Social Sciences & Humanities Open 8 (2023) 100559

Contents lists available at ScienceDirect

Social Sciences & Humanities Open

journal homepage: www.sciencedirect.com/journal/social-sciences-and-humanities-open

Regular Article

Exploring the factors influencing the effectiveness of online learning: A study on college students

Payal Kedia *, Lokanath Mishra

Institute of Management, JK Lakshmipat University, Jaipur, Raj, 302026, India

ARTICLE INFO

Keywords:
Online learning
COVID-19
Education system
Students' performance
Students' engagement
Structural equation modelling (SEM) analysis

ABSTRACT

To prevent the rapid transmission of the viruses among students and staff during the COVID-19 epidemic, on-campus classes have been cancelled at colleges and institutions throughout the world. Due to this unexpected disruption in face-to-face learning, pedagogical methods were changed, and colleges quickly accepted online instruction. Both university lecturers and professors as well as university students were impacted by the advent of online learning. The student's performance is what determines how well online learning works. Students' performance is affected by the course material, how a teacher teaches them, and a variety of other factors. So, the study's focus is to investigate the effect of numerous elements e.g. instructor-student interaction, peer interaction, social media use, family support, and technical support on College students' engagement and performance. Population of this study consist of universities' under-graduate and post-graduate students. Data were collected from 300 under-graduate and post-graduate students who belong to the three universities/colleges of Jaipur (Rajasthan) namely; JK Lakshmipat University, Arya College of Engineering and I.T., and JECRC University. Data were analyzed using two software Programs "SPSS and AMOS". After going through validity, reliability, exploratory, and confirmatory factor analysis; we applied structural equation modeling (SEM). Our findings show that Instructor-Student Interaction, Use of social media, Family as well as Technical support have a positive relationship with Students' Learning Performance through Students Engagement. It was also shown that peer interaction had a minor influence on learners' performance. All the observed Indices are within the threshold limits.

1. Introduction

Countries where instances of a new coronavirus have been detected have had severe growth disruption due to the pandemic. Countries are employing a variety of measures, including as lockdowns, workplace absences, school closures, suspension of transit services, etc., to lessen the throng. Impact of COVID-19 pandemic compelled or encouraged people to perform work remotely from their homes. The majority of countries throughout the world have temporarily shuttered their educational institutions in order to stop the COVID-19 epidemic from spreading. This countrywide shutdown will have an impact on more than 90% of students worldwide (Jena, 2020; Owusu-Fordjour, C. et al., 2020).

COVID-19 changed the education system of the whole world. According to a report by UNESCO, more than 1.6 billion children were not being able to go to schools or colleges for months and these students had to complete their studies at home, heavily depending on digital learning tools. Government agencies such as UNESCO and the Ministry of Education monitor whether or not all children and youth are continuing their education. On 25th Jan. 2021, On the occasion of International day of Education, UNESCO and partners launched a project named Geneva Global EIE Hub. The only motive behind this project is to deliver quality education to the students. It also aims to increase the political, technical, and funding space dedicated to education in emergencies. Globally, online learning is being encouraged and receiving positive reviews from many countries. Online learning has grown to be an indispensable component of the home office and classroom. It is compelling for educational institutions to make the transition from conventional to contemporary or online learning (Lin, 2021). Online learning is an electronic learning environment where there is no physical instructor, institute, and peers and also there is no restriction of time and space. The fast development of the internet is the result of globalization made it easy to adopt learning from electronic devices (Mohammed et al., 2020). Innovations in artificial intelligence (Jain & Jain, 2019) and big data

* Corresponding author.
E-mail addresses: payalkedia@jklu.edu.in (P. Kedia), lokanathmishra@jklu.edu.in (L. Mishra).

https://doi.org/10.1016/j.ssaho.2023.100559
Received 17 March 2023; Received in revised form 9 May 2023; Accepted 9 May 2023
Available online 20 May 2023
2590-2911/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

analytics made learning personalized and diversified, enabling learning outside of the traditional classroom and expanding students' horizons (Wong, 2020).

Understanding the perception of faculties on online learning has been studied by various authors but somehow it is much needed to know how much students are gaining from the online courses. After all, the success and failure of any course depends on the performance of the students. Students' level of familiarity with online course design, layout, material, level of contact between teacher and students, technical assistance, and overall experience of online class delivery are all elements that Nambiar (2020) considers when determining the success or failure of online education. Wei and Chou (2020) analyzed the impact of online learning readiness and the perceived effect on the performance and the course satisfaction of the student. Our study seeks to examine the effect of several factors on the performance of College students of India after the adoption of online learning. Both instructor and student are primary users of online learning systems (Motaghian et al., 2013) but the success and failure of e-learning are determined by the output received from the students. If students can perform better after learning through electronic devices then the instructor will be happy to go ahead with that platform.According to Singh et al. (2021), employing e-learning increases students' academic performance and helps them gain higher marks. To improve teaching and learning capacities, it is critical to enquire about faculty and student perceptions of online learning (Bolliger & Wasilik, 2009). Our study adds to the e-learning literature by demonstrating how elements such as instructor-student interaction, peer interaction, social media usage, family support, and technical assistance might impact Under-graduate/Post-graduate students' engagement and performance with e-learning systems. What factors influence college students' involvement in the COVID-19 e-learning system? Moreover, how do these factors affect college students' performance now that e-learning technologies have been implemented? are the two questions that this study needs to explore.

