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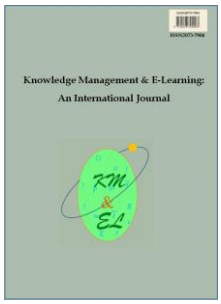

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Demystifying the effectiveness of emergency remote teaching during global pandemic: Evidence from India

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Abstract: Given the adverse impacts of the global pandemic COVID-19 on higher educational institutions worldwide, this study aims to examine the effectiveness of emergency remote teaching (ERT), especially in the developing country context, India. In addition, this study investigates the antecedents and consequences of academic performance and explores social media use as a moderator in these relationships. A carefully crafted survey instrument was distributed. Data was collected from 719 respondents from the affiliated arts and science college of a renowned university in southern India. After checking the psychometric properties of the constructs using the Smart Partial Least Squares (Smart-PLS) of structural equation modelling, and hierarchical regression was used to test the hypothesized relationships. The results of this research indicate that course content, instructor-learner interaction, and student expectation are positively associated with academic performance; social media use moderate the relationship between (i) course content and academic performance, (ii) student expectation and academic performance, and (iii) learning platforms and academic performance. The results also support the positive relationship between academic performance and students' satisfaction with ERT.

Keywords: Emergency remote teaching; Instruction quality; Course design; Course content; Instructor-learner interaction; Student expectation; Academic performance; Student satisfaction with online course

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1. Introduction

The COVID-19 global pandemic has brought phenomenal metamorphosis in the functioning of higher educational institutions (HEI) worldwide (Aguliera & Nightengale-Lee, 2020; Conrad et al., 2022; Chen et al., 2022; Sivagnanam et al., 2022; Sucu & Çakiroğlu, 2022). Along with other sectors, HEI has been the worst hit as the classes were initially canceled during the lockdown and restored by moving to virtual teaching-learning (Besser et al., 2022; Bruinen de Bruin et al., 2020; Khan, 2021). Apart from the health hazards, the transition has created multifarious problems in developing countries: lack of adequate infrastructure, unpreparedness for the emergency remote teaching (ERT), and lack of training in web-based education and learning environment (Rana et al., 2022; Roy et al., 2020). Moreover, since students' academic success depends on pedagogical, methodological, and strategic approaches, the ERT requires a concerted effort by administrators (Khan, 2021).

During the pre-pandemic era, e-learning was considered an optional supplement to in-class, face-to-face teaching, and many developed countries used a 'blended' system of education (Khan, 2021; Zhang et al., 2022). However, the global pandemic triggered the remarkable transformation of educational institutions to adopt e-learning as a rule but not as an exception (Marinoni et al., 2020). This entails the digital transformation of the teaching-learning environment whereby the students rely more on virtual mode (Baloran, 2020; Greenhow & Galvin, 2020). As a result, the institutions had to invest considerable monies in building the information technology infrastructure to facilitate web-based instructional pedagogies (Hendal, 2020; Zhou et al., 2020). At the same time, the faculty and students were forced to adjust quickly to the new learning environment. Though such overnight change was easy for developed countries, it became a challenge to developed countries such as India (D'Souza et al., 2022).

Though initially, there were some hiccups while implementing the web-based teaching in India, and it took some time to adjust to this new mode of delivering the lectures, gradually, students, faculty, and administrators adjusted to the unprecedented

change. In light of this, this study attempts to investigate the effectiveness of this emergency remote teaching (ERT) by focusing on the performance and satisfaction of students during this global pandemic. As education plays a critical role in the development of any nation, it is essential to see how the educational institutions have learned to cope with the global pandemic and effected change in the system (Vadakalu Elumalai et al., 2020). In fact, in addition to challenges, the global pandemic has created opportunities of exploring the benefits of web-based teaching, which is considered a blessing in disguise (Looi, 2022). In a short period, several researchers have documented the effects of ERT in educational institutions worldwide (Almaiah et al., 2020; Chen et al., 2022; Ng, 2022; Talidong & Toquero, 2020). Some scholars contend that the faculty and students need to acquire special skills and specialized technical knowledge to during the post-pandemic period (Alhashem et al., 2022). Several studies conducted in various countries: Sri Lanka (Dassanayaka et al., 2022), Bosnia and Herzegovina and France (Goncharuk & Cirella, 2022), Pakistan (Mushtaque et al., 2022), documented that both teachers and students need to be equipped with the on-line learning as resilient strategies to continue to strive in the pandemic environment.

Most of the earlier studies focused on the problems associated with the transition from face-to-face to ERT, and relatively few studies attempted to analyze the effectiveness of changing the landscape of the teaching environment, with some exceptions (Gopal et al., 2021). This study primarily focuses on demystifying the efficacy of ERT, after prolonged web-based teaching, especially in the Indian context. This study aims to answer the following research questions (RQs):

RQ 1: What are the predictors of student academic performance in ERT?

RQ 2: How does social media moderate the relationship between instruction quality, course design, course content, instructor-learner interaction, student expectations, learning platform, and student academic performance?

RQ 3: How does student academic performance relate to student satisfaction with ERT?

This study makes five significant contributions to the growing literature on online education. First, the study investigated the effectiveness of ERT introduced in India because of a global pandemic that was hit sometime in March 2020. This study was conducted 18 months after the introduction of ERT to see how effective it was in influencing the academic performance of students. The findings suggest that course content, instructor-learner interaction with students, and learning platforms play a vital role in enhancing students' academic performance. Second, the study found that social media use by the students would help increase their academic performance, primarily if they use networking for educational purposes. Third, this study underscores the importance of academic performance as a strong predictor of students' satisfaction with ERT. Fourth, the pandemic created an opportunity for developing countries (such as India) to introduce the online system of teaching, which was non-existent in the Indian educational system. Fifth, the conceptual model developed and tested, especially in the Indian context, is the first of its kind to demystify the effectiveness of ERT.

2. Literature review

The literature on assessing students' academic performance is vast and exhaustive (Almaiah et al., 2020; Bao & Zhang, 2012; Black & Kassaye, 2014; Vadakalu Elumalai et al., 2020). Most of the earlier scholars identified some of the essential ingredients of

academic performance: course design, course content, instructor characteristics, quality of instruction, learning tools, feedback process, the educational interest of students, etc. (Almaiah & Alyoussef, 2019; Gopal et al., 2021; Khan, 2021). While assessing academic performance, researchers focused on face-to-face and online teaching (Arbaugh, 2000; Elliott & Shin, 2002; Kauffman, 2015).

After the global pandemic, as the educational institutions were switched to the online mode of teaching (ERT), not many studies were available to assess the effectiveness of ERT. However, all available evidence suggests that online education became an 'emergency' rather than an 'option'. Under these circumstances, only sparse research was available when we conducted this study. For example, Gopal et al. (2021) ran one of the latest studies in India. Similarly, Bao conducted one study in China (2021). Gopal et al. (2021) examined factors affecting students' satisfaction and performance regarding online classes during the pandemic period of COVID–19. The results showed that instruction quality, course design, prompt feedback, and expectation of students positively impact students' satisfaction, and further student satisfaction ultimately impacts students' performance. However, Gopal et al. (2021) did not study the effect of these variables on academic performance. Barbera et al. (2013) examined the factors influencing student satisfaction and perceived learning in online courses. Some of the earlier studies found that course design and learning content are essential indicators of e-learning (Lin & Chiu, 2007). In a study conducted in Hail University, it was found that understanding the perceptions of faculty and students about the distance learning during the COVID-19 pandemic (Abdullah Alkhabra, 2022).

