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Students' satisfaction from online learning: structural equation modelling analysis based on students' perception in higher educational institutions in India

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Abstract: This study examines the foremost antecedents of students' satisfaction with online learning in higher educational institutions (HEIs) in northern India during the COVID-19 pandemic. Data was collected through an online Google form from 2,658 (2,597 considered usable) enrolled students in HEIs in northern India using the purposive sampling technique. The data were analysed using exploratory factor analysis and structural equation modelling

(SEM) using AMOS. Results revealed that learning environment, barricades, and advantages to learner are positively and significantly correlated with students' satisfaction, whereas challenges had a negative and insignificant correlation with students' satisfaction. Most notably, the significant impact of the learning environment on students' satisfaction is major, followed by barricades, advantages to learners, and challenges. This study will contribute to future research for measuring the student's perception of the adoption of online learning in diverse educational institutions.

Keywords: India; online learning; students' satisfaction; higher educational institutions; HEIs; structural equation modelling; SEM.

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1 Introduction

Technology is a crucial pillar of innovation (Androutsos and Brinia, 2019). Online education positively influences students' learning (Moreno-Guerrero et al., 2020; Bojovic et al., 2020). Adopting new teaching methodologies requires superior integration with the learning practice (Costa and Pereira, 2022). Online mode is diversified from the conventional mode in the physical environment due to computing and communication technology (Hsu et al., 2012). Online learning is a synonym for virtual learning, e-learning, distance learning through computers, etc. (Ally, 2004; Mishra, 2018). Many definitions of online learning exist; however, authors agreed upon and took the following meaning for the research purpose:

> "[t]he use of the internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, to acquire knowledge, to construct personal meaning, and to grow from the learning experience (Ally, 2004)."

India has a 35% urban share and a median age of 28.4 years of India's total 1.38 billion populations (Worldometer, 2020). The education system in India has evolved from skill-based guru centric to learning-centric to further learner-centric (Mishra, 2018). 37.4 million students were enrolled in the 2018–2019 in 993 universities and 39,931 colleges in India (IBEF, 2020). 9.5 million students will be online learners in 2021 (IBEF, 2020). Online education has completed three decades in India. Still, it has remained either supporting the mainstream education mode or limited to distant centres of universities and coaching institutes in confirmation of telecommunication infrastructure at remote centres of different institutions (Ganesan et al., 2017; Mishra, 2018). The recent move of opening the education system to online education was cautious. Still, the online mode of education has been entrusted with reforming India's education system by providing opportunities for higher education to increase employability soon (McKenzie, 2020). The development of higher education leads to skill enhancement, human capital upliftment, and wealth creation in a country (Ali, 2022).

India has seen exponential growth in COVID-19 cases since its first case was reported on 31st January 2020 (MoH&FW, 2020). In the absence of any pharmaceutical treatment, the Government of India proposed social distancing, which is a non-pharmaceutical measure, on 16th March 2020 (MoH&FW, 2020); however,

lockdown phase-1 was implemented to ensure social distancing on 24th March 2020 (MHA, 2020), and is in progress in lockdown phase-5 with relaxations. The educational institutes were proposed to shut down the formal classroom teaching and learning and adopt online mode from 16th March 2020 (MoH&FW, 2020). The government was in the process of developing infrastructure for the delivery of online learning in remote areas and providing infrastructural support to the needy (Ganesan et al., 2017) under the Digital India program, and opening up formal education to online education (McKenzie, 2020) but could not reach to the desired level before COVID-19 lockdown. The outreach to mobile phones in India is only 78%, which is a further 57% in rural settlements with a larger population share (Bhatt, 2020). A large percentage of students of higher educational institutions (HEIs) is using the online mode of learning for the first time in their life. The outreach and awareness of the electronic gadgets, which became the carrier of knowledge transfer, to students of HEIs made them comparatively more equipped and ready for online education during lockdown (Mahesh, 2020).