The rest of paper is organised as mentioned below. We formulated the hypotheses after reviewing pertinent e-learning-related studies in Section 2. We chose the purpose of our study in Section 3 after examining the relevant literature. We proceeded on to Section 4 to accomplish our objective, which covers the research model, data collection and instrumentation, and statistical techniques. In Section 5, we presented our results and discussions, including data on the respondents' demographics, measurement models, and a structural model. Section 6 is concluded with further discussion, implications, and the extent of the future. Following the conclusion, an appendix with a questionnaire is included.

2. Literature review

2.1. Instructor-student Interaction and Students' engagement

The contact between the instructor and the student in an e-learning system is crucial to the student's continued participation in the course (Molinillo et al., 2018). Liu and Pu (2020) identified that the quality of the instructor's instruction, timely completion of the course, and timely response to students all affect the decision to continue with the online course. Additionally, Lin et al. (2021) realized that apart from all these factors, the attitude of instructors towards the use of the online platform and their support is given to the students affect students' engagement. Sun et al. (2008) found that the no-response or unreasonable delays in responding to the students will not contribute to the students' success and also timely feedback improve the performance of students (Qureshi et al., 2021). Dixson (2010) advises that the instructor should make it mandatory for students to actively participate in addition to providing them with opportunities to do so. Interaction here meant to both quality and frequency of interaction among instructor and students. As a result, we suggest the hypothesis below.

H1. Interaction with Instructor significantly impact Student's engagement

2.2. Interaction with Peers and Students' engagement

Peer interaction improves students' interest and involvement in online courses. Learners are encouraged to share knowledge and ideas when they interact with their classmates (Qureshi et al., 2021). The activities like group discussions and doing any project work with the group members increase the students' engagement and their learning outcomes realized by Tsai et al. (2021). Students' who are working together on a group project, peer reviewing, and discussing in the group on a particular topic, are likely to be engaged more in the course work. Dixson (2010) observed that the student identifies multiple ways on their own to interact to their peers and the engagement of such students is found to be very high. Molinillo et al. (2018) argued that the student-student interaction has very little impact on students' engagement and their online learning. From the above discussions, we proposed the following hypothesis.

H2. Interaction with Peers significantly impact Student's engagement

2.3. Social media use and students' engagement

Smartphones, Internet, and social media have all grown commonplace among today's youth. Social media sites have the capabilities to make online learning student-friendly. In India's educational system, Social media will keep playing a crucial part (Bharucha, 2018). Teachers and students use social media to share recordings, documents, and submit assignments. Sarwar et al. (2019) indicated it as a tool that stimulates collaboration and communication among students that enhances their involvement and learning performance. Likewise, Alalwan et al. (2019) also found that social media enhances students' learning activities by providing them another platform to share their knowledge, information, and discussions with others. Sobaih et al. (2020) realized that social is used to build an online community by the students and to support each other. Teachers may transform their knowledge over time, thanks to social media platforms, which not only impact the students. Thus, proposed the following hypothesis.

H3. Use of social media significantly impact Student's engagement

2.4. Family support and students' engagement

With the adoption of online learning, individuals can learn both from family and work (Tsai et al., 2021). According to Patricia Aguilera-Hermida (2020), there are many distractions occurred during online learning such as noise of family members, housework. The student's degree of focus, the availability of educational materials, and the participation of students in online education are all influenced by family circumstances. Gill et al. (2015) also identified that level of disruption and financial problems which a family is facing influence their level of support whereas Vayre and Vonthron (2017) found that there is no relationship between family support and individuals' participation in online learning. Thus, proposed the following hypothesis.

H4. Support of Family significantly impact Student's engagement

2.5. Technical Support and students' engagement

The educational system has been drastically transformed by technological advancements. To encourage the use of e-learning systems, universities must provide access to learning resources without any technological challenges or delays (Almaiah et al., 2020). Sun et al. (2008) realized that poor technology with frequent technical problems and slow response time will discourage the students from participating in online courses. Lin et al. (2021) defined technology as a criterion for

determining if the pandemic's learning objectives fulfill the requirements of students. System characteristics like the quality of technology and the information play an important role in the adoption and usage of technology by the learner (Zhang et al., 2020). Motaghian et al. (2013) and Nambiar (2020) also found that the quality of technology influences the engagement of students and instructors in e-learning. Foregoing conversations resultant to the following proposed hypothesis.

H5. Technical Support significantly impact Student's engagement

2.6. Students' engagement and learning performance

Students' engagement refers to students' active participation in educational activities as well as their dedication to academic goals and learning (Chiu, 2021). Kordrostami and Seitz (2021) defined students' engagement as a practice to ensure the contribution of the students in discussion is safe and comfortable. So that it provides a positive learning environment. Qureshi et al. (2021) said that students who are participating in the learning process can learn better than others. Molinillo et al. (2018), Patricia Aguilera-Hermida (2020), and Sarwar et al. (2019) realized that students' engagement positively influences their learning performance. Thus, the following hypothesis is proposed.

H6. Student's engagement significantly impact their Learning Performance

3. Objective of the study

The aim of this research is to understand the variables impacting the learning performance of college students of India after the adoption of online learning.