Some researchers have empirically examined the perception of students in southwest Nigeria on online teaching during COVID-19 and found that the students get adversely affected by the power supply and unstable network (Oladele et al., 2022). In another study conducted, during the global pandemic, among faculty members in Pakistan, it was found that personal innovation and quality of services significantly impact the online learning environment (Asghar et al., 2021). While the pandemic created problems, some scholars have pointed out the potential benefits of online teaching regarding flexible scheduling and new ways of learning through digital technologies (Weldon et al., 2021). Chang and Hwang (2018) documented that the use of smartphones has supported students in medical schools, and during the pandemic, smartphones became the order of the day (Yasuda, 2021).

Literature review also reveals that some earlier studies focused on identifying factors leading to student satisfaction (Kupczynski et al., 2011), whereas others studied academic performance (Bangert, 2006). About online courses, some researchers found the factors related to student engagement in learning: a sense of community, instructor involvement, life characteristics and prior experiences, interaction, learning styles, and motivation (Bhandarkar et al., 2021). Studies on ERT unpacked several e-learning challenges (Anthony Jnr & Noel, 2021; Kamysbayeva et al., 2021), and emphasized e-learning usability and teacher behavior (Dahleez et al., 2021), and documented that student satisfaction is an indicator of quality of education (Junça Silva et al., 2022). In one of the recent studies conducted in India, Lavuri et al. (2019) documented that social networking plays a vital role in academic performance. On the contrary, Alsulimani and Sharma (2019) reported that social media did not positively affect academic performance. The results are somewhat mixed concerning the use of social media in educational settings. Though the social media is expected to have a positive effect on academic performance, there is mounting evidence that social media plays a negative role (Borgohain & Gohain, 2020), as documented in several studies conducted in China (Koranteng et al., 2019), Ghana (Owusu-Acheaw & Larson 2015), Vietnam (Pham &

Dau, 2022), and Afghanistan (Mushtaq & Benraghda, 2018), India (Balakrishnan et al., 2022). Some researchers studied the emotional stress and technostress experienced by teachers during COVID-19 pandemic (Dahabiyeh et al., 2022). However, there is a consensus among the researchers that continuous intention, satisfaction, and valuable information are essential factors influencing students' academic performance and satisfaction (Maqableh et al., 2021).

3. Hypotheses development

3.1. Instruction quality and academic performance

Students' academic performance depends on the quality of instruction by the faculty, in addition to innovativeness, trust, and the ability to disseminate knowledge in educational institutions (Salloum et al., 2019). Past researchers found a positive association between instruction quality academic performance and student satisfaction (Kauffman, 2015; Park & Choi, 2009; Tirrell & Quick, 2012). Yukselturk and Bulut (2007) found in their study that one of the strong predictors of student academic success is the instruction quality of the faculty members. Some recent studies documented that low quality of instruction leads to decreased performance, and high quality is associated with student satisfaction and academic performance (Gopal et al., 2021; Murillo & Jones, 2020). Based on available empirical evidence and logos, we offer the following hypothesis:

H1: Instruction quality is positively and significantly related to academic performance

3.2. Course design and academic performance

Designing online courses is an essential ingredient of successful teaching. Designing courses should entail shared understanding between the faculty and students to make the learning effective. Some studies found a heutagogical approach where learning is self-determined, and the student is the central focus (Aguilar, 2020; Majanja, 2020). Since online learning is radically different from face-to-face learning, the course design should be aligned to students' learning styles (Bangert, 2006; Black & Kassaye, 2014). The effective learning environment in ERT requires webinars that allow prompt feedback from the students, facilitate constant interaction and enable the students to complete the assignments on time (Gopal et al., 2021). Students comfortable with the course design are likelier to perform well than those whose learning styles do not match the course design. Based on the abundant evidence that course design is the predictor of academic performance, we offer the following hypothesis:

H2: Course design is positively significantly related to academic performance

3.3. Course content and academic performance

Couse content is the heart of any academic program. Extant research reported that lack of quality in the course content and lack of adaptability of the content to the requirements of the students are the primary reasons for the failure of teaching (Almaiah & Almulhem, 2018). Researchers also documented that the alignment of course content with the requirements of students' learning needs is essential for superior academic performance (Almaiah & Alyoussef, 2019; Ozudogru & Hismanoglu, 2016; Voogt et al., 2013). The

delivery of course content is indispensable for meeting students' learning goals—poor delivery of course content results in low academic performance and student satisfaction. Moving the course content from face-to-face to online is inadequate for academic performance (O'Dea & Stern, 2022). Recent studies conducted during the global pandemic revealed that pragmatic and quality-oriented course content is vital for improving academic performance (Krishnamurthy, 2020; Murillo & Jones, 2020). Thus, based on the available empirical evidence and intuitive appeal, we offer the following hypothesis:

H3: Course content is positively significantly related to academic performance

3.4. Instructor-learner interaction and academic performance

For successful content delivery, instructors' interaction with the students at regular intervals is significant. Teaching is not a one-way street; the quality of communication and interaction of teachers with the students is indispensable for learning (O'Dea & Stern, 2022).

According to Shale and Garrison (1990), "in its most fundamental form, education is an interaction among instructor, student, and subject content" (p.1). Several researchers in the past reported that interaction is essential for student success and the effectiveness of web-based and computer-mediated distance education (Bruning, 2005; Kim et al., 2005; Thorpe & Godwin, 2006). Irrespective of whether the classes are held virtually or face-to-face, instructors need to engage in conversation with the students to get feedback on whether they are learning the material as desired (Bangert, 2006). Sher (2009) evidenced that teacher-student and student-student interactions enable students to remember effectively. One of the recent studies demonstrated that learning in online courses requires the instructor's connectedness with the students (Martin et al., 2018). Based on the above abundant empirical evidence in support of the interaction of the teacher with the students, we offer the following hypothesis:

H4: Instructor-learner interaction is positively significantly related to academic performance

3.5. Student expectation and academic performance

The primary receiver of education is 'student', and it is essential to understand the students' expectations from teaching. One challenge influencing ERT's effectiveness during the pandemic is meeting the student's expectations. A sudden shift in the teaching-learning environment caused a radical change in the expectations of students, and Almaiah et al. (2020) found that the effectiveness of the e-learning environment depends on the alignment of students' expectations with the teaching. Prior research found a positive association between students' satisfaction expectations (Schwarz & Zhu, 2015) and teachers' need to be trained to understand the expectations of students (Gold, 2011). In a recently conducted in India on 544 undergraduate and graduate business students, researchers found that students' expectations are positively related to student satisfaction (Gopal et al., 2021). Based on the above, we hypothesize the following:

H5: Student expectation is positively significantly related to academic performance

3.6. Learning platform and academic performance

In web-based teaching, the learning platform plays a vital role in student performance (Almaiah & Almulhem, 2018). After the global pandemic, several web-teaching platforms came into vogue, including Google Meets, Google Classroom, Zoom, Microsoft Teams, etc. The success of web-teaching largely depends on the adaptability of these platforms to the technical facilities available in respective educational institutions. The more quickly the students and faculty adapt to these platforms, the more effective they will be the learning (Dhawan, 2020; Favale et al., 2020). Some researchers contend that cloud technology is helpful for web-based teaching and the instructors always try to find different learning platforms depending on the flexibility and adaptability (Bao, 2020; Kim & Ekachai, 2020). Therefore, it is more likely that an appropriate learning platform enhances students' learning and academic performance. Based on the intuitive logic and available empirical evidence, we offer the following hypothesis:

H6: Learning platform is positively significantly related to academic performance

3.7. Academic performance and online satisfaction

Student satisfaction is defined as "the favorability of a student's subjective evaluation of the various outcomes and experiences associated with education. Student satisfaction is being shaped continually by repeated experiences in campus life" (Elliott & Shin, 2002: p. 198). Student satisfaction in academic settings is a multi-dimensional and complex construct consisting of satisfaction with infrastructure, course load, administrative policies, the institution's attractiveness, positive outlook on life, etc. (Marzo-Navarro et al., 2005). Most importantly, the course design, quality of instruction, pedagogical tools, and student interaction with teachers are reflected in the academic performance is a precursor to student satisfaction. Especially in web-based teaching, academic performance is the most crucial factor leading to satisfaction (Appleton-Knapp & Krentler, 2006). Students are labeled as 'customers', and hence student satisfaction is the essential determinant of the success of educational institutions (Browne et al., 1998; Teo & Wong, 2013; Zeithaml, 1988). Educational institutions periodically conduct student satisfaction surveys to make any changes in the curriculum and meet the changing demands stemming from the environment (Ten Eyck et al., 2009; Witowski, 2008). As performance is a pre-driver of satisfaction, we offer the following hypothesis:

H7: Academic performance is positively significantly related to online class satisfaction

3.8. Social media use as a moderator

In the present-day digital world, social plays a vital role in everyone's lives, including students. While individuals constantly use social media platforms for exchanging their viewpoints, ideas, news, and opinions about the products and brands they consume and use, the utility of social media in educational institutions cannot be ignored. Regarding academics, social media helps students communicate with others to complete group assignments, term papers, and projects and facilitates performance (Mushtaq & Benraghda, 2018). Extant research revealed that social networking using social media plays a vital role in education (Azizi et al., 2019; Greenhow & Robelia, 2009; Yu et al., 2010). However, some researchers documented the negative effect of social networking when the students use social media for non-academic purposes (Abbas et al., 2019; Azizi et al., 2019; Kolhar et al., 2021). It is expected that during the global pandemic,

individuals in general and students, in particular, have more time to spend on social networking (because of frequent lockdowns and mandatory social distancing rules). At the same time, since academic performance is equally essential for their career, some scholars provided strong evidence that students focus on using social media productively (Yu et al., 2010).

In this study, we propose to see the moderating effect of social media use in influencing the strength of the relationship between the independent variables and academic performance. Through social networking, students improve learning and draw the latest information that helps them in academic performance. When instruction quality positively affects academic performance, students' productive and educational use of social media is more likely to increase academic performance. Similarly, when the course design is communicated to the students on virtual platforms, sharing information through social networking helps improve academic performance. Applying a similar logic to other variables, we offer the following exploratory moderation hypotheses:

H1a-H6a: social media use positively moderates the relationship between

a) Instruction quality and academic performance (H1a),

b) Course design and academic performance (H2a),

c) Course content and academic performance (H3a),

d) Instructor-learner interaction and academic performance (H4a),

e) Student expectation and academic performance (H5a), and

f) Learning platform and academic performance (H6a).

The conceptual model is presented in Fig. 1.

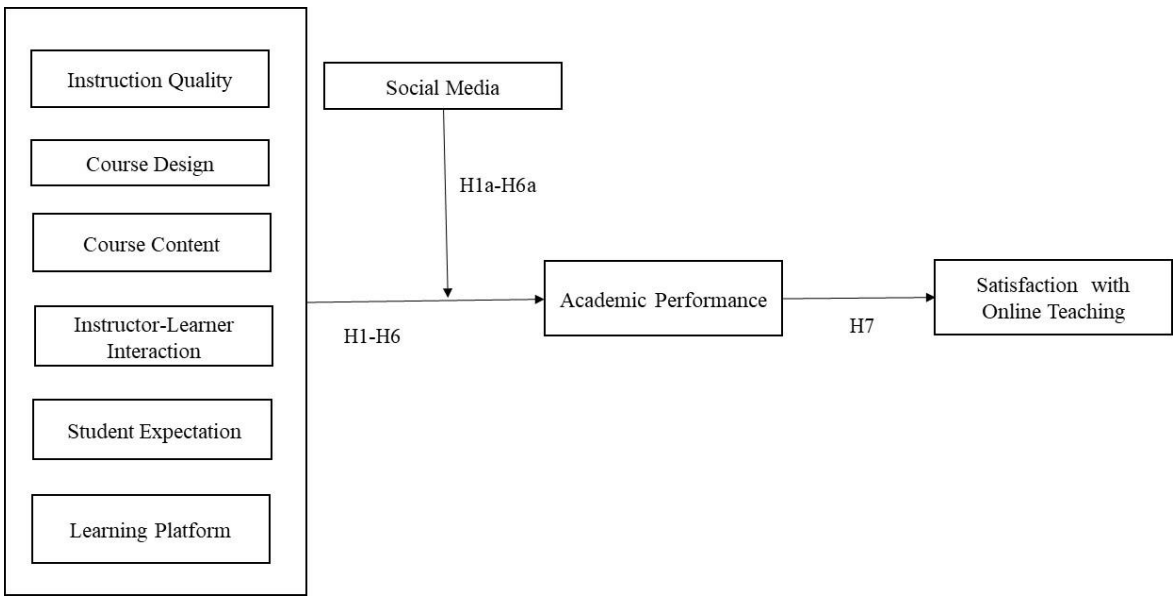

Fig. 1. Conceptual model

4. Methods

4.1. Sample and data collection

The present study aims to examine college students' academic performance and satisfaction with students with ERT during the global pandemic. The ERT started sometime around March 2020 worldwide, including in India; we wanted to see the effectiveness of ERT after eighteen months. A survey instrument was used to collect data from students pursuing undergraduate and graduate courses in a university located in the southern part of India. The data was collected by personally explaining the purpose of the study and asking the students to participate in the study. Because of frequent lockdowns and mandatory social distancing problems, we collected data using the google form, which has become a routine practice for researchers conducting during the pandemic (Lonska et al., 2021). In all, we received 719 respondents that we used in the analysis. We checked for non-response bias by comparing the first hundred respondents with the last 100 respondents and found no statistical differences between these two groups.

4.2. Measures

All independent and dependent variables were measured using the well-established constructs in the literature. The items were measured on five-point Likert scale (1 representing strongly disagree and 5 representing strongly agree).

Instruction Quality was measured using seven items adapted from Bangert (2004). The sample item reads as: "The instructor communicated effectively", and the reliability coefficient Cronbach alpha for this measure was 0 .93. *Course design* was measured using six items adapted from Bangert (2004). The sample items read as: "The course was well organized" and the reliability coefficient for course design was 0.93. *Course content* was measured using six items adapted from Makokha and Mutisya (2016). The sample item reads as: "Proper learning materials provided in the e learning", and the reliability coefficient for course content was 0.92.

Instructor-Learner Interaction was measured using three items adapted from Barbera et al. (2013). The sample items read as: "All assignments were returned with useful feedback from the instructor", and the reliability coefficient for instructor-learner interaction was 0.89. *Student Expectation* was measured using five items adapted from Bangert (2006), and the sample items read as: "The instructor provided models that clearly communicated expectations for weekly group assignments." The reliability coefficient for student expectation was 0.91.

