



The Impacts of Learner-Instructor Interaction, Learner-Learner, Learner-Content Interaction, Internet Self-Efficacy and Self-Regulated Learning on Satisfaction of Online Education of African Medical Students

Ahotovi Thomas Ahoto¹, Mark Bunji Mbaye^{1*}, Emmanuel Anyigbah²

¹School of Management, Jiangsu University, Zhenjiang, China

²School of Finance & Economics, Jiangsu University, Zhenjiang, China

Email: ahotoahotovithomas@yahoo.com, *markmbaye@yahoo.com

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Abstract

The study explores five drivers of African students' satisfaction with online education: learner-instructor interaction, learner-learner, learner-content interaction, internet self-efficacy, and self-regulated learning. A quantitative method was employed to collect online data from African medical students in America, Europe, and Asia. Data were analyzed using SPSS and AMOS version 21. Hierarchical and linear regressions were used to explore the relationship between variables. The results show that all the variables drive students' satisfaction with online education except learner-learner interaction. Again all the variables drive self-regulated learning. Internet self-efficacy drives learner-content interaction and learner-instructor interaction. Finally, internet self-efficacy mediates the relationships between students' satisfaction and other predictors. Researchers recommended that policymakers improve learner-learner interaction as it is not contributing enough to students' satisfaction with online education. Internet self-efficacy has been found to play a vital role in students' satisfaction; hence governments of countries must improve internet connectivity in their countries while schools also educate students to improve their internet self-efficacy.

Subject Areas

E-Learning and Knowledge Management

Keywords

Learner-Instructor Interaction, Learner-Learner, Learner-Content

Interaction, Internet Self-Efficacy, Self-Regulated Learning, African Medical Students

1. Introduction

Online education is not new, but the Covid-19 outbreak makes online education a major component of mainstream tertiary, secondary and primary education (Ong *et al.*, 2020) [1]. Since online education is becoming the new normal, there is critical to assess students' satisfaction with this model of schooling (Singh *et al.*, 2021) [2]. Online education has limited some of the measures available to traditional classroom education (Oyedotun, 2020) [3].

Though development in technology has improved the quality of engagement, there exist gaps in interactions between the key players of the educational structures (Mahabubul and Parvin, 2021) [4]. The interaction gaps between students, instructors and students, and students and content being taught affect the quality of education; hence, academic institutions are likely to produce poorly trained graduates for the job market (Onigbinde *et al.*, 2020) [5]. African students abroad are affected most by the Covid-19 pandemic-driven online education (Alconero-Camarero *et al.*, 2018) [6]. It is estimated that about 30,000 Africans are studying in the United States of America, over 30,000 in the United Kingdom, over 100,000 in France, 18,562 in China, and 25,000 in India, and the list continues (Ceesay, 2021) [7]. Most of these students returned home and were taking their classes online. Still, a critical group that attracts the attention of some researchers is medical students, as it is worth examining the satisfaction of African medical students' online education (Guadix *et al.*, 2020) [8].

Critical components of online education are learner-instructor interaction, learner-learner interaction, learner-content interaction, self-regulated learning, and internet self-efficacy. These were used to measure students' satisfaction with online education before the outbreak of Covid-19 (Kuo *et al.*, 2014) [9] [10]. Student satisfaction measures students' perceived gains against their actual gains from their academic institutions. It has to do with the model of instruction, infrastructure availability, and all other materials that give students a positive learning experience (Smith *et al.*, 2018) [11]. Student satisfaction is achieved when perceived or promised gains match actual output (Alconero-Camarero *et al.*, 2018) [6]. The issue of students' satisfaction has become more critical now that distance education is becoming the usual way of teaching students (Jones *et al.*, 2021) [12]. The critical issue is how prepared were schools and students before the migration from classroom to online education. Undoubtedly some gaps need to be filled for successful online education that will drive students' satisfaction because there was a total lack of orientation and planning. The main driver of wholesale online education was the Covid-19 outbreak (Alam & Asimiran, 2021) [13].