4. Methodology

4.1. Research model

After going through various existing literature, we are able to prepare our conceptual model which is shown in Fig. 1. The proposed model consists of Instructor-Student Interaction, Interaction with peers, Social Media Use, Family Support, and Technical support as independent variables, Student's engagement as an intervening variable, and Student's Learning Performance as dependent variable. The main aim to build up a conceptual framework is to examine the effect of variables on Engagement of students and their performance after the adoption of online learning.

The variables are defined as follows to have a clear understanding of the variables.

- **Instructor-Student Interaction:** This allows the instructor to provide feedback and solve the queries of the student.
- **Interaction with Peers:** Participating in the group activities, cooperating, and communicating with the other students.
- **Social Media Use:** Using broader ranges of social media platforms like; facebook, Instagram, linkedin, twitter, whatsapp for sharing information, ideas, and documents during the learning process.
- **Family Support:** Providing a peaceful atmosphere and easy availability of the electronic device to continue the course without any interruption.
- **Technical Support:** Technological devices providing facilities to connect with the instructor and institutional facilities at a remote location.
- **Students' Engagement:** The participation and involvement of students during the online learning process.
- **Students' Learning Performance:** The change in the capability and skills of the student

4.2. Data collection and instrumentation

A well-structured questionnaire was prepared using "Question Pro" software which includes various tools to design, create and circulate the survey questionnaire among various respondents. To collect the data, we used the Non-Probability Purposive Sampling technique from different social media platforms like linkedIn, instagram, facebook, and whatsapp. Undergraduate and Postgraduate university's students were considered to be our target population for the study. The questionnaire was circulated to the students of three colleges/universities of Jaipur, namely; JK Lakshmipat University, Arya College of Engineering and I.T., and JECRC University using above mentioned social media platforms. The survey received 300 responses. Additionally, reminders were sent to individuals who had not completed the questionnaire within a specific time frame.The questionnaire consists of the title of the survey, basic

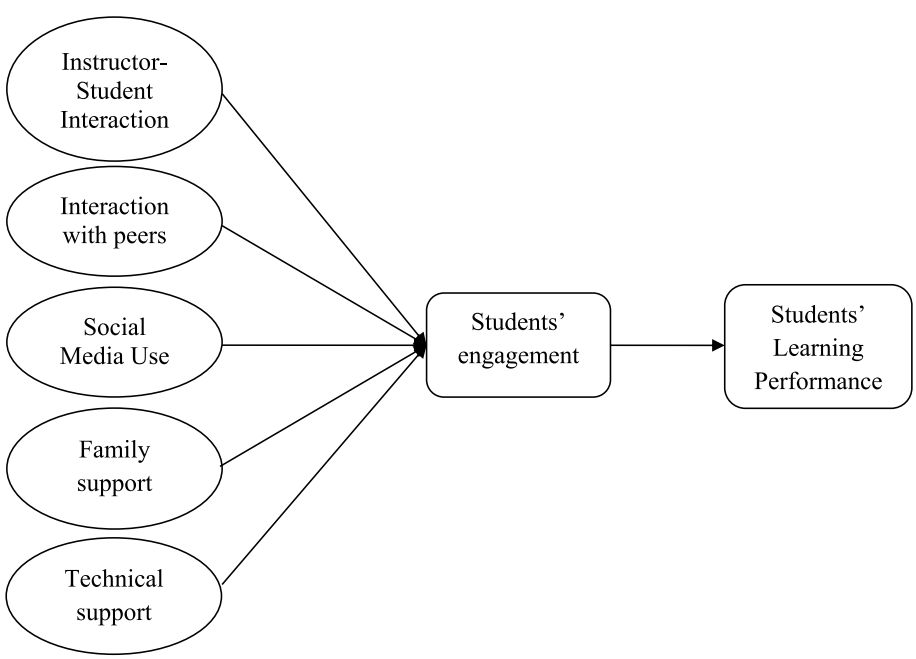

Fig. 1. Conceptual Framework of the study.

questions on demographic information of the students, and questions related to all seven constructs which include a total of 26 variables. The instrument of data collection was designed using a 5-point Likert scale to code the variables from *strongly disagree* to *strongly agree*. After developing the survey questionnaire, it was circulated to 50 students to clarify whether the questionnaire requires some modification or it is good to distribute among the respondents. Based on responses received from the pilot study, we made some modifications (removed 3 items of different constructs) to the questionnaire and distributed it among other respondents.

4.3. Statistical techniques

Techniques that are used in this study are Reliability analysis, Discriminant and Convergent validity, Exploratory and Confirmatory Factor Analysis (EFA and CFA), and Structural Equation Modelling (SEM) using two different software programs namely SPSS version 25 and Analysis of moment structure (AMOS) 23.

5. Result and discussion

5.1. Demographics

Table 1 shows the demographic details of the participants, which includes their age, gender, and educational qualifications. Females make up 55.67 percent of the total responders, while men make up 44.33 percent. 53.33 percent of students are between the ages of 18 and 20, while 40 percent lies between 21 and 25 age, according to the survey. The majority of responses (70.67 percent) are from Under Graduation, while just 29.33 percent are from Post Graduation.

5.2. Measurement model

Before going further with the analysis of latent variables (factors/constructs), we first discuss the measurements of unobserved variables. In this model, we check reliability, discriminant and convergent validity, EFA, and CFA. The structural model evaluates the measurement model using the CFA findings (Dash & Paul, 2021).

