IMPROVEMENTS IN ONLINE EDUCATION SYSTEM OF COVID-19 PANDEMIC AND ROLE OF MEDIA: A FOLLOW UP STUDY

Anwar Khan[1], Muhammad Anwar[2] & Sajjad Ahmad Jan[3]

[1]Management Sciences Department & Director ORIC Khushal Khan Khattak University, Karak
[2]Communication and Media Studies Department Khushal Khan Khattak University, Karak
[3]PhD Scholar, Sarhad University of Science and Information Technology, Peshawar

KEYWORDS	ABSTRACT
	The ongoing COVID-19-pandemic has particularly affected the education sector. Globally all educational intuitions have been shifted towards the online education system. Online system was perceived challenging due to different barriers and issues. For this reason, different research studies were conducted on online education system. However, it is not known whether any improvements have occurred in the online education system? Keeping this in mind, this study has examined improvements in online education system by looking at role of media. For this purpose, a longitudinal design was selected, and data were collected through the online-self-administered-questionnaire from 707 students studying in a public sector university of Pakistan. Data was analyzed by descriptive and inferential statistics. Results showed that with passage of time improvements had occurred in online educational system of COVID-19. This study recommends that Government should continuously work on further improving online education system towards sustainability.
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Corresponding Author	Anwar Khan: anwar.khan@kkkuk.edu.pk
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INTRODUCTION

The ongoing COVID-19 Pandemic has severely disturbed the whole world by hampering social and economic activities (Verschuur, Koks & Hall, 2021). This pandemic has affected almost every sector of economy, however, the education sector is most badly affected because it has forced the educational institutions to switch from the traditional education to online education system (Myers, 2020). The educational institutions were forced to closer due to lockdowns, resultantly the online educational system was adopted by all educational institutions, including, schools, colleges and universities (Tam & El-Azar, 2020). Such online education system had brought with itself different challenges and students faced diverse barriers in adopting online education system (Chakraborty, Mittal, Gupta, Yadav & Arora, 2021). And to tackle these challenges, diverse

international donor organizations like World Bank had provided huge amount of funds, so that the educational institutions can develop their online system (World Bank, 2020). Scholars have studied online educational system of COVID-19 and tried to find improvements or changes in online system with the passage of time. Klasen, Meienberg and Bogie (2021) found that skills of medical students during the COVID-19 were enhanced and they became more innovative and creative.

Similarly, Potra, Pugna, Pop, Negrea and Dungan (2021) found that in Romania, educational institutions managed to develop a Hybrid Higher Educational System, which had both features of in-person education and online education. Researchers have particularly found that social media had played a very significant role and the social media had helped the students to adopt to online education system through interactive learning (Khan, Ashraf, Seinen, Khan & Laar, 2021). The COVID-19 pandemic had specifically hit the educational institutions located in the Asian region because the Asian countries were not fully prepared for dealing with this pandemic (Khan & Anwar, 2021). Pakistan being a developing country, located in Asia was also badly affected by the COVID-19 pandemic and all the education educational institutions were closed. However, Pakistan is now gradually moving towards the recovery stage by gaining control over the negative effects of COVID-19 pandemic (World Bank, 2021). The online educational system, which was initially proposed by Higher Education Commission of Pakistan had really helped the universities to successfully continue their educational activities during breakdowns (Mahmood, 2021).

Moreover, higher education commission of Pakistan had formulated online readiness policy for universities (HEC, 2020), which had provided major guidelines to universities regarding the online education system during COVID-19. Despite of these guidelines, the universities around Pakistan had faced different challenges in online education system and they had faced different barriers in accessing online education system (Anwar, Khan & Sultan, 2020). The universities had tried to tackle these barriers and challenges through different ways, for example, through acquiring online technologies, training of the staff, and adopting innovative tactics (Waheed & Dahri, 2021), however, a pertinent question arises, whether any improvements had occurred in online educational system of COVID-19 inside Pakistan in such a way that existing barriers and challenges have been overcome. Keeping in mind above stated arguments, current research has been carried out as follow-up study for knowing whether any advances have occurred in online educational system of COVID-19 inside Pakistan. For knowing improvements in implemented online education system, data were collected on same questionnaire, which was last year used by Anwar et al. (2020) for knowing barriers and challenges faced by students in online education system.