The outreach of the online system was low due to the limitation of outreach to hardware (Mishra, 2018; Bhatt, 2020), poor telecommunication infrastructure, connectivity and low digital literacy (Mahesh, 2020), and satisfaction of the learner in online mode (Bawa, 2016). The lack of infrastructure, technology, and training exposed the preparedness of the Indian education system for online education (Bhatt, 2020; Mahesh, 2020). The use and success of the online learning mode before and during lockdown is still under debate. Online learning during lockdown has different influencing factors, opportunities, and challenges from regular online learning if the conditions prevail for a longer duration for the education system. The study is needed for the conventional education system in normal conditions in the future. A large number of articles during lockdown surfaced the need for a thorough literature review of the online education system and a scientific study exploring the online learning environment, advantages to the learner, challenges, barricades, and students' satisfaction, with the identification of intended input by the student community and successful output. Therefore, it is necessary to assess the components, outreach, strengths, weakness, challenges, and opportunities of online education for the successful output from this learning mode.

2 Review of literature

The current education system is student-centric. The published literature has presented four components of an online education system: the learner, teacher, course content and delivery, and transmission infrastructure for the successful delivery of content (Anderson, 2004). Globally, the unexpected changes in the education system have built up difficulties among learners regarding giving complete attention to online classes (Rameez et al., 2020). Student's academic performance is influenced by their poor attendance, absence of career guidance, professional development, and academic support (Makibinyane and Khumalo, 2021). Likewise, Performance motivation is positively associated to students' academic performance (Garg et al., 2021). Interactivity, teacher support, and learning environment are items of distance and open learning scale (DOLES) and dimension of distance education (DDE), which are scales for measuring the effectiveness of open learning and distance education, and course interaction, structure and support (CISS) instrument used for comparative analysis of the

effectiveness of online mode in comparison with the face-to-face mode of learning (Johnson et al., 2000). Bawa (2016) explored various cognitive, social, and family factors presenting the weaknesses and opportunities related to students and teachers to evaluate online education and proposed solutions. The factors related to the perception of students towards teachers and the impact of teachers on the minds of students have been given due importance (Bawa, 2016). Rios (2019) also explored items related to the framework of cognitive, social, and teaching presence influencing the effectiveness of online education. Student engagement and interaction increase student satisfaction (Ellis and Calvo, 2006; Martin and Bolliger, 2018). Network issues, technical complexities, inadequate infrastructure facilities, and user-friendliness of e-learning platforms have been presented for instruments (Nagar, 2020). Muilenburg and Berge (2005) proposed the student's barriers in technical skills, cost to access the internet, technical problems, academic skills, learner motivation, social interaction, and administrative issues to assess the effectiveness of online education by using factor analysis. Enjoyment, motivation, effectiveness, and worth of time are the measures of the effectiveness of online education (Muilenburg and Berge, 2005). The various issues faced by students during online learning in the COVID-19 pandemic are technological skills, loneliness at home, and mental health (Ranadewa et al., 2021; Rameez et al., 2020), internet connectivity, technical capabilities, costly data pack of internet, availability and quality of device, teacher-student interaction, preparation of online assignment, and learning environment and concentration issues at home (Duraku and Hoxha, 2020; Nambiar, 2020; Ranadewa et al., 2021; Rameez et al., 2020), power cuts and issues about broadband with audio and video quality (Nambiar, 2020). Rizvi and Nabi (2021) revealed inadequate bandwidth and network connectivity issues, feeling of isolation and demotivation due to lack of face-to-face student-faculty and student-student interactions, the unsuitable environment at home for attending online classes, excessive screen time causing fatigue, lack of e-library, time management difficulty in understanding calculation-based subjects, and device breakdown as major challenges faced by students during online learning.

The measurement of students' satisfaction is an important concern; therefore, it must be considered for evaluating course effectiveness (Basuony et al., 2021). During the COVID-19 pandemic, a high degree of satisfaction among students towards online learning resulted in excellence in their academic performance (Djuwandi et al., 2022). Likewise, teachers' work satisfaction is also determined by their satisfactory performance towards educational tasks (Brinia et al., 2020). Ranadewa et al. (2021) define learners' satisfaction as 'the degree to which a learner is delighted towards the involvement in online learning'. Sun et al. (2008) expressed student satisfaction as 'the degree of perceived learner satisfaction with e-learning settings as a whole' and influenced by the six dimensions, i.e., instructor, learner, course, technology, design, and learning environment (Sun et al., 2008). Likewise, Ranadewa et al. (2021) categorised the factors influencing learners' satisfaction as academic, accessibility, technological, mental well-being, and teachers' commitment. Students' satisfaction is directly influenced by perceived usefulness, ease of use, accessibility, and compatibility (Islam and Azad, 2015; Islam et al., 2018). The features of an e-learning system, i.e., system quality, information quality, task-technology fit, utility value, and usefulness, affect students' satisfaction (Al-Samarraie et al., 2018). Wu et al. (2010) revealed course design, interaction with teachers and peers, individual learning process, and learning achievement as the factors influencing student satisfaction. Sabah (2016) established a relationship of satisfaction

with mobile learning based on the items related to social influence and the learning environment.