5.2.1. Reliability analysis

To check the normality of the data and the interior constancy of the data, a reliability test was assessed (Taber, 2018) which represents the construct of Instructor-Student Interaction, Interaction with Peers, Social Media use, Family Support, Technical Support, Students' Engagement, and Students' Learning Performance using Cronbach's alpha given in Table 2. Cronbach's alpha of overall constructs should be greater than 0.7 (Dash & Chakraborty, 2021). Our Computed Cronbach alpha is 0.848 indicating our data are reliable.

5.2.2. Discriminant validity

The degree to which one construct differs from another is measured by discriminant validity (Hair, 2014, p. 390). It denotes that the construct is distinct from others. The Average Variance Extracted (AVE) of every construct should be larger than the corresponding Squared Inter-Construct Correlation (SIC) to establish discriminant validity (Ab Hamid et al., 2017). Here in Table 3, the AVE of all the constructs is greater than their corresponding SIC which means that the model demonstrates Discriminant Validity.

Table 1
Demographic information of the respondents.

Sr. No.	Characteristics	Categories	No. of Respondents	Percentage (%)
1	**Age**	Below 18 Years	15	5.00
		18–20 Years	160	53.33
		21–25 Years	120	40.00
		Above 25 Years	5	1.67
2	**Gender**	Female	167	55.67
		Male	133	44.33
3	**Education**	Under Graduation	212	70.67
		Post Graduation	88	29.33

Table 2
Reliability analysis[a].

Factor	Items	Cronbach's Alpha
ISI	5	0.805
IP	4	0.781
SMU	4	0.855
FS	4	0.775
TS	3	0.719
SE	3	0.745
SLP	3	0.753
Combined Scale	26	0.848

[a] It is to be noticed that in existing pieces of literature, authors presented their statistics with three rather than two decimal numbers (Qureshi et al., 2021; Sarwar et al., 2019).

5.2.3. Convergent validity

The extent to which all elements of the same construct are associated is known as convergent validity (Hair, 2014, p. 390). To set up convergent validity, we have to check Composite Reliability (Refer to Table 3), Average Variance Extracted (Refer to Table 3), and Factor Loading (Refer to Table 5) (Ab Hamid et al., 2017). Composite Reliability (CR) should be greater than 0.7 and is used to confirm the reliability of the factors (Kumar et al., 2021; Yakubu & Dasuki, 2019). Average Variance Extracted of 0.5 or more and factor loading above 0.6 specifies the convergent validity is accurate (Hulland, 1999). This model demonstrates Convergent validity.

5.2.4. Exploratory Factor Analysis

It is a method for identifying, arranging, reducing, and organising the number of components in a construct (Effendi et al., 2019; Suhr, 2006). To check whether the collected data are sufficient to run the model, we go for Kaiser-Meyer-Olkin and Bartlett's Test. KMO Value ranges from 0 to 1 where a value below 0.5 is not accepted and values above 0.8 are considered to be good or adequate (Reddy & Kulshrestha, 2019). KMO analyzes the adequacy of the data whereas Bartlett's Test evaluates the appropriateness of the data. From Table 4, we obtained a KMO value of 0.813 (>0.80) which is Good and significant Bartlett's test of Sphericity [Chi-square X^2 (325) = 2831.611, $p < 0.001$]. It means that the correlation value of items is not equal to zero.

The relationship between each item and the construct is represented by correlation which is also known as "Factor Loadings" (Bryman & Cramer, 2004). In the Principal Component method, components having eigenvalues more than 1.0 are extracted into different components (Hair, 2014, p. 390), and the factor loadings of the item above 0.6 are rotated in such a manner that they explain the underlying construct (Hulland, 1999; Truong & McColl, 2011). From the output shown in Tables 5 and it is revealed that eigenvalue more than 1.0 are extracted with the total variance explained as 64.56% and all the items of each construct are above 0.6.

5.2.5. Confirmatory factor analysis

The outcomes of Exploratory Factor Analysis are confirmed using Confirmatory Factor Analysis (CFA) (Flora & Flake, 2017; Suhr, 2006). To analyze the results, we run the CFA model and found that all the observed values are within the threshold limits.

From the above-mentioned Table 6, the Goodness of Fit Index (GFI) is 0.916, which appears to be good, however, the Adjusted GFI (AGFI) is 0.893, which is somewhat lower than the benchmark, Tucker-Lewis Index (TLI) is 0.955, and Comparative Fit Index (CFI) is 0.961. The

Table 3
Discriminant validity**.

Factors	AVE	CR	Squared Inter-Construct Correlation (SIC)						
			ISI	IP	SMU	FS	TS	SE	SLP
ISI	0.576	0.872	–	0.000	0.011	0.016	0.001	0.011	0.043
IP	0.598	0.856	0.000	–	0.007	0.047	0.003	0.000	0.090
SMU	0.724	0.913	0.011	0.007	–	0.000	0.008	0.011	0.001
FS	0.549	0.829	0.016	0.047	0.000	–	0.114	0.126	0.301
TS	0.619	0.829	0.001	0.003	0.008	0.114	–	0.001	0.018
SE	0.633	0.838	0.011	0.000	0.011	0.126	0.001	–	0.091
SLP	0.596	0.815	0.043	0.001	0.090	0.301	0.018	0.091	–

Table 5
Factor Loading, Eigen values and Percentage of Extraction using Principal Component Method**.