In this way the current study has examined whether the students are still facing those barriers and challenges, or any improvements have occurred in the online educational system. For knowing improvements, the previously collected data of Anwar et al (2020) will be compared with the freshly collected data of current study. Finding of the current stud will be particularly beneficial to the teachers (at individual level), the institutions (at organizational level) and the policy makers (at state level) for knowing the nature of improvements that have occurred in the online educational system of Pakistan. In this way teachers, administrators of universities and policy makers in higher education system can know outputs of efforts regarding developing and sustaining the online education system in Pakistan during the COVID-19 pandemic. Moreover, they can also know existing deficits areas, which can be covered by exerting additional efforts.

In this way, the country will be in better position to maintain and sustain its online educational system.

Problem Statement

Ongoing COVID-19 pandemic has severely disturbed all sectors of world economy (Verschuur et al., 2021). Particularly the education sector is most badly affected because COVID-19 pandemic has forced the educational institutions to switch to online education system (Myers, 2020). The online education system had brought with itself different challenges and barriers in adopting the online education system (Chakraborty et al., 2021). Researchers have closely studied the online educational system of COVID-19 and have tried to find improvements or changes in the online system with the passage of time. Like for example, Klasen et al (2021) found that skills of medical students during COVID-19 were enhanced and they became more innovative and creative. Similarly, Potra et al (2021) found that in Romania, the educational institutions managed to develop a hybrid higher educational system, which had both features of in-person education and online education. Researchers have particularly found that social media had played a very significant role and social media had helped the students to adopt to online education system through interactive learning (Khan et al., 2021). Pakistan was also badly affected by COVID-19 pandemic and all education educational institutions were closed (World Bank, 2021). Online educational system that was initially proposed by higher education commission of Pakistan had helped universities to effectively continue educational activities during breakdowns (Mahmood, 2021).

Despite of these guidelines, the universities around Pakistan had faced different challenges in the online education system and they had faced different barriers in accessing online education system (Anwar et al., 2020). The universities had tried to tackle these barriers and challenges through different ways, for example, through acquiring online technologies, training of staff, and adopting the innovative tactics (Waheed & Dahri, 2021), improving language, increased accessibility to online resources and improved online examination (Mumtaz et al., 2021), still, a pertinent question arises, whether any improvements had occurred in the online educational system of COVID-19 inside Pakistan in such a way that the previously existing barriers and challenges have been overcome. This question is particularly important for higher education institutions located in the remote regions of Pakistan, where the students and faculty still face problems of electricity and internet connectivity. Moreover, students also have lack of access to the online library and other facilities. Apart from this, students in such areas have relatively less awareness about online resources. Keeping this in mind, the current study has examined the improvements in already implemented online education system of COVID-19 pandemic in a public sector university located in underprivileged region of southern Khyber Pakhtunkhwa, Pakistan.

LITERATURE REVIEW

Online education refers to the electronic mode of delivering educational contents by the help of computer and other electronic devices (Kentnor, 2015). The idea of online education emerged with the development of computer and internet technologies. Educational Scientists along with the computer experts developed teaching methodologies that could be used to deliver teaching virtually without any physical limitations (You, 2020). In this way the online teaching system revolutionized the education system around the world by providing an unlimited access to the teaching and education. The online education system was perceived as convenient, time and

cost wise efficient. For such reasons, the online education system is most widely use around the world. Online education system although being widely applicable has shortcomings and this system is beneficial to those who have access to modern computer and internet technologies. This limitation of online education has made system less beneficial and less applicable (Dung, 2020).

Apart from this, the students and teachers also faces different other challenges and barriers in using online education system, these include, lack of access to internet (Adnan & Anwar, 2020), lack of finances to buy internet and computer technologies (Rahiem, 2020), lack of skills and knowledge to deal online technologies (Coman et al., 2020), social and privacy issues and issues with family members (lack of support from family) (Anwar et al., 2020). All these challenges and issues combine and make the online education system less effective and less applicable, especially among those who faces said challenges and issues. In this connection, however, not every online system is total ineffective, and educational researchers along with the computer experts are trying best to improve the online education system in such a way that they try to remove the issues by enabling the users of online education system to overcome the barriers and challenges. In this regard, different research studies have been conducted to know "how to improve the online education system" and findings of these studies revealed that the education institutions have used different tactics to overcome barrier and challenges in online education system.