Ghaderizefreh and Hoover (2018) revealed that technical issues, a sense of isolation, lack of social support, students' anxiety, and enthusiasm significantly impacted their satisfaction with online learning. Similarly, technological concerns, i.e., unavailability of required technologies, internet connectivity and slow speed, and expensive bills of internet connections (Ranadewa et al., 2021; Aboagye et al., 2020), academic concerns, i.e., ineffective communication, supportive academic materials, limited interaction among students, and group discussion (Aboagye et al., 2020) impact learners' satisfaction towards online classes. Likewise, Gopal et al. (2021) found that quality teaching of instructors followed by expectations of students, course design, and promptness in feedback are the key determinants of students' satisfaction with online classes during the COVID-19 pandemic period. In the context of Cairo City, Egypt, Basuony et al. (2021) conducted a study to measure the factors influencing students' satisfaction with online education and revealed that internet access and speed, adequate online resources, sufficient IT facilities, the timing of online classes, ability and helpfulness of teachers to motivate students towards online learning, instructor-student interaction, online assessment pedagogy, and students' self-motivation had a significant impact on students' satisfaction. The teacher-student interaction is determined by the friendly and positive environment of learning created by teachers and results in the active participation of students in the learning process (Urbancova and Fajcikova, 2020). Teachers' online teaching skills lead to their interaction with students online (Brinia and Psoni, 2022). In the setting of Sri Lankan universities, Hettiarachchi et al. (2021) revealed that perceived learners' motivation has a positive and significant impact on satisfaction, whereas perceived challenges of e-learning, i.e., technical difficulties, IT literacy, feeling of isolation, and absence of practical exposure, and limited resources and interaction, i.e., limited e-resources and limited interaction with teachers and classmates had a negative and significant impact on students' satisfaction with e-learning during the COVID-19 pandemic. Likewise, Nikou and Maslov (2022) did a study on Finnish university students' satisfaction with e-learning during the COVID-19 pandemic and revealed that digital communities, i.e., teacher-learner interaction, and learner-to-learner interaction, information technology (quality and accessibility), i.e., user interface design of websites, website ease of use, internet connection speed, efficient and reliable technological infrastructure, and online course design quality, i.e., adequate and relevant information of course, accurate and complete content, and attractive and consistent layout have a positive and significant impact on students' satisfaction. The existing studies have been developed for online learning during normal conditions; however, the lockdown situation has emerged for the first time; therefore, a structural analysis is required. Based on the reviewed literature, the following hypotheses have been formulated.

H1 Learning environment significantly impacts students' satisfaction with online learning.

H2 Advantages to learners significantly impact students' satisfaction with online learning.

H3 Challenges significantly impact students' satisfaction with online learning.

H4 Barricades significantly impact students' satisfaction with online learning.