Construct	Statements	Factor Loadings	Eigen Values	% of variance	Cumulative %
ISI	ISI1	0.779	5.747	22.103	22.103
	ISI2	0.784			
	ISI3	0.693			
	ISI4	0.712			
	ISI5	0.698			
IP	IP1	0.787	2.027	7.796	49.178
	IP2	0.818			
	IP3	0.719			
	IP4	0.765			
SMU	SMU1	0.821	2.934	11.284	33.387
	SMU2	0.776			
	SMU3	0.785			
	SMU4	0.842			
FS	FS1	0.604	2.079	7.995	41.382
	FS2	0.808			
	FS3	0.790			
	FS4	0.740			
TS	TS1	0.769	1.264	4.860	60.021
	TS2	0.779			
	TS3	0.720			
SE	SE1	0.724	1.180	4.539	64.560
	SE2	0.711			
	SE3	0.729			
SLP	SLP1	0.737	1.556	5.984	55.162
	SLP2	0.769			
	SLP3	0.811			

Table 4
Test for sampling adequacy**.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Value		.813
Bartlett's Test	Approx. Chi-Square	2831.611
	Degree of Freedom	325
	Significance	.000

Table 6
Model fit summary of confirmatory factor analysis**.

Indices	Observed Value	Suggested Value
Number of Statements	26	–
Chi-Square/Df	1.362	<5.00
GFI	0.916	>0.90
AGFI	0.893	>0.90
TLI	0.955	>0.90
CFI	0.961	>0.90
RMR	0.041	<0.08
RMSEA	0.035	<0.08

Root Mean Square Residuals (RMR) and Root Mean Square Error of Approximation (RMSEA) values were likewise detected as 0.041 and 0.035, respectively, indicating that the model is completely fit (Sakthivel, 2017; Bentler, 1990; Dash & Paul, 2021; Maydeu-Olivares et al., 2018).

5.3. Structural model

A structural model (SEM) was created to determine the relationship among the constructs in the conceptual model (Chakraborty et al., 2021; Yakubu & Dasuki, 2019). The standardized path coefficient is presented in Fig. 2. The computed model fit indices are used to determine the path's result (refer to Table 6).

The variables used in the structural model are.

I. Observed, endogenous variables
   1. Student's Engagement
   2. Student's Learning Performance
II. Observed, exogenous variables
   1. Instructor-Student Interaction
   2. Interaction with Peers
   3. Social Media Use
   4. Family Support
   5. Technical Support
III. Unobserved, exogenous variables
   1. e1: Error term for Student's Engagement
   2. e2: Error term for Student's Learning Performance

Table 7 shows that the unstandardised coefficient of Instructor-Student Interaction on Student Engagement is 0.105, which illustrates the partial influence of Instructor-Student Interaction on student engagement while all other route factors remain constant. This means that the frequency and quality of interaction between Instructor-Student would enhance by 0.105 units, increases student engagement. Similarly, increasing the usage of social media by 0.175 units and increasing technical and family assistance by 0.150 units will boost student involvement. At the 1% level, this coefficient value is significant.

Interaction with Peers' effect on Students' engagement is not significant. Hence, it has very less or no effect on the engagement of students.

Based on the Standardised coefficient, Students' engagement in their learning performance (0.698) is the most influencing path in this SEM model, followed by Family support on Engagement (0.245), and use of social media on Engagement of students (0.233).

6. Conclusion

After the adoption of technologies, the learning system is growing faster and reaching the students sitting miles away from the institution or instructor. COVID-19 completely changed the educational scenario. It became very important for us to study the behavior of teachers as well as student after the adoption of online learning. To make the online successful, the output which comes from the student should be better. In

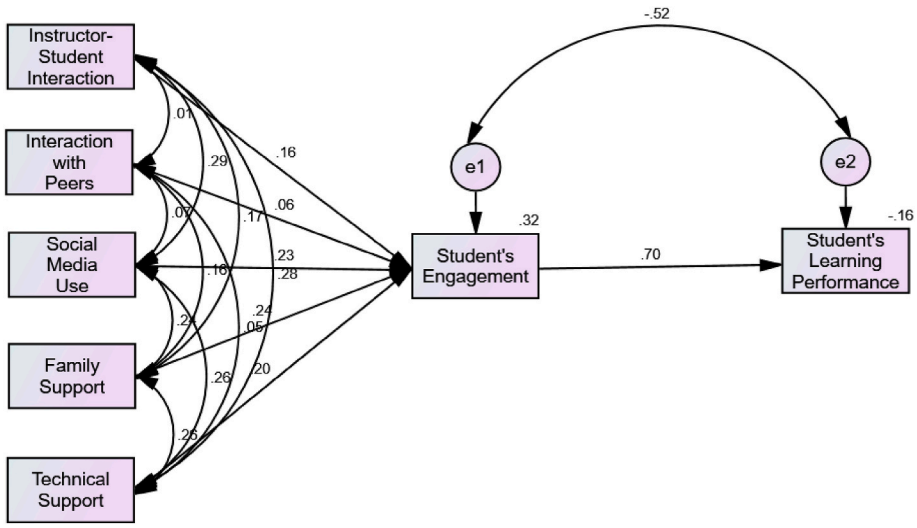

Fig. 2. Structural equation model (SEM).