Learning Platform was measured using three items adapted from Barbera et al. (2013), The sample items read as: "All-important site content was easy to locate and identify", and the reliability coefficient for instructor-learner interaction was 0.89. *Social media use* was measured using seven items adapted from Mushtaq and Benraghda (2018). The sample items read as: "The usage of social media is useful in higher educational institutions, because they are an effective communication application.". The reliability coefficient for social media use was 0.953.

Academic Performance was using six items adapted from Wilson et al. (1997). The sample item reads as: "The online classes have sharpened my analytic skills", and the reliability coefficient for Academic Performance was 0.94. *Student satisfaction* with online classes was measured using six items adapted from Bangert (2006). The sample

items read as: "The online classes were valuable", and the reliability coefficient for course content was 0.95.

The study also used three control variables: gender, stream of study, and place of residence.

5. Analysis and results

5.1. Confirmatory factor analysis (CFA), discriminant validity, convergent validity, and reliability

By following the two-step process recommended by Anderson and Gerbing (1988), in the first step we tested the measurement model and did CFA, using Smart Partial Least Squares (Smart-PLS) software. The results of CFA are mentioned in Table 1a.

As shown in Table 1a, the factor loadings of all the constructs were well above the minimum level of 0.70, and the reliability coefficients (Cronbach's alpha) are higher than 0.70. Further, the composite reliability (CR) are within the acceptable levels. These statistics provide validity of the instrument. The Fornell-Larcker (1981) criterion of discriminant validity of the measures was presented in Table 1b. The Hetero Trait Mono Trait method of discriminant validity was presented in Table 1c.

Table 1a
Measurement properties (confirmatory factor analysis)

Variable	Alpha	CR	Standardized Loadings (λ_{yi})	Reliability (λ^2_{yi})	Variance ($Var(\varepsilon_i)$)	Average Variance-Extracted $\Sigma (\lambda^2_{yi}) / [(\lambda^2_{yi}) + (Var(\varepsilon_i))]$
Instruction quality	0.93	0.94				0.71
The instructor communicated effectively			0.86	0.74	0.26	
The instructor was enthusiastic about online teaching			0.84	0.70	0.30	
The instructor was concerned about student learning			0.86	0.74	0.26	
The instructor was generally respectful of student learning			0.85	0.72	0.28	
The instructor was accessible to me outside of the online course			0.81	0.66	0.34	
The instructor used Webinar to create a comfortable learning space			0.83	0.69	0.31	
The instructor personalized interactions with me whenever necessary			0.83	0.68	0.32	
Course Design	0.93	0.95				0.75
The course was well organized			0.85	0.71	0.29	
The course was designed to allow assignments to be completed across different learning environments			0.87	0.76	0.24	
The instructor facilitated the course effectively			0.87	0.76	0.24	
Webinar was used to create an efficient learning environment			0.88	0.77	0.23	
Webinar helped me to learn educational statistics more quickly			0.86	0.73	0.27	
The course was designed to allow me to take responsibility for my own learning			0.86	0.75	0.25	
Course Content	0.93	0.95				0.75
Proper learning materials provided in the e learning			0.82	0.67	0.33	
The supporting modules given in e learning for the content are simple to understand			0.87	0.76	0.24	

e-Learning enhance the student in critical thinking, analysis, problem solving			0.85	0.72	0.28	
Content was presented at an appropriate level for me.			0.89	0.78	0.22	
Content was relevant to the objectives of the course.			0.86	0.74	0.26	
Content was stimulating to me as a learner			0.87	0.76	0.24	
Instructor-Learner Interaction	0.90	0.93				0.83
All assignments were returned with useful feedback from the instructor.			0.92	0.84	0.16	
The instructor responded promptly			0.91	0.82	0.18	
The instructor provided individualized guidance that met my needs.			0.90	0.81	0.19	
Student Expectation	0.92	0.94				0.75
The instructor provided models that clearly communicated expectations for weekly group assignments.			0.85	0.72	0.28	
The instructor used good examples to explain statistical concepts			0.89	0.78	0.22	
The assignments for this course were of appropriate difficulty level			0.85	0.72	0.28	
The instructor used webinar design instructional materials that were understandable			0.87	0.75	0.25	
Our faculty are extremely good at explaining things to us			0.87	0.76	0.24	
Learning Platform	0.89	0.93				0.82
All-important site content was easy to locate and identify			0.91	0.82	0.18	
The site provided a clear means of obtaining technical help			0.93	0.86	0.14	
The media used were appropriate for the content			0.89	0.79	0.21	
Academic Performance	0.94	0.95				0.78
The online classes have sharpened my analytic skills			0.89	0.79	0.21	
Online classes really try to get the best out of all its students			0.88	0.78	0.22	
This course has helped me develop the ability to plan my own work			0.86	0.74	0.26	
Online classes have encouraged me to develop my own academic interests as far as possible			0.90	0.80	0.20	
Online classes have improved my written communication skills			0.87	0.76	0.24	
As a result of doing online classes, one feel more confident about tackling unfamiliar problems			0.89	0.79	0.21	
Satisfaction with Online Teaching	0.95	0.96				0.81
The online classes were valuable			0.90	0.81	0.19	
Taking the online classes increased my interest in educational statistics			0.92	0.84	0.16	
We are generally given enough time to understand the things we have to learn			0.92	0.84	0.16	
The online classes improved my understanding of educational statistics			0.90	0.80	0.20	
The online learning is the best learning experience I have ever had			0.87	0.76	0.24	
Overall, I am satisfied with the quality of this course			0.90	0.81	0.19	
Social Media Use	0.95	0.96				0.78
The usage of social media is useful in higher educational institutions, because they are an effective communication application			0.85	0.73	0.27	
Group discussions can be arranged with the experts using social media			0.87	0.76	0.24	
An appointment can be fixed with other subject experts through social media			0.88	0.77	0.23	
Social media site are helpful for the students' studies because students can receive announcements from lecturers and faculty			0.91	0.82	0.18	
The social media help in the students' studies because the students can discuss their assignments with friends.			0.89	0.78	0.22	
Using social media improves the interaction with classmates, lecturers and other subject experts			0.89	0.78	0.22	
social media facilitate the academic activities and coordinate with others			0.90	0.81	0.19	

Table 1b
Discriminant validity: Fornell-Larcker criterion

	1	2	3	4	5	6	7	8	9
1. Academic Performance	0.88								
2. Course Content	0.73	0.86							
3. Course Design	0.66	0.80	0.87						
4. Instructor-Learner Interaction	0.71	0.81	0.75	0.91					
5. Instruction Quality	0.60	0.74	0.78	0.73	0.84				
6. Learning Platform	0.66	0.74	0.72	0.71	0.63	0.91			
7. Satisfaction with Online Teaching	0.83	0.68	0.60	0.65	0.57	0.59	0.90		
8. Student Expectation	0.70	0.78	0.75	0.78	0.70	0.77	0.65	0.86	
9. Social Media Use	0.67	0.72	0.69	0.68	0.68	0.70	0.68	0.70	0.88