3 Research methodology

The present study examines the foremost antecedents of students' satisfaction with online learning in HEIs in northern India during the COVID-19 pandemic. The survey questionnaire was prepared after reviewing similar literature from the studies (Islam and Azad, 2015; Al-Samarraie et al., 2018; Islam et al., 2018; Lee et al., 2019; Samsudeen and Mohamed, 2019; Ahmad, 2020) and consists 38 items, i.e., six demographics questions as gender, locality, level of education, education stream, type of educational institution, and family monthly income, and 32 statements on a five-point Likert scale (Islam et al., 2018; Lee et al., 2019; El Refae et al., 2021; Kulal and Nayak, 2020; Hettiarachchi et al., 2021; Gopal et al., 2021; Basuony et al., 2021) was prepared for getting responses on online mode from the students of HEIs in northern India including the States of Haryana, Delhi, Punjab, Chandigarh, Uttar Pradesh, and Himachal Pradesh during COVID-19 pandemic. In-depth consultations of three academicians engaged in online classes ensured the content validity of the survey instrument before approving it for a pilot study of over 38 students of HEIs with diverse institutions and education streams. The survey instrument was then revised based on the feedback obtained from 38 students before the final online spreading among HEIs students. The purposive sampling technique was used for students' selection from the targeted population based on researchers' knowledge and professional judgment (Kumar et al., 2022; Al-Samarraie et al., 2018; Etikan et al., 2016; Tongco, 2007). The survey was conducted from April 2021 to May 2021, as students have more than one year of experience with online learning in India after adopting the online mode of teaching-learning on 16th March 2020 (MoH&FW, 2020). Out of 2,900 distributed survey questionnaires to students, 2,658 responses were received. Further, 61 questionnaires were considered invalid due to duplicity, and finally, 2,597 valid responses from HEIs students were considered for the analysis using SPSS and AMOS with a response rate of 89.55%. Factor analysis has been used for structural equation modelling (SEM), which uses confirmatory factor analysis (CFA) and path analysis; it is a highly recommended multivariate statistical technique for analysing psychological traits like perception, attitude, and satisfaction in many fields of research (Fan et al., 2016); however, a strong theoretical understanding of the subject of research, data screening, principles of correlation/regression, and result interpretation are prerequisite for the application of SEM (Hair et al., 2019). Students' perceptions are important for analysing the quality of learning (Johnson et al., 2000). SEM has been successfully used to analyse the perception of various stakeholders in the education sector regarding form-learning (Panwar and Garg, 2022; Sabah, 2016), and e-learning (Lee et al., 2019).

3.1 Demographic profile of respondents

The students have been classified based on the variables belonging to gender, the locality in residential address, level of education, educational stream, type of university/ institution, and monthly income of the family. The demographic characteristics of the respondents are in line with the socio-economic structure, enrolment, and students with an awareness of skills for handling the gadgets for online education. Out of 2,597 respondents, 66.7% were male, and 33.3% of the respondents were female. More than one-fourth (26.8%) of respondents reside in the villages, 14% live in town, two-fifth

(40.2%) live in the cities, and 19.0% of the total respondents live in a metro/capital city of the states/union territory of India. Further, 62.3% of the respondents are pursuing undergraduate courses, 35.0% post-graduate studies, and 2.7% are enrolled in doctoral studies. The enrolment data of respondents pursue architecture (10.6%), arts/education (22.8%), engineering and technology (24.7%), humanities (10.7%), management/ commerce (14.2%), medical/pharmacy (6.4%), and sciences (10.6%) as their stream of education. This indicates that the majority of the student respondents are pursuing professional courses. The students belong to central government universities (7.2%), state private universities (14.4%), state government universities (34.5%), the institution of national importance (NIT, NID, NIFT, NITTTR) (6.3%), IIT/IIIT/IIM/AIIMS (0.4%), deemed university (15.7%), and colleges (21.5%). Furthermore, 671 (25.8%) students belong to a family with a monthly family income of Indian Rupee (INR) up to 25000, and 535 (20.6%) students belong to a family with a monthly family income in the range of INR 25,001–50,000. Further, 590 (22.7%) students belong to a family with a monthly family income in the INR 50,001–100,000, 347 (13.4%) students belong to a family with a monthly family income in the range of INR 100,001–200,000, and 454 (17.5%) students belong to a family with a monthly family income more than INR 200,000.

4 Results and discussion

4.1 Exploratory factor analysis (EFA)

An EFA with varimax rotation was employed for 32 items. The Kaiser-Meyer-Olkin (KMO) and significance of Bartlett's test of sphericity were found to be 0.943 (KMO $\geqslant$ 0.60) and 0.000 levels, respectively. A communality score > 0.5 is the threshold for item retention (Yildiz and Kara, 2012). Factor loading ±0.50 and exceeding ±0.70 indicate a well-defined structure for any factor analysis (Hair et al., 2019). Therefore, three items with factor loadings below 0.50 were dropped from the analysis. The remaining 29 items are grouped into five factors with eigenvalue > 1. The five identified factors, 'learning environment (ten items)', 'advantages to learner (six items)', 'challenges (five items)' and barricades (three items), are considered independent factors, and students' satisfaction (five items) dignified as dependent factor shown in Table 1. These five identified factors explain 70.60% of the total variance. The Cronbach's alpha value of the constructs used in this study, i.e., learning environment (0.906), advantages to the learner (0.889), challenges (0.854), barricades (0.891), and students' satisfaction (0.855) were found to be greater than 0.70 (Diamantopoulos et al., 2012) as shown in Table 1.