Table 7
Structural equation model analysis**.

Variables			Unstandardised Co-efficient (B)	Standardized Co-efficient (B)	t-value	P-value	Remarks
(H1) Students' Engagement	<—	Instructor-Student Interaction	0.105	0.160	3.612	***	Failed to reject
(H3) Students' Engagement	<—	Social Media Use	0.175	0.233	5.175	***	Failed to reject
(H4) Students' Engagement	<—	Family Support	0.150	0.245	5.482	***	Failed to reject
(H5) Students' Engagement	<—	Technical Support	0.150	0.198	4.427	***	Failed to reject
(H2) Students' Engagement	<—	Interaction with Peers	0.046	0.058	1.418	0.156	Rejected
(H6) Students' Learning Performance	<—	Students' Engagement	0.815	0.698	6.331	***	Failed to reject

this study, we are examining the variables which affect the performance of the students after the adoption of online learning. After going through various pieces of literature, we categorized them in such a way that they accomplish the objective of our study.

Firstly, we have developed six hypotheses based on our objective of the study then gone through various analyses to examine the validity and reliability of the data. From Exploratory Factor Analysis, we extracted seven constructs namely Instructor-Student Interaction, Interaction with Peers, Social media use, Family Support, Technical Support, Students' Engagement, and Students' Learning Performance. Then we ran Confirmatory Factor Analysis and show that all the parameters are within the threshold limits. We were good to go ahead to determine the relationship of the constructs of our conceptual model and to check whether accept the hypothesis or not.

Our first hypothesis was to determine the relationship between instructor-student Interaction and Students' Engagement and our findings show that the involvement of the student will increase if there will be more interaction between the instructor and the student. The second hypothesis was to determine the relationship between Interaction with Peers and Students' Engagement then it is seen that interaction with Peers will not influence their participation in the course. The third hypothesis shows that if the student uses social media for the study purpose then will actively participate in the learning activities. It indicates that there is a significant relationship between social media use and student involvement. Similarly, our fourth and fifth hypotheses demonstrate a positive association between family support and student involvement, as well as between technical support and student engagement. Students will be able to participate actively in the learning process if family and technology are not a barrier during the learning process. The ultimate outcome of our sixth and final hypothesis is that student involvement has a beneficial impact on student learning performance.

It is concluded that the Interaction between instructors and students, social media use, technological and family support directly or indirectly affect the participation and the performance of the student. Family support was found to be missing in the existing pieces of literature. So, it was crucial to carry out the study to identify factors influencing the study's efficiency. Future research could be done by identifying various other factors like psychological, demographical, economic, and determining their effect on the performance of the students or the effectiveness of online learning.

CRediT authorship contribution statement

Payal Kedia: Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing. **Lokanath Mishra:** Conceptualization, Investigation, Resources, Data curation, Writing – review & editing, Visualization, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

APPENDIX

CONSTRUCT	ITEMS	SURVEY QUESTIONS	REFERENCE
Instructor-Student Interaction (ISI)	ISI1	I feel that Instructor care about my learning.	(Liu & Pu, 2020; Qureshi et al., 2021)
	ISI2	Instructor provides me the timely feedback.	
	ISI3	I frequently interact with instructor during online learning.	
	ISI4	Discussing with the instructor is very helpful for my learning.	
	ISI5	Instructor encourages students to express their opinion.	
Interaction with Peers (IP)	IP1	By group discussion, I may have a deeper understanding of the subjects.	(Liu & Pu, 2020; Qureshi et al., 2021)
	IP2	My learning abilities got developed through peer interaction.	
	IP3	I can improve my problem-solving abilities by interaction with my peers.	
	IP4	I do not hesitate to exchange my ideas with peers on any topic.	
Social Media Use (SMU)	SMU1	I utilise social media to exchange scholarly materials with my colleagues.	(Qureshi et al., 2021; Sarwar et al., 2019)
	SMU2	I utilise social media to finish my assignments.	
	SMU3	I cooperate and interact with my colleagues on social media.	
	SMU4	I use social media to understand the concept in an easy way.	
Family Support (FS)	FS1	My family always appreciate me whenever I learn new things.	Author
	FS2	I found solution of my every problem from my family members.	
	FS3	I always found peaceful learning environment at my home.	
	FS4	My family members help me in completing my academic task on time.	
	FS5	In my home, I have a dedicated room for studying. So, I can focus on my online lecture without being interrupted.	
Technical Support (TS)	TS1	Lack of computer skills make me uncomfortable during online classes.	(Almaiah et al., 2020; Sun et al., 2008)
	TS2	Many times, I got automatically disconnected during my online class.	
	TS3	I can continue my online studies without interruption since I have access to a quick internet connection at home.	
	TS4	My digital device's storage space is running out rapidly.	
Students' Engagement (SE)	SE1	I enjoy discussions with instructor or peer via email or online chats.	(Dixson, 2010; Kordrostami & Seitz, 2021; T.-J. Lin, 2021; Molinillo et al., 2018)
	SE2	An effective tool for social connection is online or web-based communication.	
	SE3	It's essential for me to fully comprehend the contents of online courses.	
	SE4	Learning through online platform is interesting.	
Students' Learning Performance (SLP)	SLP1	My ability to complete academic assignments quickly has improved.	(Qureshi et al., 2021; Sarwar et al., 2019)
	SLP2	With e-learning platform, I was able to gain more in-depth knowledge of the subject.	
	SLP3	Online quizzes, assignments, group discussions aided to my learning.	
	SLP4	From other social media users, I was able to pick up new knowledge and abilities.	