Table 1c
Discriminant validity: Hetero trait mono trait (HTMT) criterion

	1	2	3	4	5	6	7	8	9
1. Academic Performance									
2. Course Content	0.78								
3. Course Design	0.70	0.86							
4. Instructor-Learner Interaction	0.76	0.89	0.82						
5. Instruction Quality	0.64	0.79	0.84	0.80					
6. Learning Platform	0.72	0.82	0.79	0.79	0.69				
7. Satisfaction with Online Teaching	0.87	0.72	0.63	0.70	0.60	0.64			
8. Student Expectation	0.75	0.84	0.81	0.86	0.76	0.85	0.69		
9. Social Media Use	0.71	0.77	0.73	0.74	0.72	0.76	0.71	0.75	

Table 1d
Multicollinearity diagnosis

Indicator	VIF	Indicator	VIF	Indicator	VIF
AP1	3.788	CD6	2.782	SMU5	3.68
AP2	3.529	II1	2.967	SMU6	3.827
AP3	2.934	II2	2.693	SMU7	4.192
AP4	3.681	II3	2.506	IQ1	2.853
AP5	3.255	LP1	2.712	IQ2	2.508
AP6	3.699	LP2	3.12	IQ3	3.114
CC1	2.376	LP3	2.405	IQ4	2.932
CC2	2.955	SAT1	3.928	IQ5	2.281
CC3	2.501	SAT2	4.708	IQ6	2.496
CC4	3.294	SAT3	4.666	IQ7	2.463
CC5	2.984	SAT4	3.938	SE1	2.389
CC6	3.158	SAT5	3.347	SE2	3.048
CD1	2.802	SAT6	3.77	SE3	2.318
CD2	3.397	SMU1	2.832	SE4	2.77
CD3	3.058	SMU2	3.452	SE5	2.76
CD4	3.368	SMU3	3.499		
CD5	2.965	SMU4	4.179		

Note. Abbreviations: VIF = Variance Inflation Factor; AP = Academic Performance; CC = Course Content; CD = Course Design; II = Instructor -Learner Interaction; LP = Learning Platform; SAT = Satisfaction with online teaching; SMU = Social Media Use; IQ = Instruction Quality' SE = Student Expectation

We checked for multicollinearity by checking the variance inflation factor (VIF) values, and found that these values were less than 5.0, thus suggesting that ulticollinearity is not a problem with the data (Hair et al., 2011). The VIF values of the indicators of all the constructs were presented in Table 1d.

5.2. Descriptive statistics

The descriptive statistics: means, standard deviations, and correlations were presented in Table 2.

Table 2
Descriptive statistics: means, standard deviations and correlations

Variable	Mean	SD	1	2	3	4	5	6	7	8	9
1. Instruction quality	3.67	0.94	**0.84**								
2. Course design	3.68	0.93	0.78**	**0.87**							
3. Course content	3.64	0.94	0.74***	0.79***	**0.87**						
4. Instructor-Learner interaction	3.62	1.00	0.72***	0.74***	0.80***	**0.91**					
5. Student expectation	3.70	0.92	0.69***	0.75***	0.78***	0.78***	**0.87**				
6. Learning platform	3.67	0.96	0.63***	0.72***	0.74***	0.70****	0.76***	**0.90**			
7. Academic Performance	3.43	1.07	0.59***	0.65***	0.72***	0.70***	0.70***	0.65***	**0.88**		
8. Social media use	3.69	0.96	0.67***	0.68***	0.72**	0.67***	0.70***	0.70***	0.67***	**0.88**	
9. Satisfaction with online teaching	3.45	1.10	0.56***	0.59***	0.67***	0.64***	0.64***	0.58***	0.83***	0.67***	**0.90**

Note. ***$p < 0.01$. Numbers in the diagonals are the square roots of Average Variance Extracted (AVE) estimates

A preliminary analysis of correlations between the variables suggest that correlations ranged between 0.56 and 0.83. Since the correlations are high, it is essential to compare the correlations between the variables with the square root of AVE values to check for multicollinearity. If the correlations between the correlations are less than square root of AVEs of the variables it is suggested that multicollinearity is not a problem. In this research, the correlation between academic performance and satisfaction with online teaching was 0.83 which is less than the square root of AVEs of these variables (0.88 and 0.90 respectively).

For all other variables too, the correlations between the variables are less than the AVE values (Hair et al., 2011).

5.3. Common method variance (CMV)

As CMV is inherent in survey research in social sciences, it is essential to check for CMV. Following the suggestions from Podsakoff et al. (2003) we checked for CMV by performing a single-factor analysis and found that a single factor accounted for less than 30 percent variance. Secondly, we also performed latent variables method whereby we subjected all the indicators to one construct each time and found the inner VIF values of less than 3.3, thus suggesting that data is not contaminated by CMV (Kock, 2015).

5.4. Hypotheses testing

To test the hypotheses (H1-H6 and H1a-H6a), hierarchical regression was performed, and the results are presented in Table 3.

Table 3
Hierarchical regression results of the direct and moderator effects on academic performance

Variables	Column 1	Column 2	Column 3
Dependent Variable---→	Academic Performance	Academic Performance	Academic Performance
	Step 1	Step 2	Step 3
Control variables			
Gender	-0.054 (-1.446; .149)	-0.067*** (-2.884; 0.004)	-0.057***(-2.461; 0.014)
Stream	0.056 (1.472; 0.141)	.002 (0.071; 0.943)	.001 (0.035; 0.972)
Place of residence	.033 (0.868; 0.386)	-0.020 (-0.854; 0.393)	-0.026 (-1.118; 0.264)
Main variables			
Instruction quality		-0.061 (-1.471; 0.142)	-0.005 (-0.040; 0.968)
Course design		.036 (0.783; 0.434)	-0.024 (-0.149; 0.882)
Course content		.262*** (5.338; 0.000)	.695*** (3.738; 0.000)
Instructor-Learner interaction		.195*** (4.367; 0.000)	0.178 (1.074; 0.283)
Student expectation		0.165*** (3.651;0 .000)	-0.129 (-0.819; 0.413)
Learning platform		.073 (1.791; 0.074)	-0.212 (-1.445; 0.149)
Social Media Use		.201*** (5.334; 0.000)	0.003 (0.041; 0.968)
Moderators			
Instruction quality x Social Media Use			-0.091 (-0.429; 0.668)
Course design x Social Media Use			0.110 (0.410; 0.682)
Course content x Social Media Use			-0.780** (-2.446; 0.015)
Instructor-Learner interaction x Social *Media Use*			0.034 (0.125; 0.901)
Student expectation x Social Media Use			0.568** (2.121; 0.034)
Learning platform x Social Media Use			0.503** (2.109; 0.035)
R^2	0.007	0.617	0.629
Adj R^2	0.003	0.612	0.621
ΔR^2		0.610	0.012
F	1.665	114.097***	74.505***
ΔF		161.162***	3.879***
Df	3, 715	10,708	16,702

Note. Standardized regression coefficients are reported; "*t*" values and "*p*" values are in parenthesis ***$p < 0.000$; **$p < 0.05$

First, control variables were entered into the regression equation (see column 1 in Step 1) and the results reveal that none of the control variables was significant [(β_{gender} = -.054, p = 0.149), (β_{stream} = .056, p = .141) and place of residence ($\beta_{\text{place of residence}}$ = .033, p = .386)].

The main variables were entered in the second step of regression equation (column 2, Table 3). The regression coefficients of instruction quality (β = - 0.061, p = .142) and course design (β = 0.036, p = 0. 434) are not significant, thus not supporting H1 and H2. The beta coefficients of course content (β = 0.262, $p < 0.000$) instructor-learner interaction (β = 0.195, $p < 0.001$), student expectation (β = 0.165, $p < 0.000$) are significant, thus supporting H3, H4, and H5. The regression coefficients of learning platform (β = 0.073, p = 0.074) was positive but not significant, thus not supporting H6.