Before the Covid-19 outbreak, the main focus on improving online education

was an improvement of the technological environment that would enable easy access and quality interactions between players. Still, many students taking online classes have not envisaged or opted for online classes hence items that yielded satisfaction may not be well planned for (Ceesay, 2021) [7]. Student satisfaction defines how positively students recognize their learning experiences, and a quality learning experience is essential for students' knowledge acquisition (Tuma *et al.*, 2021) [14]. Increased student satisfaction may reduce drop-out rates by building students' persistence and making them commit to their program (Weld *et al.*, 2021) [15]. Items that define student satisfaction with classroom education depend mainly on the educational institution. Still, concerning online education, the burden of providing students with quality academic experience goes beyond the school's effort to other functionaries such as the home, internet facility of home countries, and others (Oyedotun, 2020) [3].

Interaction in education defines the engagement between students and instructors, students and other students, students and school staff, and other educational stakeholders (Cheruiyot & Brysiewicz, 2019) [16]. In other cases, students may interact with objects of study and the contents of what they are learning (Kuo *et al.*, 2014) [9] [10]. Studies have established three types of interactions as drivers of online education (Dhahri *et al.*, 2020) [17]. The interactions range from learner-learner interaction, learner-instructor interaction, and learner-content interaction. In addition, our other two drivers are internet self-efficacy and self-regulated learning (Pintrich, 2015) [18]. These five constructs effectively measured students' satisfaction with online studies (Kuo *et al.*, 2014) [9] [10]. Interaction between players in the educational sector is key to students' satisfaction; traditionally, the interaction between the players occurs within academic institutions. But online education will take more effort for any active interactions to occur after online classes due to the challenges of different time zones and other engagements (Linda *et al.*, 2020) [19].

The second contributing factor to students' satisfaction is learner-instructor interaction; there are many questions about when learner-instructor interaction ends (Kuo *et al.*, 2014) [9] [10]. Though many records this as classroom action, it must be stated that it goes beyond the classroom, or teaching engagement is done in online classes (Oyedotun, 2020) [3]. While some institutions schedule time for students to meet instructors for extra support, others allow students to call on their instructors anytime they need them (Gupta *et al.*, 2021) [20]. It was easier with traditional classroom procedures, but many issues came to play regarding learner-instructor interaction (Kuo *et al.*, 2014) [9] [10]. Online courses may not be complicated, but the learner interacts with the instructor after classes in the online education system (Lennox *et al.*, 2021) [21]. Network and time availability issues may impede their engagement, especially when there are many hours between students and lecturers (Oyedotun, 2020) [3].

Poor learner-instructor interaction online may impede students' academic progress (Mahabubul & Parvin, 2021) [4]. It has been established that students' main ways to resolve difficulties in understanding a lesson are the extra attention

they get from their instructors. Hence, online education may not have promoted many learner-instructor interactions, affecting the quality of students prepared for the labor market (Parker & Grech, 2018) [22].

The last interaction determining students' satisfaction is learner-content interaction; in contrast, the above two interactions are two-way, but learner-content interaction is one-way (Kuo *et al.*, 2014) [9] [10]. It defines ways the student explores topics to understand better what is being thought (Ellison *et al.*, 2021) [23]. Learner-content interaction is enhanced when the learning environment makes students focus on their academic activities (Gupta *et al.*, 2021) [20]. When students are present on-campus library, other structures create the enabling environment for quality learner-content interaction (Singh *et al.*, 2021) [2]. With the online classes, the design of the place students receive their learning and the facilities available for the student to do self-reading is determining factor (Ellison *et al.*, 2021) [23]. A previous study demonstrated how homes were not adequately designed for online education; hence activities at home affect students' concentration on their academic work (Singh *et al.*, 2021) [2]. Though the availability of reading materials on the Internet may ease learner-content interaction in real terms, many students may not get the content of what they were taught as the learning environment at home may not be conducive enough (Kuo *et al.* 2014) [9] [10].

Two factors determining students' satisfaction with online education are internet self-efficacy and self-regulated learning (Larose *et al.*, 2001) [24]. Internet self-efficacy measures students' ability to explore the Internet for study purposes; it involves using it to derive study materials and communicate with stakeholders within one educational framework (Kuo *et al.*, 2014) [9] [10]. Technology has enriched online education and internet availability; However, some developing countries in Africa have poor internet connectivity (Oloyede *et al.*, 2021) [25]. Generally, many students can get the needed connectivity to access online education (H. Liu *et al.*, 2021) [26]. Studies show that having the Internet *alone* is not enough, but the ability of the student to explore the Internet to accomplish what they want is the issue (Larose *et al.*, 2001) [24]. Internet self-efficacy has been established to determine students' satisfaction with online education. It is defined as one's ability to use the Internet to accomplish an object with less or no assistance. Knowing what to do with the Internet enhances online education and limits students' struggle to access online classes (Kuo *et al.*, 2014) [9] [10].