These tactics include introduction of hybrid higher educational system (Potra et al., 2021); use of the social media technologies for supporting the online education system (Khan et al., 2021); training of staff and adopting innovative tactics (Waheed & Dahri, 2021) and improving language, increased openness to online resources, free access to software and improved online examination (Mumtaz et al., 2021). In this connection, online education system gained particular attention after advent of COVID-19 pandemic when all education institutions were forced to shutdown due to the lockdowns. The educational institutions starting using online education system by using different internet and virtual technologies for delivering education to the students. Since the COVID-19 pandemic induced online system was implement almost one and half years ago, therefore, diverse research studies, for example Mishra et al (2020), Muthuprasad et al (2021), Chakraborty et al (2021), Edelhauser and Dima (2021) have been conducted on it, particularly, researchers have studied challenges and issues that were faced by users in using online education system.

Moreover, researchers have also explored users' perceptions and overall experiences of users in using the online education system. Findings of the published studies revealed that initially the online education system was perceived as challenging, however, with a passage of time, the educational institutions have tried their best to overcome challenges by developing a relatively stable and more implementable online education system. Research studies for example Budur et al. (2021) and Xue et al. (2021) have also found that the online education system had got improved in the developed countries, while in developing countries, particularly, the remote regions, online education system was not that much effective. For this reason, it is imperative for the future researchers to explore the improvements in the online education system inside the underdeveloped and underprivileged regions of the world. Researchers and theorists have proposed different theories and models for explaining nature e-learning and virtual teaching system. Review of these theories can help in understanding nature and functioning of online

education system, moreover, it can help in understanding challenges and issues in online education system.

Theories like for example community–embedded learning theory (Kazmer, 2005) and Braided Learning Theory (Preston, 2008) propose that humans within a community interact with each other and learn from each other, whereas this interaction within a community can be either physical or virtual. Therefore, community of the practice work as a nucleus of learning. Other theories on online education and learning include Computer Supported Collaborative Learning Theory (Stahl et al., 2006) and E-learning (Andrews & Haythornthwaite, 2007). More recently Chiu (2021) applied the Self-Determination Theory to online education system of COVID-19 and found that motivationally caring classroom environment can foster behavioral, emotional, cognitive and agentic engagement of students and ultimately help them to learn, achieve, and develop skills. Keeping in view the findings of Chiu (2021), current study has also used the Self-Determination Theory to know whether any improvements have occurred in online education system of COVID-19 over disabling of barriers and challenges that were faced by students in year 2020.

RESEARCH METHODOLOGY

Due to the quantitative nature of the study, positivist paradigm has been adopted for this stdy. Moreover, since this was a follow-up study in which the previously collected data of year 2020 were compared with freshly collected data of year 2021, therefore, a longitudinal descriptive design was adopted for this study. In this connection, based upon the nature of this study, the longitudinal design is helpful in measuring certain characteristics of object at different points of time. In this way, the changes or variability in the characteristics could be known (Ruspini, 2003).

Population and Sample

This study was conducted at a selected public sector university, which is located in a remote southern region of Khyber Pakhtunkhwa. At the time of data collection total 1787 students were enrolled in different academic programs of the University. Since it was not time-wise feasible nor cost-wise suitable to collect data from all 1787 students, therefore, a sample was drawn from the total students through a stratified random sampling procedure (Sharma, 2017). To get a sample size, the total population was initially divided into two stratums. These stratums were created on basis of gender and academic departments. And in the second stage, simple random sampling was done in each stratum. In this way a sample of (n=707) was obtained from the total population of (N=1787), as clear from Table 1. Researchers like Cooper et al. (2007) have suggested that if a population size is already known then probability techniques like stratified random sampling should be employed in such a way that at least 40% of sample size from the total population should be obtained. In the current study a sample size of (n=707) is 40% of the (N=1787).