The model was significant and explains 61.7% of the variance in academic performance because of the main variables [F (10,708) = 114.097, $p < 0.001$; $R^2 = 0.617$, and adjusted $R^2 = 0.612$].

To test the moderation hypotheses, we followed the procedures outlined by Aiken and West (1991) and entered the moderation variables in Step 3 (Column 3 of Table 3). (*Check and improve the language of this sentence) The regression coefficient of interaction terms instruction quality and social media use ($\beta_{\text{instruction quality x social media use}} = -0.091$, $p = 0.668$) and of course design and social media ($\beta_{\text{course design x social media}} = 0.110$, $p = 0.682$) were not significant, thus not supporting H1a and H2a. The regression coefficient of interaction term course content and social media use was significant ($\beta_{\text{course content x social media use}} = -0.780$, $p < 0.001$), thus supporting H3a. The regression coefficient of multiplicative term between instructor-learner interaction and social media use was not significant ($\beta_{\text{instructor-learner interaction x social media use}} = .034$, $p = 0.901$), thus not supporting H4a. The regression coefficients of multiplicative terms between student expectation and social media use ($\beta_{\text{student expectation x social media use}} = 0.568$, $p < 0.05$) and learning platform and social media use ($\beta_{\text{learning platform x social media use}} = 0.503$; $p < 0.05$) were significant, thus supporting H5a and H6a. The interaction model was significant and explained 62.9% variance in the academic performance because of the interaction as well as main variables [(F (16,702) = 74.505, $p < 0.001$; $R^2 = 0.629$, and adjusted $R^2 = .621$, $\Delta F = 3.879$, $p < 0.001$; $\Delta R^2 = 0.012$].

The moderating effects are shown in Fig. 2, 3, and 4.

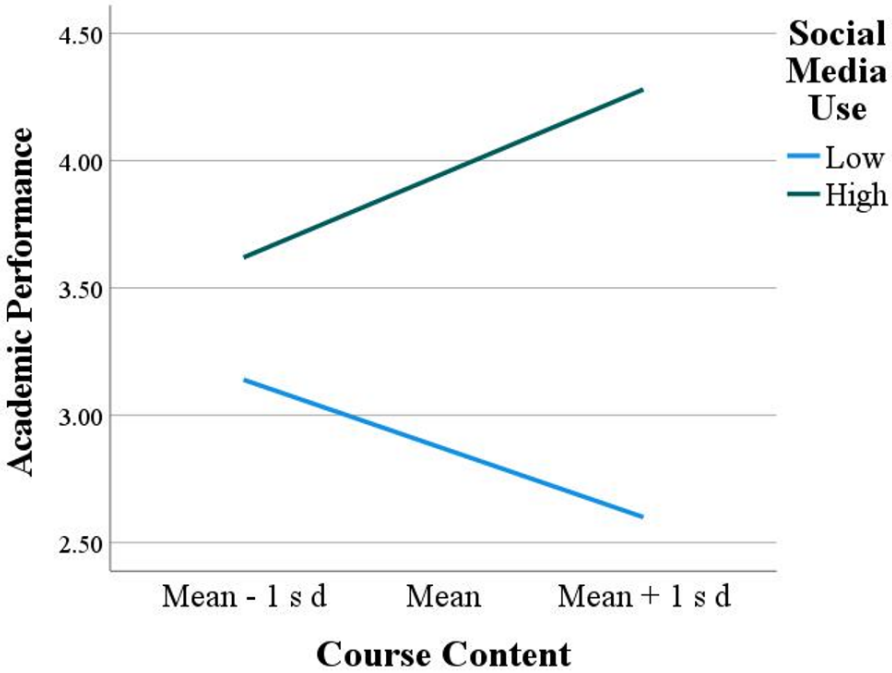

Fig. 2. Social media use as a moderator in the relationship between course content and academic performance

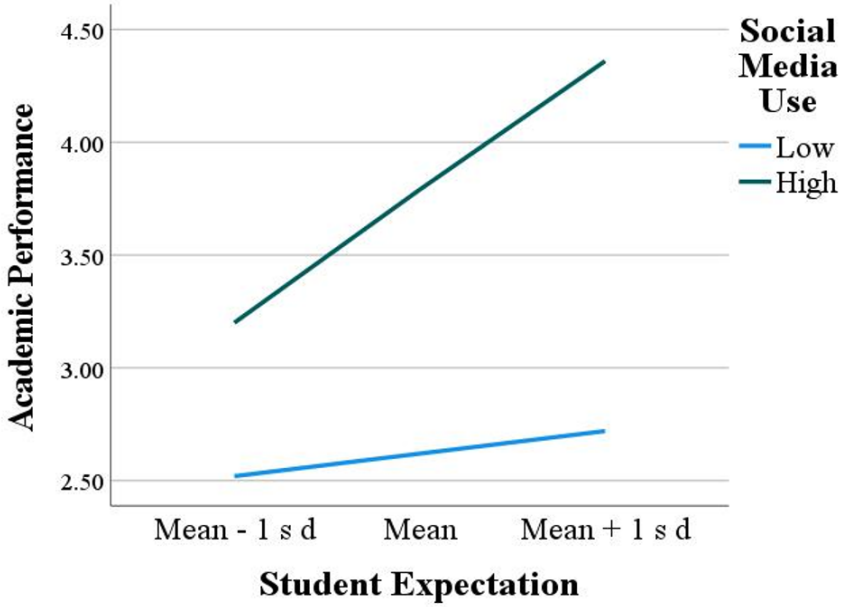

Fig. 3. Social media use as a moderator in the relationship between student expectation and academic performance

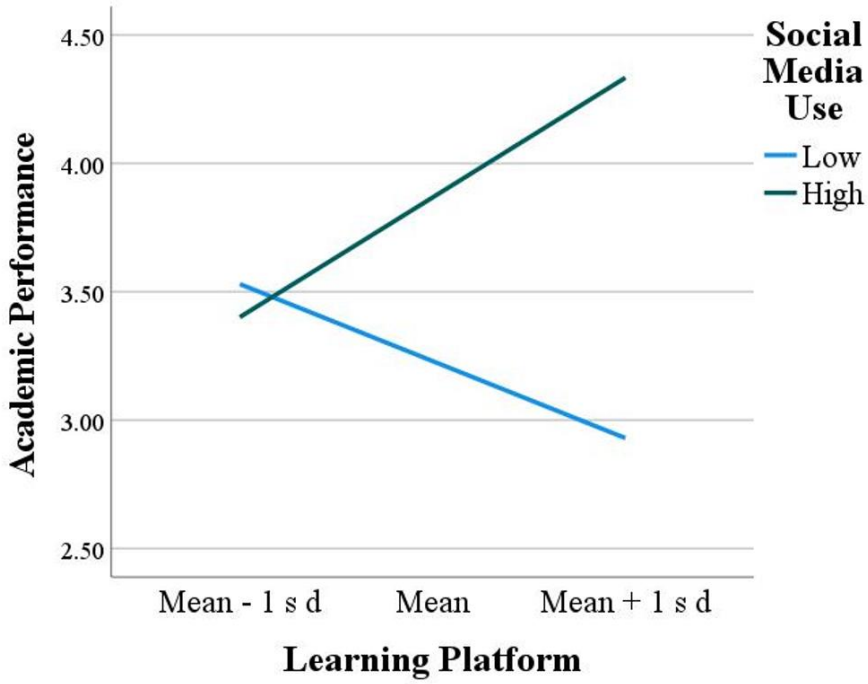

Fig. 4. Social media use as a moderator in the relationship between learning platform and academic performance

The interaction between course content and social media use (Fig. 2) show that the relationship is positive between course content and academic performance when social media use was high (the slope of the curve was positive). On the contrary, the relationship between course content and academic performance is negative when social media use is low (slope of the curve is negative). These results support H3a.