4.2 Confirmatory factor analysis

CFA was conducted to confirm the appropriateness of the factor structures and examine whether the model fits each factor's items surely explained the factor. To carry out CFA, the factors that were derived from the EFA were set up and tested. The value of CMIN/*df* (χ^2) and root mean square error of approximation (RMSEA) is often sufficient to evaluate the model's fitness. The other absolute, incremental, and parsimony fit indices are applied to support the results (Hair et al., 2019). Various indices in the form of comparative fit index (CFI) > 0.90, standardised RMR (SRMR) from preferably < 0.1, RMSEA < 0.08, collaborative fit index (CFI) > 0.9, Turker-Lewis index (TLI) > 0.9

approaches to 1, and goodness of fit and adjusted goodness of fit index (AGFI) > 0.90 are considered acceptable (Yildiz and Kara, 2012; Hair et al., 2019; Lee et al., 2019). The value of CMIN, *df*, and CMIN/*df* are 859.158, 345, and 2.490. The values of the standardised coefficients of all factor loadings are significant (p = 0.000), and CMIN/*df* value is within the highly significant limit of |3.00|. A high overall criterion of indices > 0.95 is followed to avoid limiting the sensitivity of Chi-square for a large sample size. The observed goodness-of-fit measures CFI (0.991), TLI (0.989), GFI (0.978), AGFI (0.972), RFI (0.982), IFI (0.991), RSMEA (0.024), and SRMR (0.024) are highly significant in their respective criteria (Table 2). These all indicate that the proposed model best fits the data. The factor loadings of the learning environment varied from 0.78 to 0.96, advantages to learner varied from 0.58 to 0.92, challenges varied from 0.66 to 0.81, barricades varied from 0.83 to 0.91, and students' satisfaction varied from 0.66 to 0.79, as shown in Figure 1.

4.3 Correlation analysis

Table 3 shows the mean value, standard deviation, and correlation analysis among the factors. The mean value and standard deviation of students' satisfaction, learning environment, advantages to the learner, challenges, and barricades are presented in Table 3 and are 3.14 (0.937), 3.58 (1.123), 1.82 (1.291), 4.01 (0.808), and 2.89 (1.138) respectively. The results of correlation analysis revealed that learning environment, barricades, and advantages to learner are positively and significantly correlated with students' satisfaction, whereas challenges had a negative but insignificant correlation with students' satisfaction.

4.4 Path analysis

The path analysis explains the impact of latent constructs, i.e., learning environment, advantages to learner, challenges, and barricades on students' satisfaction. Figure 2 shows the path analysis model. The positive significant impact of learning environment on students' satisfaction is most (β = 0.32, p < 0.001) than barricades (β = 0.21, p < 0.001), and advantages to learner (β = 0.15, p < 0.001). Hence, it confirms H1, H2, and H3. The results of the present study are consistent with the previous research that the learning environment (Ranadewa et al., 2021; Aboagye et al., 2020; Gopal et al., 2021; Basuony et al., 2021; Ghaderizefreh and Hoover, 2018), barricades (Nikou and Maslov, 2022; Ranadewa et al., 2021), and advantages to learner (Aboagye et al., 2020; Gopal et al., 2021; Nikou and Maslov, 2022; Basuony et al., 2021; Rameez et al., 2020) significantly influence students' satisfaction. However, challenges has insignificant and negative influence on students' satisfaction (β = –0.05, p > 0.05). Thus, H4 is not supported, as shown in Figure 2. The result is not in line with Hettiarachchi et al. (2021), who reported a negative but significant impact of challenges of e-learning on students' satisfaction.