Table 1

Population and Sample Details

	Gender			
Departments	Male	Male	Female	Female
Management Sciences	111	44	15	7
English	155	64	190	80

Chemistry	25	10	14	6
Botany	07	02	25	00
Geology	225	90	00	00
Zoology	07	03	29	11
Physics	98	40	73	27
Computer Science & Bio Informatics	170	70	94	35
Education & Research	17	07	03	01
Library and Information Science	162	60	190	80
Communication & Media Studies	102	40	22	9
Educational & Research	12	05	03	01
Mathematics	26	10	12	05
Total	1117	445	670	262

Data Collection Process

A self-administered online questionnaire was used to collect data. The questionnaire was created by adopting items from the scales of following studies:

a) First variable of Administrative Issues was measured by taking four items from the study of Muilenburg and Berge (2005).

b) Second variable of social and privacy Issues was assessed by taking four items from the study of Alshehri and Lally (2019).

c) Third variable of lack of training and skills was measured by taking four items from the study of Muilenburg and Berge (2005).

d) Fourth variable of lack of finances was measured by four items from the study of Klepfer et al. (2018).

e) Fifth variable of technical problems was measured by two items from the study of Muilenburg and Berge (2005) and three items from study of Yang and Cornelius (2004).

f) Sixth variable of lack of family support was measured by two items from the study of Muilenburg and Berge (2005) and two items from the study of Musingafi et al. (2015).

g) Seventh variable of Challenges in laboratory work was measured by four items from the study of Rowe et al. (2018).

h) Eight variable of Role of Media was measured by four items from study of Sobaih et al. (2020).

All items were scaled on 5-points Likert Scale. Questionnaire was built in Google Forms and then its link was propagated to the students studying in the thirteen selected academic departments. Responses from students were recorded online and then checked for missing analysis before doing final analysis.

Data Analysis Process

Data was analyzed both by descriptive and inferential statistical techniques. Details of which are given below:

a) Missing Data was checked by running the Little's Test for Missing Data Completely at Random (Little, 1988).

b) Frequency Tables containing cumulative means and percentages were used for presenting level of the agreement on each variable.

c) Reliability and internal consistency of the data were determined by calculating the Cronbach's Alpha Coefficients.
d) Construct Validity of the data was determined by running Exploratory Factor Analysis with varimax rotation and extraction done with Principal Components Analysis (Kaiser, 1974).
e) The effect of time and improvements in online education system was determined by running General Linear Model of Repeated Measures of ANOVA (GLM RM-ANOVA). For this purpose, initially homogeneity and sphericity was determined by running Mauchly's test of Sphericity, that need to be non-significant at p>0.05 (Verma, 2015). Moreover, F-test values were chosen by examining Epsilon, which if >0.75, then Huynh-Feldt Correction is selected, however, if it is <0.75, then Greenhouse-Geisser Correction is chosen (Field, 2013). Finally, Planned Post-hoc analyses were performed by calculating mean differences with t-tests.

RESULTS AND PRESENTATION

Results of study are presented in a proper sequence. Starting with presenting results of missing data: then presenting results of reliability and validity analysis and finally presenting results of GLM RM-ANOVA.

Missing Data & Dropout Analysis

Missing data and dropout analysis is one of important step before doing final analysis, since it helps the researchers to know the cases that have not fully completed the questionnaire. In this regard researchers like Hair et al. (2016) have stated that any questionnaire containing more than 10% of missing data is ideal for deletion. Results indicated that out of total 707 distributed questionnaires, only 560 questionnaires were returned. To know level of missing data, Little's Test for missing data completely at Random (Little, 1988) was run on 560 returned questionnaires. Result of Little's Test showed that 68 questionnaires had missing data that exceeded the limit of 10%, thus such questionnaire were discarded. In this sequence, sample size dropped from 707 to 492.

Reliability Analysis

Table 2 presents the results of reliability analysis. The Cronbach's Alpha Coefficients are within good range, i.e., >0.50 (Hair et al., 2016), which provides enough proof of internal consistency of data.

Table 2
Reliability Analysis Results

Variables	Cronbach's Alphas (Time 02)
Lack of Finances	0.64
Administrative Issues	0.68
Social and Privacy Issues	0.70
Technical Problems	0.69
Lack of Training and Skills	0.72
Challenges in laboratory work	0.58
Lack of Family Support	0.67
Role of Social Media	0.56

Validity Analysis
Table 3 shows the results of Construct Validity of the data, which was determined by running exploratory factor analysis with varimax rotation and extraction done with principal components analysis (Kaiser, 1974). It is clear that all factor loadings, KMO values and communalities are within normal range, i.e., >0.50 (Hair et al., 2016) that shows that data is possessing construct validity.