Fig. 3 shows the moderating effect of social media use between student expectations and academic performance. Higher levels of social media use are associated with increase in academic performance even when student expectations are low. When the student expectations increase from low to high, the academic performance increases at a rapid rate when social media use was high as compared to low social media use. These results render support to H5a.

The moderating effect of social media use in the relationship between learning platform and academic performance (shown in Fig. 4) reveal that higher levels of social media use are associated with a positive relationship and low levels of social media are associated with a negative relationship. These results support H6a.

5.5. Effect of academic performance on satisfaction with online teaching

Hypothesis 7 proposes that academic performance is positively associated with satisfaction of students with online teaching. The results of hierarchical regression showing the effect of academic performance on satisfaction are presented in Table 4.

Table 4
Hierarchical regression results of the direct effects on Satisfaction with online teaching

Variables Dependent Variable---→	Column 1 Satisfaction with online teaching Step 1	Column 2 Satisfaction with online teaching Step 2
Control variables		
Gender	-0.080* (-2.145; 0.032)	-0.044* (-2.161; 0.031)
Stream	0.046 (1.229; 0.219)	-0.007 (-0.323; 0.747)
Place of residence	0.028 (.754; 0.451)	-0.007 (-0.339; 0.735)
Academic performance		0.83*** (39.95; 0.000)
R^2	0.009	0.707
Adj R^2	0.005	0.703
ΔR^2		0.698
F	2.142	404.21***
ΔF		1598.48***
Df	3, 715	4, 714

Note. Standardized regression coefficients are reported; "t" values and "p" values are in parenthesis
***$p < 0.001$; *$p < 0.05$

As can be seen in Table 4, the control variables were entered in the equation first (step 1; column 1) and found that regression coefficient of gender was significant (β = -0.080, $p < 0.05$) and the regression coefficients of age and place of residence were not significant. The regression coefficient of academic performance on satisfaction of students with online courses was significant (β = 0.83, $p < 0.001$), thus supporting H7. The model is significant and explained 70.7% of variance in online class satisfaction because of independent variables including academic performance (R^2 = 0.707, adjusted R^2 = 0.703; F (4,714) = 404.21, $p < 0.001$; ΔR^2 = 0.698; and ΔF = 1598.48; $p < 0.001$].

Table 5
Summary of the results of hypotheses testing

Hypotheses	Result
H1. Instruction quality is positively and significantly related to academic performance	Not supported
H2. Course design is positively significantly related to academic performance	Not supported
H3. Course content is positively significantly related to academic performance	Supported
H4. Instructor-Learner interaction is positively significantly related to academic performance	Supported
H5. Student expectation is positively significantly related to academic performance	Supported
H6. Learning platform is positively significantly related to academic performance	Not supported
H7. Academic performance is positively significantly related to online class satisfaction	Supported
H1a. Social media use positively moderates the relationship between Instruction quality and academic performance.	Not Supported
H2a. Social media use positively moderates the relationship between course design and academic performance.	Not supported
H3a. Social media use positively moderates the relationship between course content and academic performance.	Supported
H4a. Social media use positively moderates the relationship between instructor-learner interaction and academic performance.	Not supported
H5a. Social media use positively moderates the relationship between student expectation and academic performance.	Supported
H6a. Social media use positively moderates the relationship between learning platform and academic performance.	Supported

The results of findings from this study are presented in Table 5. The path diagram (direct effects) was shown in Fig. 5.

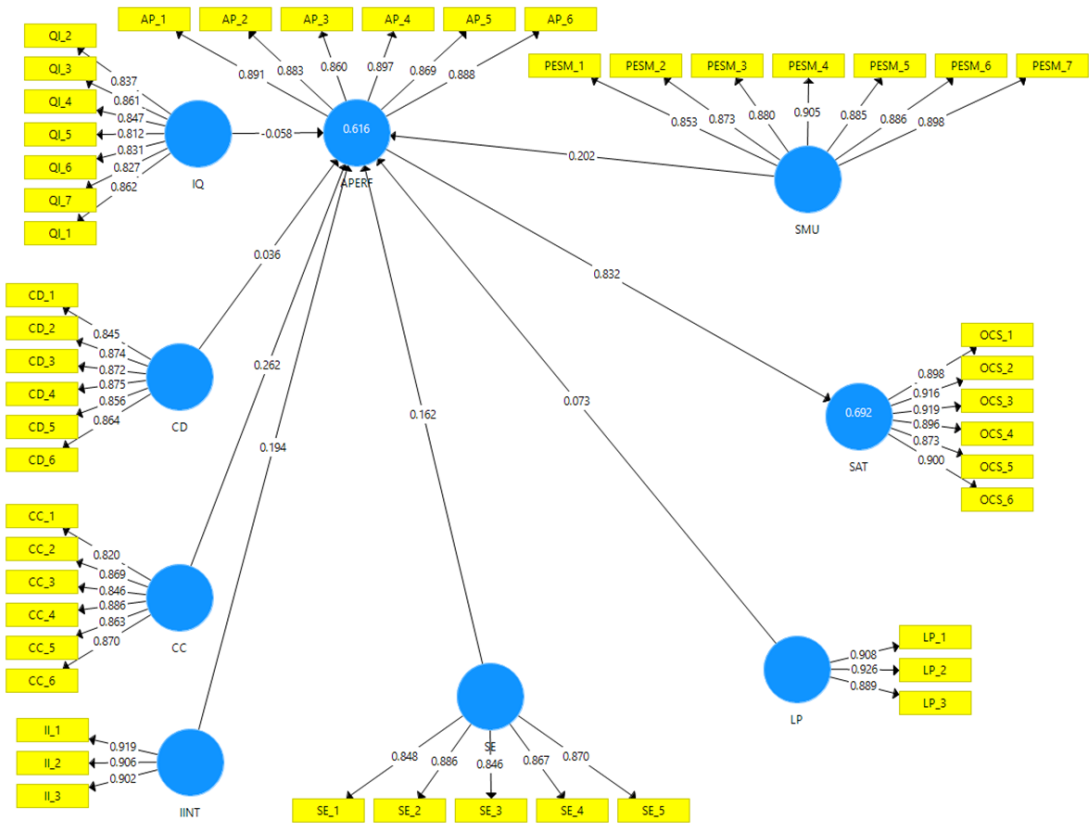

Fig. 5. Path diagram showing the direct effects

6. Discussions

In this study, a simple concept is constructed to examine the effectiveness of ERT from a developing country's (India) perspective. After verifying the psychometric properties of the survey instrument using the Smart PLS software of structural modelling, the hypotheses were tested using hierarchical regression. As a result, three of the direct hypotheses and three of the moderation hypotheses were supported.