Table 1 EFA and descriptive statistics

Constructs and scale items	*Variables*		*Communalities*	*Learning environment*	*Advantages to learner*	*Challenges*	*Barricades*	*Satisfaction*	*Mean value*	*Standard deviation*
				1	*2*	*3*	*4*	*5*		
Internet connectivity/bandwidth	V1	B1	0.811				0.871		2.821	1.266
Video streaming	V2	B2	0.852				0.884		2.880	1.245
Audio quality	V3	B3	0.799				0.851		2.990	1.258
Online learning is exciting	V4	S1	0.782					0.818	3.221	1.198
Online learning is enjoyable	V5	S2	0.782					0.818	3.168	1.206
Online learning is secure	V6	S3	0.523					0.659	2.997	1.234
Online learning is worth my time	V7	S4	0.600					0.715	3.317	1.237
Effectiveness of online learning	V8	S5	0.536					0.598	3.030	1.008
Punctuality of the teacher	V9	LE1	0.680	0.810					3.905	1.225
Appearance, i.e., enthusiasm and interest	V10	LE2	0.786	0.858					3.598	1.250
Communication/dissemination skills	V11	LE3	0.794	0.863					3.660	1.231
Presentation, i.e., clarity and understandability	V12	LE4	0.814	0.860					3.481	1.306
Contents quality	V13	LE5	0.785	0.855					3.595	1.250
Course coverage	V14	LE6	0.750	0.839					3.581	1.295
Responsiveness, i.e., question and answers	V15	LE7	0.763	0.852					3.565	1.289
Feedback quality, i.e., timely and helpful	V16	LE8	0.785	0.855					3.495	1.319
Quality of evaluation/grading	V17	LE9	0.742	0.829					3.515	1.319

Table 1 EFA and descriptive statistics (continued)

Constructs and scale items	*Variables*		*Communalities*	*Learning environment*	*Advantages to learner*	*Challenges*	*Barricades*	*Satisfaction*	*Mean value*	*Standard deviation*
				1	*2*	*3*	*4*	*5*		
Learning environment, i.e., welcoming and inclusive	V18	LE10	0.772	0.825					3.465	1.360
Offering convenience/flexibility	V19	A1	0.662		0.793				1.903	1.672
Promotes participation and interaction	V20	A2	0.705		0.815				1.639	1.466
Contributes effective communication	V21	A3	0.707		0.813				1.656	1.482
Meets individuals learning needs	V22	A4	0.691		0.807				1.664	1.488
Easy accessibility	V23	A5	0.640		0.779				1.932	1.691
Cost saving, i.e., material and travel	V24	A6	0.519		0.699				2.183	1.826
A mindset of teachers/administrators	V25	C1	0.582			0.753			3.980	0.965
Assessment and examinations	V26	C2	0.655			0.809			4.061	0.995
Transparency	V27	C3	0.703			0.837			3.925	1.023
Quality of learning	V28	C4	0.688			0.826			4.007	1.046
Resources/devices availability	V29	C5	0.565			0.739			4.057	1.058
Eigenvalues				10.176	3.537	3.000	2.280	1.483		
% of variance explained				35.088	12.196	10.346	7.862	5.114		
Cumulative % of variance explained				35.088	47.284	57.630	65.491	70.605		
Cronbach's alpha				0.906	0.889	0.854	0.891	0.855		

Figure 1 Confirmatory factor model for students' satisfaction with online learning (see online version for colours)