Students have different abilities in using the Internet. However many use the word technology age to imply that every child knows how to use the Internet; it must be stated that applying the Internet in online education and academic research differs from using the Internet for other recreational activities (Larose *et al.*, 2001) [24].

Self-regulated learning is another determinant of students' satisfaction with online education (Kuo *et al.*, 2014) [9] [10]. It defines the students' ability to plan their study schedules, including drawing time table on what to learn and

when to learn it, how to position studies against other activities, and when to seek extra support from friends and instructors on academic issues (Linda *et al.*, 2020a) [19]. Self-regulated learning is essential to students achieving their academic goals both in the traditional classroom and in online education, but the term is more useful in online or distance education as it has to be with self-discipline in line with one's studies (Kuo *et al.*, 2014) [9] [10]. Online education requires self-discipline from online classes and when the course is over (Pintrich, 2015) [18]. Unlike classroom education, where instructors and other school authorities partially regulate students' actions toward learning, online education comes with less monitoring from the school authorities; hence the students' success depends on their ability to regulate their learning (Linda *et al.*, 2020) [27].

Studies show that students have many ways to avoid online classes or be ineffective in online courses (Ceasay, 2021) [7]. Many students were found sleeping while some left their computers during studies though they were absent in class (Tuma *et al.*, 2021) [14]. Self-regulated learning is pivotal in students' satisfaction with fewer marching orders for learning and attending classes (Weld *et al.*, 2021) [15].

2. Study Hypotheses

2.1. Hypothesis 1: Effects of Variables on Students' Satisfaction with Online Classes

H1a: Learner-instructor interaction positively predicts medical students' satisfaction with online classes.

H1b: Learner-learner interaction positively predicts medical students' satisfaction with online classes.

H1c: Learner-content interaction positively predicts medical students' satisfaction with online classes.

H1d: Self-regulated learning positively predicts medical students' satisfaction with online classes.

H1e: Internet self-efficacy positively predicts medical students' satisfaction with online classes.

2.2. Hypotheses 2: Effects of the Interactions of Students' Self-Regulated Learning

H2a: Learner-instructor interaction has positive effects on medical students' self-regulated learning.

H2b: Learner-learner interaction has positive effects on medical students' self-regulated learning.

H2c: Learner-content interaction has positive effects on medical students' self-regulated learning.

H2d: Internet self-efficacy has positive effects on medical students' self-regulated learning.

2.3. Hypotheses 3: Mediating Effects of Internet Self-Efficacy on the Relationships between the Interactions and Satisfaction

H3a: Internet self-efficacy mediates the relationship between learner-instructor interaction and students' satisfaction.

H3b: Internet self-efficacy mediates the relationship between learner-learner interaction and students' satisfaction.

H3c: Internet self-efficacy mediates the relationship between learner-content interaction and students' satisfaction.

2.4. Hypotheses 4: Effects of Internet Self-Efficacy on the Interaction

H4a: Internet self-efficacy has positive effects on learner-instructor interaction.

H4b: Internet self-efficacy has positive effects on learner-learner interaction.

H4c: Internet self-efficacy has positive effects on learner-content interaction.

3. Methodology

This is a quantitative cross-sectional study that uses a questionnaire for data collection.

3.1. Sampling and Data Collection

The researchers adopted a stratified sampling approach to select respondents. The researchers first contacted 35 lecturers in medical schools in Asia, America, and Europe, which have African students through their social media pages. Twenty-eight lecturers responded and provided the researchers with the conduct of 73 students, which the researchers contacted through their emails, and 66 students responded through their emails and also gave the social media contacts of 522 medical students who were conducted to participate in the survey through their social media pages. A total of 332 took part in filling the online questionnaires, out of which 307 questionnaires were fit and used for the analysis.