References

Ab Hamid, M. R., Sami, W., & Mohmad Sidek, M. H. (2017). Discriminant validity Assessment: Use of fornell & larcker criterion versus HTMT criterion. *Journal of Physics: Conference Series, 890*, Article 012163. https://doi.org/10.1088/1742-6596/890/1/012163

Alalwan, N., Al-Rahmi, W. M., Alfarraj, O., Alzahrani, A., Yahaya, N., & Al-Rahmi, A. M. (2019). Integrated three theories to develop a model of factors affecting students' academic performance in higher education. *IEEE Access, 7*, 98725–98742.

Almaiah, M. A., Al-Khasawneh, A., & Althunibat, A. (2020). Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. *Education and Information Technologies, 25*(6), 5261–5280. https://doi.org/10.1007/s10639-020-10219-y

Bharucha, J. (2018). Exploring education-related use of social media: Business students perspectives in a changing India. *Education and Training, 60*(2), 198–212. https://doi.org/10.1108/ET-07-2017-0105

Bolliger, D. U., & Wasilik, O. (2009). Factors influencing faculty satisfaction with online teaching and learning in higher education. *Distance Education, 30*(1), 103–116. https://doi.org/10.1080/01587910902845949

Bryman, A., & Cramer, D. (2004). Quantitative data analysis with SPSS 12 and 13. *Routledge*. https://doi.org/10.4324/9780203498187

Chakraborty, D., Biswas, W., & Dash, G. (2021). Marching toward "heart work": Connecting in new ways to thrive amidst COVID-19 crisis. *Conflict Resolution Quarterly, 39*(1), 7–27. https://doi.org/10.1002/crq.21313

Chiu, T. K. F. (2021). Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic. *Journal of Research on Technology in Education*, 1–17. https://doi.org/10.1080/15391523.2021.1891998

Dash, G., & Chakraborty, D. (2021). Digital transformation of marketing strategies during a pandemic: Evidence from an emerging economy during COVID-19. *Sustainability, 13*(12), 6735. https://doi.org/10.3390/su13126735

Dash, G., & Paul, J. (2021). CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting. *Technological Forecasting and Social Change, 173*, Article 121092. https://doi.org/10.1016/j.techfore.2021.121092

Dixson, M. D. (2010). Creating effective student engagement in online courses: What do students find engaging? *The Journal of Scholarship of Teaching and Learning, 10*(2), 1–13.

Effendi, M., Matore, E. M., Khairani, A. Z., & Adnan, R. (2019). Exploratory factor analysis (EFA) for Adversity quotient (AQ) instrument among youth. *Journal of Critical Reviews, 6*(6), 234–242.

Flora, D. B., & Flake, J. K. (2017). The purpose and practice of exploratory and confirmatory factor analysis in psychological research: Decisions for scale development and validation. *Canadian Journal of Behavioural Science, 49*(2), 78–88. https://doi.org/10.1037/cbs0000069

Gill, B., Hayes, S., & Senior, C. (2015). The effects of family support and gender on mature student engagement in higher education. *Frontiers in Psychology, 6*. https://doi.org/10.3389/fpsyg.2015.00156

Hair, J. F. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage Publications.

Hulland, J. (1999). Use of partial least squares (pls) in strategic management research: A review of four recent studies. *Strategic Management Journal, 20*(2), 195–204. https://doi.org/10.1002/(SICI)1097-0266(199902)20

Jain, S., & Jain, D. R. (2019). Role of artificial intelligence in higher education-an empirical investigation. *International Journal of Research and Analytical Reviews, 6*(2), 144–150.

Jena, P. K. (2020). Impact of pandemic COVID-19 on education in India. *International Journal of Current Research, 12*(7), 12582–12586. https://doi.org/10.31235/osf.io/2kasu

Kordrostami, M., & Seitz, V. (2021). Faculty online competence and Student affective engagement in Online Learning. *Marketing Education Review*, 1–15. https://doi.org/10.1080/10528008.2021.1965891

Kumar, P., Kumar, N., & Ting, H. (2021). An impact of content delivery, equity, support and self-efficacy on student's learning during the COVID-19. *Current Psychology*. https://doi.org/10.1007/s12144-021-02053-3

Lin, T.-J. (2021). Exploring the differences in Taiwanese university students' online learning task value, goal orientation, and self-efficacy before and after the COVID-19 outbreak. *The Asia-Pacific Education Researcher, 30*(3), 191–203. https://doi.org/10.1007/s40299-021-00553-1

Lin, C.-L., Jin, Y. Q., Zhao, Q., Yu, S.-W., & Su, Y.-S. (2021). Factors influence students' switching behavior to online learning under COVID-19 pandemic: A push–pull–mooring model perspective. *The Asia-Pacific Education Researcher, 30*(3), 229–245. https://doi.org/10.1007/s40299-021-00570-0