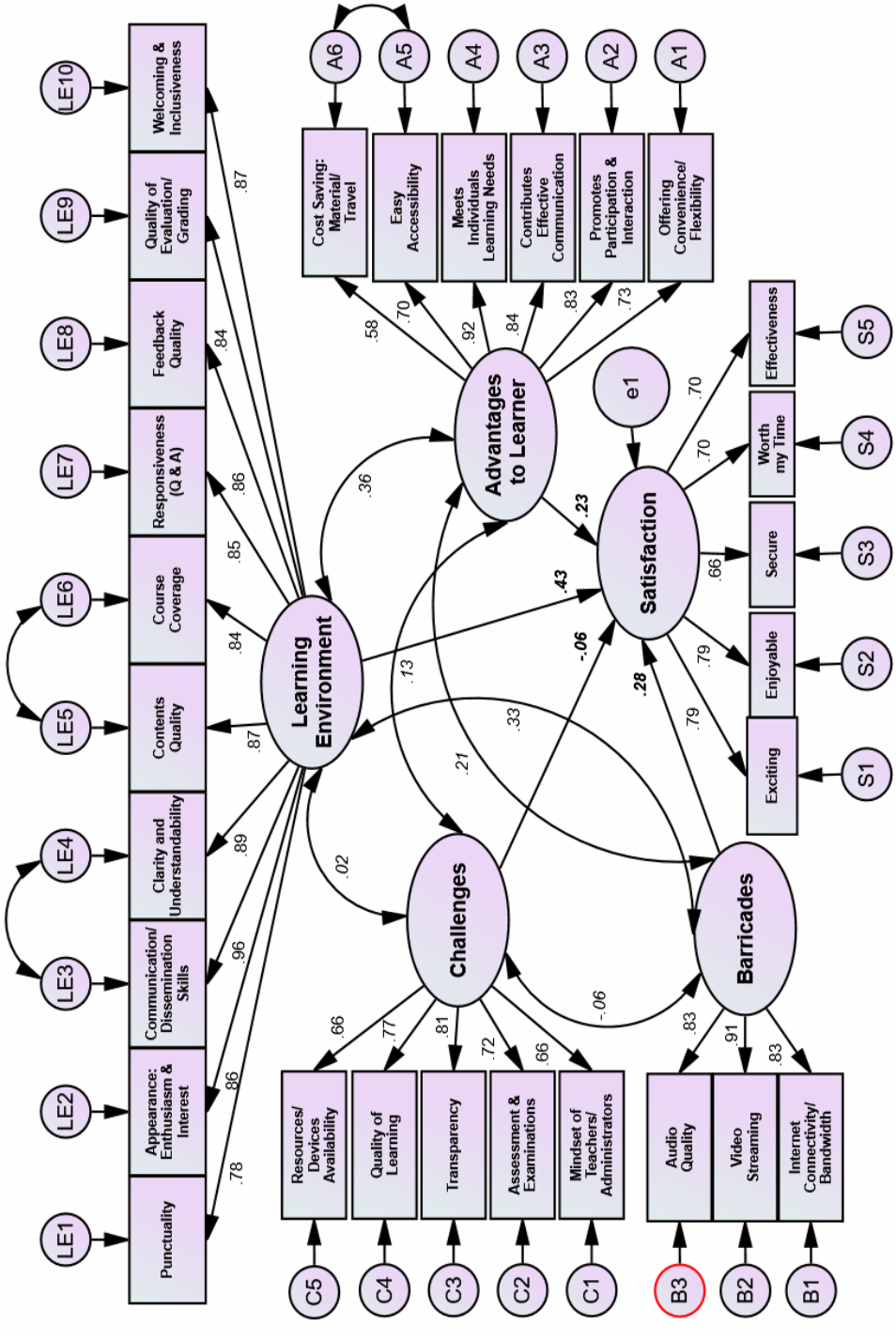


Table 2 Various measures of goodness-of-fit indices

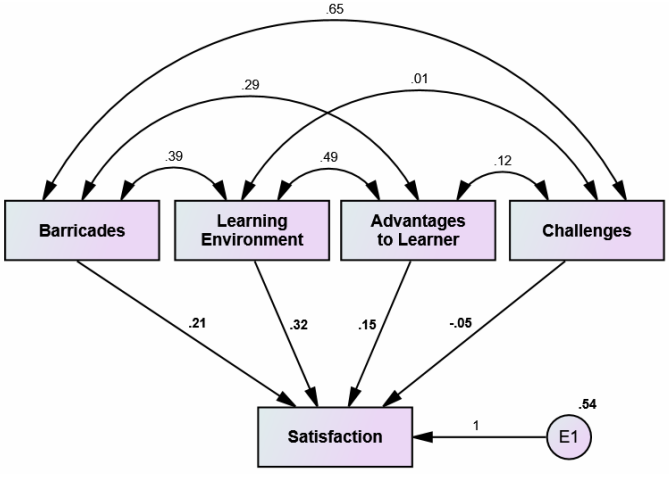
CFI		*RSMEA (< 0.08)*			*SRMR*
(> 0.95)	LO 90	M	HI 90	PCLOSE	(< 0.10)
0.991	0.022	0.024	0.026	1.00	0.024
CFI	*TLI*	*GFI*	*AGFI*	*RFI*	*IFI*
(> 0.95)	(> 0.95)	(> 0.95)	(> 0.95)	(> 0.95)	(> 0.95)
0.991	0.989	0.978	0.972	0.982	0.991

Table 3 Mean value, standard deviation, and correlation among factors

Constructs	*Mean value*	*Standard deviation*	*Students' satisfaction*	*Learning environment*	*Advantages to learner*	*Challenges*	*Barricades*
Students' satisfaction	3.14	0.937	*1*				
Learning environment	3.58	1.123	0.531**	*1*			
Advantages to learner	1.82	1.291	0.378**	0.337**	*1*		
Challenges	4.01	0.808	–0.033	0.013	0.115**	*1*	
Barricades	2.89	1.138	0.419**	0.303**	0.197**	–0.062	*1*

Note: Significance at: **0.01 (two-tailed).