Table 3
Construct Validity Results

Variables	F-Loadings	Communalities	KMO
Lack of Finances	0.53 to 0.86	0.55 to 0.79	0.52
Administrative Issues	0.56 to 0.78	0.51 to 0.62	0.67
Social and Privacy Issues	0.65 to 0.82	0.51 to 0.68	0.80
Technical Problems	0.80 to 0.86	0.68 to 0.75	0.70
Lack of Training and Skills	0.71 to 0.91	0.51 to 0.85	0.72
Challenges in laboratory work	0.63 to 0.81	0.53 to 0.65	0.61
Lack of Family Support	0.60 to 0.87	0.50 to 0.61	0.65
Role of Social Media	0.71 to 0.80	0.54 to 0.63	0.54

Improvement in Online Education System
Results of planned Post-hoc analysis helped in determining effect of time and overall improvement in the online education system. Table 4 shows the differences in mean scores of the challenges and barrier in relation to time. As clear from Table 4, there are remarkable differences in the mean scores between Time 01 and Time 02, which means that challenges and barriers like Lack of finances, administrative issues, social and privacy issues, and lack of training have decreased significantly. Moreover, family support, media role and laboratory work facilities have much improved.

Table 4
Differences in Mean Scores in Relation to Time

Barriers and Challenges	MS Time 01	MS Time 02	MD (T01-T02)	t-test	df	Sig Level
Lack of Finances	3.651	1.500	2.151	23.4	491	0.000
Administrative Issues	2.115	1.781	0.334	23.4	491	0.000
Social and Privacy Issues	3.988	2.318	1.671	39.8	491	0.000
Technical Problems	3.718	2.602	1.116	108.8	491	0.000
Lack of Training and Skills	3.734	2.570	1.164	127.6	491	0.000
Challenges in laboratory work	1.857	3.793	-1.936	-112.1	491	0.000
Lack of Family Support	4.074	4.325	-0.251	-20.10	491	0.000
Role of Social Media	2.231	3.793	-0.562	-10.10	491	0.000

The effect of time on the barriers and challenges in visible from results of GLM RM-ANOVA, which reveals that the significant difference had occurred in the mean scores of barriers and challenges across the two times, i.e., Time 01 during year 2020 and T02 during year 2021, as clear from the Table 5 the F-test value is [F (15, 7365) = 3131.493, p= 0.000). It should be noted that t-test values for last three variables are negative because they have low or very high mean

scores during time-01, while they have high score during time-02, due to that their t-test scores are negative.

Table 5
Results of GLM RM-ANOVA

	Source	T-III SS	df	MS	F	Sig.	Partial ES
Change in B&C	Sphericity Assumed	7126.860	15	475.124	3131.493	0.000	0.864
	Greenhouse-Geisser	7126.860	3.323	2144.422	3131.493	0.000	0.864
	Huynh-Feldt	7126.860	3.349	2128.181	3131.493	0.000	0.864
	Lower-bound	7126.860	1.000	7126.860	3131.493	0.000	0.864
Error (Change in B&C)	Sphericity Assumed	1117.450	7365	0.152			
	Greenhouse-Geisser	1117.450	1631.809	0.685			
	Huynh-Feldt	1117.450	1644.262	0.680			
	Lower-bound	1117.450	491.000	2.276			

DISCUSSION

The current study aimed at knowing the improvement in online education system of COVID-19 through overcoming of the barriers and challenges, which were faced by the students after the closure of universities and implementation of the online education system. The results revealed that after passing of the one year, there was remarkable decrease in the barriers and challenges faced by the students and, the online education system had much improved in comparison to the system that was implemented last year. The results of this study are in concurrence with the findings of other similar studies published on same topic. Detailed results of the current study show that with passage of time, the students had learned to manage their financial problems associated with the online education and there was a sharp decrease in the mean score of this variable from $\bar{x}$=3.65 for the year 2020 to $\bar{x}$=1.500 for the year 2021. Amendola et al (2021) conducted a longitudinal study on the university students in Switzerland and found that the interaction of time with the variable of the financial problems was significantly negative (β= −0.124, p value= <0.001), which means that as the time passed the financial problems of the students decreased and the student had learned to manage their finances during COVID-19 pandemic.