Liu, N., & Pu, Q. (2020). Factors influencing learners' continuance intention toward one-to-one online learning. *Interactive Learning Environments, 1–22*. https://doi.org/10.1080/10494820.2020.1857785

Mohammed, K. S., Rashid, C. A., Salih, H. A., & Budur, T. (2020). The role of online teaching tools on the perception of the students during the lockdown of covid-19. *International Journal of Social Sciences and Educational Studies, 7*(3). https://doi.org/10.23918/ijsses.v7i3p178

Molinillo, S., Aguilar-Illescas, R., Anaya-Sánchez, R., & Vallespín-Arán, M. (2018). Exploring the impacts of interactions, social presence and emotional engagement on active collaborative learning in a social web-based environment. *Computers & Education, 123*, 41–52. https://doi.org/10.1016/j.compedu.2018.04.012

Motaghian, H., Hassanzadeh, A., & Moghadam, D. K. (2013). Factors affecting university instructors' adoption of web-based learning systems: Case study of Iran. *Computers & Education, 61*, 158–167. https://doi.org/10.1016/j.compedu.2012.09.016

Nambiar, D. (2020). The impact of online learning during COVID-19: Students' and. *The International Journal of Indian Psychology, 8*(2), 12.

Owusu-Fordjour, C., Koomson, C. K., & Hanson, D. (2020). The impact of COVID-19 on learning - the perspective of the GHANAIAN student. *European Journal of Education Studies, 7*(3). https://doi.org/10.5281/ZENODO.3753586

Patricia Aguilera-Hermida, A. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *International Journal of Educational Research Open, 1*. https://doi.org/10.1016/j.ijedro.2020.100011

Qureshi, M. A., Khaskheli, A., Qureshi, J. A., Raza, S. A., & Yousufi, S. Q. (2021). Factors affecting students' learning performance through collaborative learning and engagement. *Interactive Learning Environments*, 1–21. https://doi.org/10.1080/10494820.2021.1884886

Reddy, D. L. S., & Kulshrestha, P. (2019). Performing the KMO and Bartlett's test for factors estimating the warehouse efficiency, inventory and customer contentment for E-retail supply chain. *International Journal for Research in Engineering Application & Management, 5*(9), 13. https://doi.org/10.35291/2454-9150.2019.0531

Sakthivel, D. N. (2017). Perception of college students towards effectiveness of social media Advertisements: Structural equation modeling approach. *Global Journal for Research Analysis, 6*(12), 3.

Sarwar, B., Zulfiqar, S., Aziz, S., & Ejaz Chandia, K. (2019). Usage of social media tools for collaborative learning: The effect on learning success with the moderating role of cyberbullying. *Journal of Educational Computing Research, 57*(1), 246–279. https://doi.org/10.1177/0735633117748415

Singh, A., Sharma, S., & Paliwal, M. (2021). Adoption intention and effectiveness of digital collaboration platforms for online learning: The Indian students' perspective. *Interactive Technology and Smart Education, 18*(4), 493–514. https://doi.org/10.1108/ITSE-05-2020-0070

Sobaih, A. E. E., Hasanein, A. M., & Abu Elnasr, A. E. (2020). Responses to COVID-19 in higher education: Social media usage for sustaining formal academic communication in developing countries. *Sustainability, 12*(16), 6520. https://doi.org/10.3390/su12166520

Suhr, D. D. (2006). *Exploratory or confirmatory factor analysis* (Vol. 17).

Sun, P.-C., Tsai, R. J., Finger, G., Chen, Y.-Y., & Yeh, D. (2008). What drives a successful e-learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education, 50*(4), 1183–1202. https://doi.org/10.1016/j.compedu.2006.11.007

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Truong, Y., & McColl, R. (2011). Intrinsic motivations, self-esteem, and luxury goods consumption. *Journal of Retailing and Consumer Services, 18*(6), 555–561. https://doi.org/10.1016/j.jretconser.2011.08.004

Tsai, C.-L., Ku, H.-Y., & Campbell, A. (2021). Impacts of course activities on student perceptions of engagement and learning online. *Distance Education, 42*(1), 106–125. https://doi.org/10.1080/01587919.2020.1869525

Vayre, E., & Vonthron, A.-M. (2017). Psychological engagement of students in distance and online learning: Effects of self-efficacy and psychosocial processes. *Journal of Educational Computing Research, 55*(2), 197–218. https://doi.org/10.1177/0735633116656849

Wei, H.-C., & Chou, C. (2020). Online learning performance and satisfaction: Do perceptions and readiness matter? *Distance Education, 41*(1), 48–69. https://doi.org/10.1080/01587919.2020.1724768

Wong, R. (2020). When no one can go to school: Does online learning meet students' basic learning needs? *Interactive Learning Environments*, 1–17. https://doi.org/10.1080/10494820.2020.1789672

Yakubu, M. N., & Dasuki, S. I. (2019). Factors affecting the adoption of e-learning technologies among higher education students in Nigeria: A structural equation modelling approach. *Information Development, 35*(3), 492–502. https://doi.org/10.1177/0266666918765907

Zhang, Z., Cao, T., Shu, J., & Liu, H. (2020). Identifying key factors affecting college students' adoption of the e-learning system in mandatory blended learning environments. *Interactive Learning Environments*, 1–14. https://doi.org/10.1080/10494820.2020.1723113