The results indicate that instruction quality (Hypothesis 1) and course design (Hypothesis 2) are not associated with academic performance. However, the course content is positively related to academic performance (Hypothesis 3), and the finding is consistent with results from previous studies (Almaiah & Alyoussef, 2019; Voogt et al., 2013). The results also support the positive association of instructor's interaction with academic performance (Hypothesis 4); the finding supports the results from previous research (Kim et al., 2005; Martin et al., 2018).

The positive association of students' expectations with academic performance (Hypothesis 5) supported this research. This is consistent with what is expected during the global pandemic when expectations of students have undergone radical change. The literature also helps that students' expectations strongly predict their academic performance (Gopal et al., 2021; Schwarz & Zhu, 2015). This study did not find support for using the learning platform and academic performance (Hypothesis 6). As several learning platforms are available, institutions may be using learning platforms that are incompatible with students' requirements. A mismatch may also have harmful consequences. Surprisingly, this study did not find a negative relationship between learning platforms and academic achievement. One of the essential findings is that academic performance predicts student satisfaction with online teaching (Hypothesis 7). This finding is consistent with the past research in the literature (Ten Eyck et al., 2009; Witowski, 2008).

Regarding moderation effects, the results suggest that social media use moderated the relationship between course content (Hypothesis 3a), students' expectations (Hypothesis 5a), learning platforms (Hypothesis 6a), and academic performance. However, social media use did not show any interaction effect with instruction quality (Hypothesis 1a), course design (Hypothesis 2a), and instructor-learner interaction (Hypothesis 4a).

6.1. Theoretical implications

This research makes significant contributions to the literature on remote teaching and administrators in educational institutions. First, in developing countries like India, the lack of adequate technological infrastructure acted as a severe impediment when educational institutions had to make the unplanned and unprecedented shift to web-based teaching. It took nearly six to seven months to get used to the change in the teaching-learning platform, and slowly both faculty and students were getting used to ERT. This study demonstrated that course content plays a vital role in influencing the students' academic performance. Second, faculty interaction with students was considered crucial in affecting academic performance. This is expected during the pandemic when face-to-face interaction was impossible; faculty showed interest in interacting with the students through several web-based platforms (such as Google Meet and Zoom). Third, though it was challenging for faculty and students to adjust to the new environment, administrators enforced web-based teaching as a mandatory requirement. Finally, anecdotal evidence indicates that faculty and students were comfortable with ERT, as everyone is concerned

with protecting their health by following social distancing norms. Though it took some time for the deadly virus to enter Indian territory, the devastating effect of the virus in Europe and the USA has made the country's leaders realize the importance of imposing periodical lockdowns and social distancing. Such measures were necessary to protect of lives of the second most populated country.

Third, students' expectations during the global pandemic play a significant role in increasing academic performance. During the worldwide pandemic, as several studies reported, expectations of students have undergone radical changes in terms of meeting deadlines for submitting homework and assignments and grading policies. These expectations have an essential effect on academic performance.

Fourth, a key finding of this study is that social media use altered the relationship between course content and academic performance. When students can use social media for educational purposes: downloading the study material, doing group assignments, doing homework, and contacting friends on theoretical issues, their performance showed an upward trend. On the other hand, when students use social media for non-academic purposes, as some studies found, their academic performance suffers. Fifth, social media use profoundly affects students' expectations to influence academic performance positively. Social media use allows students to interact with faculty and co-students to address their queries about academic matters, which helps the students to perform better. Finally, the finding that learning platforms interact with social media use to positively affect academic performance suggests that educational institutions need to use appropriate learning platforms compatible with students' devices. To sum, the finding that academic performance is a precursor to student satisfaction with online teaching adds to the growing literature on online education.

6.2. Practical implications

This research has several implications for policymakers in educational institutions. First, moving the course content from face-to-face to online is necessary but insufficient to improve academic performance. The administrators and policymakers need to invest monies into information technology infrastructure to ensure that faculty and students do not find it inconvenient to shift to the web-based academic environment. Second, as the faculty and students were not trained in web-based teaching, it is essential to provide training to deliver lectures using online platforms. The administrators must provide technical assistance to the faculty members, which is generally practiced in educational institutions in developed countries (such as the USA, UK, Australia, and Canada). Though it takes time to change the course structure and design overnight, it is more important to provide a platform that facilitates faculty interaction with the students to enable them to learn effectively. During the global pandemic, both students and faculty were to deal with the virus on the one hand and complete the assignments; on the other hand, the academic workload needed to be adjusted to the changing environment. The administrators must implement flexibility in meeting the deadlines, slashing the course content, and emphasizing core aspects of learning. Third, administrators should consider the global pandemic as an opportunity to introduce a 'blended method of teaching' so that students and faculty get used to face-to-face and online teaching. In western countries, blended or hybrid method of education has been practiced for over two decades. This is one of the reasons why developed countries were able to switch to web-based teaching overnight. In developing countries such as India, it took some time to adjust to the switch of teaching mode. After the introduction of web-based instruction, things improved when we conducted the study, and several universities conducted webinars and meetings

virtually. Viva-voce examinations were held remotely, and performance has not deteriorated. The results from this study vouch for this improvement in the teaching-learning climate, especially in the context of ERT.

6.3. Limitations and future research

The present study is not without any limitations. First, the study was conducted in one of the premier universities in southern India. Though the sample size is large enough, a more significant sample involving students from the universities in the north, east, and west may make the results generalizable. However, we argue that all the universities are governed by the University Grants Commission (UGC), and the rules and regulations are uniform throughout the country. So, to some extent, the results from this study are generalizable. Second, this study was based on survey data which may have the inherent problem of social desirability bias, which is concerned with the tendency of the respondents to give responses favorably. To counter this problem, we ensured the anonymity of the survey results with the expectation that the respondents give honest answers. Third, we focused on a limited number of variables in this study. Future researchers may include the feedback from students and students' evaluation of teachers, which is not done in Indian universities, as opposed to western universities. Teacher evaluation of students would help improve the quality of instructions which in turn, help achieve higher academic performance.

Fourth, future researchers may make cross-country comparisons and see if any cultural differences exist in the factors affecting academic performance and satisfaction of students with online teaching. Finally, a comparison of the effectiveness of education between educational institutions in developed nations and developing nations would help understand the differences in students' academic performance.

From the viewpoint of administrators, future studies may focus on the steps administrators take in smoothening the transformative process from traditional face-to-face to web-based teaching. Future researchers also may highlight the challenges and opportunities faced by administrators. Finally, in addition to academic performance, future studies may dwell on horizontal communication between faculty and vertical communication between faculty and administrators to see their effect on the success of educational institutions.

7. Conclusion

As academic institutions play a vital role in economic development, administrators and policymakers must take adequate care in providing quality education to the students. The recent hit global pandemic has forced all educational institutions to switch to online teaching (called Emergency Remote Teaching), and the present study is aimed at investigating the effectiveness of ERT, particularly in the context of a developing country, India. The results underscore the importance of course content, instructor interaction with the students, and learning platforms in achieving higher academic performance. The results also highlight the importance of proper use of social media for educational purposes, rather than non-academic purposes, to increase academic performance. The study corroborates the notion that academic performance is a precursor to student satisfaction. We conclude that the global pandemic has created opportunities of including web-based teaching in developing countries such as India. Further, as the online instruction is expected to continue for some more time, as the global pandemic is

slowly becoming endemic, blended or hauntological teaching may eventually substitute the traditional chalk-and-talk face-to-face teaching.

Author Statement

The authors declare that there is no conflict of interest.

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