3.2. Measures

The six constructs (satisfaction, internet self-efficacy, learner-learner interaction, learner-instructor interaction, learner content interaction, and self-regulated learning) were adopted from Kuo *et al.* (2014) [9] [10], Larose, Mastro, and Eastin (2001) [24], and Pintrich *et al.* (1993) [28]. The originators measured some of the constructs with 5-point Likert scales and others with 7-point Likert scales. To make the tools relevant to the current situation, the researchers submitted the constructs and their measuring questions to nine professors teaching in medical schools for their input. Eight professors returned the questions with their information; the researcher consolidated their inputs to the finalized questionnaire used for data collection. The adopted tools used for the study are added in **Appendix**.

3.3. Data Analysis

SPSS version 21 and AMOS version 21 were used to analyze data. AMOS software was used for data validation analysis, while SPSS was used to run the hierarchical linear regression analysis for testing the hypotheses.

4. Background Variables of Respondents.

The majority of respondents (73.5%) were males; ages ranging from 20 - 25 for 69.3%, and 30.7% were aged above 25 years but less than 30 years. Respondents' were in various levels of their first-degree medical education, with 76.9% being in level 200 to 400 and 23.1% above level 400. A total of 47% of students were from universities in Asia, with the majority studying in China and India, 36% were studying in Europe, with the majority schooling in Russia, France, and the United Kingdom, and the rest of the students were studying in the United States of America and Cuba. The majority of 42% of the students were from West Africa, mainly Nigeria, Ghana, Senegal, and Mali. We were followed by 39% from countries in southern Africa, primarily angular, Zimbabwe, South Africa, and Botswana. We had 12% of respondents from Eastern African countries, mainly Kenya, Tanzania, and Uganda; only 7% were from central and northern African countries, largely the Democratic Republic of Congo, Cameroon, and Tunisia.

4.1. Data Validation

Exploratory factor analysis was conducted using principal component analysis with varimax rotation. Factors that loaded less than 0.6 were eliminated, the reliability test produced Cronbach's alpha above the minimum threshold of 0.7, and Average Variance Extracted (AVE) was also above 0.5 thresholds (**Table 1**). Sampling adequacy measure using Kaiser-Meyer-Olkin (KMO) generated sample adequacy of 0.934, Bartlett's Test of Sphericity, Approx. Chi-Square 7199.549, df 253 at Sig. 0.000, the data is free from Common Method Variance. Further analysis on the fitness of the model produced the following results CMIN = 506.561, DF = 225, CMIN/DF = 3.248, CFI = 0.961, SRMR = 0.052, RMSEA = 0.064 all rated as excellent. All the above results show the data met *et al* the validity and internal consistency fitness concerning Kuo *et al.* [9].

4.2. Initial Analysis

From **Table 2**, the inter-factor correlation analysis shows the correlations between the variables. The strongest correlation between self-regulated learning and learner content interaction is followed by internet self-efficacy and learner-learner interaction. Other variables were also significantly correlated.

4.3. Hypotheses Testing

Testing for hypotheses was performed using hierarchical regression analysis on SPSS version 21, as shown in **Table 3**. Hypothesis H1a - H1e were tested in **Table 3**, Model 2, hypotheses H2a - H2d were tested on **Table 3**, Model 3, while

Table 1. Convergent validity and internal consistency analysis.

Variables	Codes	E	A	CR	AVE
Students Satisfaction	SSF4	0.946	0.813	0.919	0.693
	SSF3	0.857			
	SSF1	0.775			
	SSF5	0.771			
	SSF2	0.763			
	Self-Regulated Learning	SRL2			
	SRL3	0.851			
	SRL4	0.791			
	SRL7	0.775			
	SRL5	0.733			
	SRL1	0.699			
	SRL6	0.679			
Internet Self-Efficacy	ISE3	0.931	0.737	0.919	0.692
	ISE5	0.911			
	ISE1	0.899			
	ISE2	0.875			
	ISE4	0.872			
	ISE6	0.857			
	ISE7	0.783			
	Learner-Learner Interaction	LLI1			
	LLI3	0.868			
	LLI2	0.833			
	LLI4	0.817			
	LLI6	0.798			
	LLI5	0.794			
	LLI7	0.735			
Learner-Instructor Interaction	LII1	0.954	0.977	0.978	0.816
	LII2	0.938			
	LII4	0.928			
	LII5	0.917			
	LII3	0.833			
	LII6	0.723			
	Learner-Content Interaction	LCI3			
	LCI4	0.851			
	LCI2	0.832			
	LCI1	0.796			

Note: α = Cronbach's alpha; E= Estimate, CR = Composite Reliability; AVE = Average Variance Extracted.