Other results of the current study show that challenges like Social and Privacy Issues, and Lack of Family Support also changed with passage of time. The mean score of Social and Privacy Issues variable deceased from $\bar{x}$=3.98 for the year 2020 to $\bar{x}$=2.31 for the year 2021. Similarly, mean score of Lack of the Family Support variable increased from $\bar{x}$=4.07 for the year 2020 to $\bar{x}$=4.32 for the year 2021, which means that the students privacy issues were resolved with time and their families started giving them support. Al Mahadin and Hallak (2021) conducted study on the visual interaction in online classes during COVID-19 pandemic and found that student had learned to manage their privacy and confidentiality issues by using simple tactics like keeping camera consistently in turned-off mode, opening camera in the group (when all class members were available online), and dressing properly (wearing veil) when camera was in turned-on mood. While Maiya et al. (2021) did study on assessing the longitudinal changes in school bonding during COVID-19 pandemic and found that students with strong family support had better relationship with their teachers and class fellows. Moreover, with students' bonding with education increased with family support after a passage of the time. Other barriers and challenges like lack of training and skills and challenges in laboratory work had also changed

with time.

Lack of Training and Skills variable deceased from $\bar{x}=3.734$ for the year 2020 to $\bar{x}=2.570$ for the year 2021. And challenges in laboratory work variable increased from $\bar{x}=1.857$ for the year 2020 to $\bar{x}=3.793$ for the year 2021. In this connection, it means that with time, the students had improved their skills via training, and they have also learned to overcome the challenges in the laboratory work. A study by Aristovnik et al. (2020) on effects of the COVID-19 Pandemic on academic life of the students found that initially student had difficulty in dealing with the online education because of lack of skills and training, however, In this regard, soon they developed skills of adjusting online software and programs They obtain these skills from online teaching platforms. While Shidiq et al. (2021) did study on the responses of science teachers regarding learning of laboratory work during COVID-19 pandemic. In this connection, this study found that with passage of time teachers and students had started using variety of online techniques, like for example, providing simulations and animations via Macromedia for conducting online laboratory work. Such techniques had really helped the students to learn the laboratory work online.

Finally, results regarding role of media show that media (particularly social media) had played a very significant role in the online education. In this connection, the role of media increased with passage of time as clear from the mean scores increased from $\bar{x}=3.23$ for the year 2020 to $\bar{x}=3.79$ for the year 2021. In this connection, it means that students started relying on social media more frequently for learning and skill development. Hu and Yu (2021) conducted the study on effects of ICT-based social media technologies on learning and academic performance of students and found that those students who had a positive attitude toward the ICT-based social media technologies had performed better and had more learning as to those who had negative attitude toward ICT-based social media technologies. In this connection, it means that social media can act both the positive and negative, however, it depends on how the student use the social media. Thus, if they use it positive, then it will help them to increase their academic performance.

CONCLUSION
The current study found that with passage of time, the students can learn to adopt to the online education system of COVID-19 by overcoming barriers and challenges. However, the students need to be proactive by having the positive attitude towards accepting change. It means that improvements in the previously implemented online education system have already been made through an evolutionary process. Keeping in view findings of this study, it has been concluded that the universities in Pakistan need to be proactive in adopting to the change, moreover, the universities should try to develop positive attitude of student toward change. In this connection, the positive attitude could be developed through the continuous awareness, counseling, and training of the students, so that they can learn about the newly implemented online education system. In this connection, the higher education commission of Pakistan should issue updated versions of the Online Readiness Policy Guidance Note and Policy Guidelines for Universities on COVID-19. Moreover, the Government of Pakistan should pay a special attention to the further upgradation of the existing online education system. Here the role of media (especially social media) should not be ignored. In this connection, the universities should use media as an interactive tool for training of their students and faculty about the online education system in instiutions.

Limitations & Future Directions

This study was conducted on the small sample through the selection of only one public sector university. The future researchers can conduct the similar longitudinal study on relatively large sample by selecting many universities from different regions of Pakistan. Moreover, this study had collected two wave data, which may not be helpful in the comprehending the true nature of change that has occurred in online education system. The future studies can collect multiple waves of data at time slots, which will help in understanding improvements in online education system in a broader way. The current study was conducted only among the students, which has limited our understanding of the teachers' perspective, therefore, future studies can include both students and teachers as their sample. In this way, views of both students and teachers can be found. Finally, although this study was longitudinal in nature, but no manipulation of the variables was done, due to which no causal inferences could be drawn. Future studies can be conducted by applying the causal longitudinal design, which will help in knowing the causal linkages between the enhancements in the online education and students' attitudes or learning levels.

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