaction and grades of two class, 2017 (experience traditional education) and 2018 (mixed education).
Kang 2021	Korea	medical	college	mixed	students	Blackboard	Investigate the general experience, learning strategies, important features, and overall satisfaction of medical students

Karthik Vishwanathan 2021	India	medical	college	quantitative	students	Zoom and Google Meet	Evaluate the impact of online teaching using videoconferencing platforms on the education environment, satisfaction, and perception of the medical undergraduate students to online teaching.
Khan 2021	India	NR	secondary school	quantitative	students	Google Meet, WhatsApp, YouTube	Study the academic perception of students and positive/negative attitude
Wang 2021	China	Dentistry	college	quantitative	Students and teachers	ilab-x.com, MOOC, Rain Classroom, Tencent Classroom, Superstar Learning, Zoom	Survey the current online undergraduate education status in dental medicine in mainland China including theory and practical curriculum.
Li-a 2021	china	medical	college	quantitative	students	NR	Survey medical students' perspectives on online learning experience and challenge.
Li-b 2021	China	international medical and nursing	college	quantitative	students and teachers	NR	The factor influence the satisfaction of online education; Barriers and facilitators to online medical and nursing education.
Liu 2020	China	engineering, Science, Humanities, Art, and Social Science, Medical and Health Sciences	college	mixed	students and teachers	rain class	Evaluate the nature, quality, and outcomes of online learning using mixed methods and the participant including students, teachers and leaders.
Ma-a 2021	China	NR	Primary and secondary schools	quantitative	parents and children	NR	Evaluate the mental health and the effectiveness and attitudes towards online education among Chinese children aged 7–15 years
Ma-b 2021	China	NR	senior high school	quantitative	parents and children	NR	Evaluate the prevalence of post-traumatic stress disorder symptoms and attitudes towards online education in Chinese high school students.
Manna 2021	India	Medical and Allied Health	college	quantitative	students	Google platform, Edmodo and Zoom application	Evaluate the current online education practice, its effectiveness

Manou 2021	Greece	Pathology	college	quantitative	students	Skype for Business, YouTube	Explore participation and interactivity in a synchronous e-learning non-mandatory participation course.
Martín Ayala 2021	Spain	Psychology	college	quantitative	students	Google Meet, Moodle	Survey academic performance of psychology students in online education
Mishra 2020	India	NR	college	mixed	students	"MZU-LMS, Google Classroom, Zoom, Cisco WebEx, Google Meet, Skype, Webina, YouTube Video, YouTube, Facebook Streaming, WhatsApp, Telegram,	Study the perceptions of teachers and students on online teaching-learning modes
Mohamed 2020	Egypt	veterinary medical	college	quantitative	students	YouTube videos, university platforms, educational websites, and educational applications; Zoom (highest) WhatsApp, Google classroom, and social networks. Microsoft Teams, Edmodo, Skype, and Google Meet	Study the academic performance of veterinary medical students and researchers who experience online education
Moralista 2020	Philippines	NR	college	quantitative	teachers	NR	Determined the perception toward online education among faculty
Morgado 2021	Portugal	Dentistry	college	quantitative	students	NR	Assess dental students' self-perception, motivation, organization, acquired clinical skills, and knowledge using the online problem-based learning methods.
Nathaniel 2021	America	Medical Neuroscience Course	college	quantitative	students	Panopto	Compare students' performance in summative and formative examinations between adaptive blended learning activities and face to face learning
Pesha 2021	Russia	NR	college	quantitative	students	NR	Investigate the challenge, difficulty and satisfaction of online education

Punaji 2021	Indonesia.	NR	college	quantitative	students	Microsoft Team, WhatsApp	Compare the effect of Microsoft Team and WhatsApp in reading comprehension skills
Shrivastava 2021	India	Dentistry	college	quantitative	students	Microsoft Teams	Study academic outcome of online dental education and psychological and physical well-being of the students.
Shunit 2021	Israel	Gynecology Medical	college	quantitative	students and teachers	ZOOM	Assess the feasibility of an online clinical rotation in Obstetrics and Gynecology
Song 2021	China	NR	college	quantitative	students and teachers	NR	Examined the current opinions of online education from teachers and students
Suhaib 2020	Arab	health sciences	college	quantitative	students	Zoom, eLearning, School Portal, Moodle, Microsoft Teams, Email, Google Classroom, Online forum, WhatsApp, and Facebook.	COVID-19 affect attitudes about online education for undergraduate health sciences students.
Kim 2021	Korea	Medical	college	quantitative	students	ZOOM	Evaluate the assessment to and satisfaction with student clerkship.
Tao 2021	China	nursing	college	quantitative	students	MOOC, SuperStar Universal Learning	Compare their abilities in the process of new knowledge acquisition between traditional group, blended group and online group
Thom 2021	America	anatomy	college	mixed	students	NR	Evaluate the effectiveness and student perceptions of an online near-peer anatomy curriculum.
Szopiński 2022	Poland	business	college	quantitative	students	NR	Evaluation of online studies, the frequency of participation in online courses, and the preferences regarding the mode of study in the future.
Toti 2021	America	Computer Science	college	mixed	students	NR	Study the perception of the transition to remote teaching in a group of computer science students

Varma 2020	India	architecture programs	college	quantitative	students	Zoom, MS Teams, Whatsapp, NPTEL, SWAYAM ; EdX, Coursera, YouTube, Slideshare	Evaluated suitability of online teaching for architecture education
Wang-b 2021	China	Dentistry	college	quantitative	Students and teachers	Superstar Learning, Rain Classroom, Tencent Classroom; Pmphmooc, DingTalk, Zoom Meeting, Tencent Meeting	Survey satisfaction, necessity and efficacy of online education for dental education
Wenceslao 2021	Philippine	NR	college	mixed	Students and teachers	NR	Investigated the challenges to online engineering education in higher educational institutions
Xu 2021	China	English writing courses	college	mixed	students	Zoom or VooV meeting	Orientations towards written corrective feedback and their use of self-regulated learning writing strategies in online English writing course
Jiang 2021	China	English language	junior high school	mixed	students	Quizlet	Focused on the achievement and experience of Chinese EFL junior high school students
Zhu 2021	China	leadership course	college	quantitative	students	Blackboard Collaborate Ultra	Impact of online leadership course on students' learning outcomes and well-being.