Table 2. The inter-factor correlation analysis.

	Mean	SD	SSF	ISE	SRL	LLI	LII	LCI
SSF	2.2625	0.79804	1					
ISE	2.7431	0.58865	-0.583**	1				
SRL	2.8914	0.92381	-0.025	0.316**	1			
LLI	2.7466	0.66805	-0.424**	-0.874**	-0.357**	1		
LII	2.5128	0.77769	0.412**	0.248**	0.667**	-0.064	1	
LCI	2.9764	1.29701	0.130*	0.099	0.887**	-0.261**	0.819**	1

Note: Mean, Standard Deviation, Correlation coefficients and p-value; **p < 0.01, ***p < 0.001; SSF, Students Satisfaction; ISE, Internet Self-Efficacy; SRL, Self-Regulated Learning; LLI, Learner-Learner Interaction; LII, Learner-Instructor Interaction; LCI, Learner-Content Interaction.

Table 3. Hypotheses testing with hierarchical regression analysis to indicate the relationships between the variables and the mediating effects of work climate on supervisors' fairness and task performance relationship, and job satisfaction on supervisors' fairness and helping behavior.

variables	students satisfaction (SSF)	Students satisfaction (SSF)	Self-Regulated Learning (SRL)	Students satisfaction (SSF)
	Model 1	Model 2	Model 3	Model 4
	b(t)	B(t)	b(t)	b(t)
(Constant)	2.795*** (8.158)	2.187* (5.769)	-0.696* (-2.207)	0.037* (0.221)
Age	-0.215 (-2.607)	-0.096 (-1.423)	0.060 (0.991)	0.013 (0.461)
Gender	-0.076 (-0.770)	0.025 (0.309)	0.108 (1.489)	0.014 (0.439)
Content	0.005 (0.099)	0.005 (0.124)	-0.088 (-2.235)	-0.026 (-1.454)
Level	0.150* (2.025)	0.053 (0.876)	-0.038 (-0.693)	-0.010 (-0.397)
African Region	-0.115 (-0.930)	-0.003 (-0.026)	0.015 (0.162)	0.008 (0.206)
LII		0.698*** (7.186)	0.827*** (19.244)	0.037*** (-0.896)
LLI		-0.335*** (-5.019)	-0.551** (-11.044)	-0.505*** (-10.210)
LCI		0.220*** (3.654)	0.754*** (23.892)	0.701*** (28.588)
SRL		0.168** (1.251)		
ISE		0.1025** (5.880)	0.091* (2.610)	0.831* (14.376)
R ²	0.027	0.363***	0.618**	0.920**
Change in R ²	0.027	0.336***	0.618**	0.054**
F	1.657***	21.184***	69.217**	394.561**

Notes: b, Unstandardized beta coefficient; t-value in parenthesis; *p < 0.05, **p < 0.01, ***p < 0.001; LII, Learner-Instructor Interaction; LLI, Learner-Learner Interaction; LCI, Learner-Content Interaction; SRL, Self-Regulated Learning; ISE, Internet Self-Efficacy; SSF, Students Satisfaction.

hypotheses H3a - H3c were tested on Model 4 of **Table 3**. The background variables (age, gender, contents, level, and African region) were controlled. From Model 2 in **Table 3**, Learner-Learner Interaction negatively predicts Students' Satisfaction with online education. In contrast, Learner-instructor Interac-

tion, Learner-Content Interaction, Self-Regulated Learning, and Internet Self-Efficacy predict Students' Satisfaction. The above results indicated that hypotheses *H1a*, *H1c*, *H1d*, and *H1e* were supported, but *H1b* is not.

Hypotheses H2a - H2d were tested on Model 3 in **Table 3**; from Model 3, Learner-Instructor Interaction, Learner Content Interaction, and Internet Self-Efficacy predict Self-Regulated Learning while Learner-Learner Interaction does not. **Table 3** Model 2 indicated that hypotheses *H2a*, *H2c*, and *H2d* were supported, but *H2b* was not.

Set of hypotheses under H3a - H3c shows the mediating effects of internet self-efficacy on the relationships between the three interactions and students' satisfaction; the researchers do the mediating by introducing internet self-efficacy to the relationships between the interaction and students' satisfaction Model 4 of **Table 3**. The results show that internet self-efficacy partially mediates the relationships between students' satisfaction and the three interactions: Learner-Instructor Interaction and Learner-Learner Interaction.