Figure 2 Path model (see online version for colours)



5 Conclusions

This study was intended to develop the indicators of online learning from the perspective of students' perception of HEIs in northern India during lockdown due to the COVID-19 pandemic. The present study is the extent of previous studies measuring the students'

perception of online learning in COVID-19 situation (Djuwandi et al., 2022; Nikou and Maslov, 2022; Hettiarachchi et al., 2021; Ranadewa et al., 2021; Al-Nasa'h et al., 2021; Basuony et al., 2021; Gopal et al., 2021; Duraku and Hoxha, 2020; Rameez et al., 2020; Nambiar, 2020; Aboagye et al., 2020). The results show that students' satisfaction with online learning is composed of four factors, i.e., learning environment, advantages to learner, challenges, and barricades. An online survey of 2597 students of HEIs geographically spread across northern India's respondents. SEM was applied to 29 items and resulted in five factors: learning environment, advantages to learner, challenges, barricades, and students' satisfaction in online learning. Results revealed that learning environment, barricades, and advantages to learner are positively and significantly correlated with students' satisfaction, whereas challenges had a negative and insignificant correlation with students' satisfaction. Most notably, the impact of learning environment on students' satisfaction is most followed by barricades, advantages to learner, and challenges. The association of items under various factors of the learning environment (Johnson et al., 2000; Ellis and Calvo, 2006; Martin and Bolliger, 2018), advantages to learner (Bawa, 2016; Rios, 2019), and challenges in online learning (Muilenburg and Berge, 2005), barricades (Muilenburg and Berge, 2005; Nagar, 2020), and satisfaction (Muilenburg and Berge, 2005) are in confirmation to the existing research on assessment of students' perception towards adopting e-learning.

The learning environment is the outcome of the tangible and intangible aspects related to the teacher, course content, and the concentration and interest of the learner. The learner's advantages are cost-effectiveness, time, accessibility, flexibility, and convenience. The control over the mindset of teachers/administration, assessment, quality of learning, resource availability, and transparency is a challenge in online learning. Internet connectivity/bandwidth, video streaming, and audio quality are identified as barricades in online learning. Students' satisfaction with online learning is measurable from the psychological feeling of excitement, enjoyment, data security, the worthiness of time, and effectiveness. Online learning will develop more due to the psychological impact of lockdown on technological infrastructure development, associated advantages of online learning, and new government policies. Online education mode has been introduced and was in a growing phase before lockdown in various institutions at various levels. Online mode as a limited option in lockdown due to the COVID-19 pandemic kept the wheel of learning moving. During the lockdown period, the student's psychology reflects online learning as exciting, enjoyable, and secure, worth time, and effective is in confirmation (Muilenburg and Berge, 2005). The online mode of education is projected to increase its stake and support the regular mode post lockdown. The student's satisfaction and identification of various factors contributing to satisfaction in terms of advantages, barriers, challenges, and learning environment will help develop online education. The outcome of the present study will act as inspiration for future studies and a helping tool to add to advantage, remove barriers, overcome challenges and improve the learning environment. This study has a few limitations also. A purposive sampling technique was applied to collect the data in the present study. Still, this sampling method does not accurately represent the entire student population of HEIs as it is a non-probability sampling method. The time skyline of the present study was cross-sectional, considering the availability of restricted resources for this research. Future research should examine the students from HEIs of other regions of India to increase the validity of the survey instrument. Future research may examine the students' perception of e-learning from developing countries and other areas of the country, a

longitudinal study may also be conducted in the future, and a comparison can be made between the conventional classroom and online modes of education. Moreover, future research should analyse the students' perception of e-learning adoption in HEIs and compare it with the present study results to further validate the findings. Additionally, the testing of the proposed instrument in normal scenarios is proposed for future study.

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