The last set of hypotheses under H4a - H4c explores internet self-efficacy's influence on the three interactions using hierarchical linear regression. The results in **Table 4** indicated that Internet Self-Efficacy has negative effects on Learner-Learner Interaction but predicts Learner-Instructor. **Table 4** showed that hypotheses *H4a* and *H4c* were supported, but hypothesis *H4b* was not supported.

Table 4. Hypotheses testing with hierarchical linear regression analysis to check the effects of internet self-efficacy on the three interactions.

Variables	Learner-Instructor Interaction (LII)	Learner-Learner Interaction (LLI)	Learner-Content Interaction (LCI)
	Linear regress 1	Linear regression 2	Linear regression 3
	b(t)	b(t)	b(t)
(Constant)	4.061*** (10.849)	0.038 (0.236)	3.249*** (5.059)
Age	-0.081 (-1.017)	-0.022 (-0.653)	-0.114 (-0.839)
Gender	-0.131 (-1.394)	-0.023 (-0.560)	-0.081 (-0.503)
Content Level	-0.024 (-0.476)	-0.003 (-0.147)	-0.129 (-1.472)
African Region	0.038 (0.539)	-0.002 (-0.050)	0.046 (0.376)
ISE	-0.163 (-1.380)	0.055 (1.081)	-0.111 (-0.550)
R	0.312*** (4.197)	-0.995*** (-30.952)	0.239* (1.879)
R ²	0.278**	0.875**	0.154**
Adjusted R ²	0.077**	0.766**	0.024**
F	0.056**	0.761**	0.004**
	4.196**	163.516**	1.22**

Notes: b, Unstandardized beta coefficient; t-value in parenthesis; **p < 0.01, ***p < 0.001; LII, Learner-Instructor Interaction; LLI, Learner-Learner Interaction; LCI, Learner-Content Interaction; ISE, Internet Self-Efficacy.

5. Discussion

Online education has emerged as a preferable means of education due to technological breakthroughs, but the outbreak of Covid-19 in late 2019 has escalated the dependence on online classes (Ceesay, 2021) [7]. Many studies are currently being carried out to decide the future of online education even without Covid-19 due to its enormous investment in the sector (Tuma *et al.*, 2021) [14]. There is a growing perception that online education has come to stay; therefore, there is a need to investigate how online education can be improved to enable students to gain a similar level of satisfaction from the classroom (Weld *et al.*, 2021) [15].

The researchers explore the effects of five variables on students' satisfaction with online education and how the interplay of these variables can influence students learning. The results indicated that learner-instructor interaction, learner-content interaction, self-regulated learning, and internet self-efficacy predict students' satisfaction with online education during the Covid-19 outbreak while learner-learner interaction does not. These findings are similar to Kuo Walker and others, who show the same variables to predict students' satisfaction with online education in two separate studies (Kuo *et al.*, 2014) [9] [10]. Nonetheless, the finding of this study varies a little from Kuo and others as they find learner-learner interaction as a predictor of students' satisfaction, this study established that in the current situation of the Covid-19 outbreak, learner-learner interaction does not predict student satisfaction with online education. Another variation is that, per the findings of Kuo and others, internet self-efficacy does not predict students' satisfaction enough. Still, this study finds internet self-efficacy a major predictor of students' satisfaction with online education. The improvement in internet connectivity over the years and the increased ability of the youth to explore the Internet have been identified as a possible game-changer in online education (Kotoua *et al.*, 2015 [29], Liu & You-Hsien, 2021 [30], Ceesay, 2021 [7]). Hence this may account for internet self-efficacy being a predictor of students' satisfaction with online education. Again learner-learner interaction does not predict students' satisfaction with online education may be due to the Covid-19 pandemic, creating physical and social distance (Liu & You-Hsien Lin, 2021) [30]. Ceesay (2021) [7] acknowledged that students' interactions had reduced dramatically due to the disturbing effects of Covid-19 on academic work.

The second hypothesis explores how learner-instructor interaction, learner-learner interaction, and learner-content interaction predict self-regulated learning. The study outcome shows that two of the three variables positively influence self-regulated learning except for learner-learner interaction. Though these hypotheses were not exploited in both studies (Kuo *et al.*, 2014) [9] [10], similar studies indicated that instructors' duties do not end with lecturing. Still, they influence students to take individual responsibility for their studies by giving them assignments and other exercises that drive them to learn (Gupta *et al.*, 2021 [20] and Ellison *et al.*, 2021 [23]). Again self-regulated learning goes beyond reading one's books or performing assignments since it considers the preparations be-

fore attending classes and other schedules for learning (Kuo *et al.*, 2014) [9] [10]. Hence the desire to explore the content of lessons is a major driver of self-regulated learning, as this study has established.

The study investigates the mediating effects of internet self-efficacy in the relationship between students' satisfaction and three other variables: learner-instructor interaction, learner-learner interaction, and learner-content interaction. The results indicated that internet self-efficacy partially mediates all three relationships. This finding further emphasized the vital role of internet self-efficacy on students' satisfaction with online education during a Covid-19 pandemic. The above finding is in line with Gupta *et al.* (2021) [20], Tuma *et al.* (2021) [14], and Dhahri *et al.* (2020) [17], who have equally established the key role of internet self-efficacy on distance or online education as it is the main medium of engagement, transition and search for information.

The final set of hypotheses examined internet self-efficacy's predictive ability on learner-instructor interaction, learner-learner interaction, and learner-content interaction. The finding suggested that internet self-efficacy predicts learner-instructor interaction and learner-content interaction but does not predict learner-learner interactions. This outcome is similar to the findings of several studies conducted about online education during the Covid-19 pandemic; most of these studies have clearly stated the improvement of the Internet, technologies, and the upsurge ability of the youths to explore the Internet and other technological breakthroughs have brought to online education (Wang *et al.*, 2018) [31]. The negative relationship between learner-learner interaction and internet self-efficacy has further supported the factor that student interactions have deteriorated due to Covid-19, which is the main driver of online medical education (Gumede & Badriparsad, 2021) [32]. Though learner-learner interaction in the context of the classroom cannot be compared to online classes, the menace of Covid-19 is making interactions among students more difficult than in previously organized online education (Karamouzian & Madani, 2020) [33].

6. Policy Implication

The outbreak of Covid-19 has influenced institutions to channel more investment into online education. There are many signals that online education may be accepted as an option for classroom teaching and learning even after the Covid-19 pandemic. This understanding calls for better online education to build reliable human resources for the industry. The study has established significant components that need to be enhanced to better online education: learner-instructor interaction, learner-learner interaction, learner-content interaction, internet self-efficacy, and self-regulated learning. The study shows that learner-learner interaction is not getting attention in online education. It is the only variable that does not influence student satisfaction with online education and does not influence self-regulated learning.

Lecturers must devise a way to influence learner-learner interaction among

students since it also plays a key role in building the student for the corporate world. Again internet self-efficacy needs to be improved in developing countries with more robust internet connectivity and cheaper data.

7. Recommendation

The researchers recommend that more studies be carried out on the five variables; learner-instructor interaction, learner-learner interaction, learner-content interaction, internet self-efficacy, and self-regulated learning. These variables are critical determinants of online learning education. Again learner-learner interaction should be given more attention by lecturers giving students group assignments that may influence interactions.

Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix: 1 Research Tool

Variables	Codes	E	A	CR	AVE
Students Satisfaction	SSF4	0.946	0.813	0.919	0.693
1. This course contributed to my educational development.	SSF3	0.857			
2. I am satisfied with the level of interaction in this course.	SSF1	0.775			
3. This course contributed to my professional development.	SSF5	0.771			
4. Overall, I am satisfied with this class.	SSF2	0.763			
Self-Regulated Learning	SRL2	0.853	0.832	0.972	0.810
1. I often find that I have been reading for class but don't know what it was all about	SRL3	0.851			
2. If course materials are difficult to understand, I change how I read the material.	SRL4	0.791			
3. When reading for this course, I make up questions to help focus my reading	SRL7	0.775			
4. I try to change how I study to fit the course requirements and instructor's teaching style.	SRL5	0.733			
5. During class time, I often miss important points because I think of other things.	SRL1	0.699			
6. I ask myself questions to make sure I understand the material I have been studying in this class.	SRL6	0.679			
Internet Self-Efficacy	ISE3	0.931	0.737	0.919	0.692
1. Understanding terms/words relating to Internet software.	ISE5	0.911			
2. Understanding terms/words relating to Internet hardware.	ISE1	0.899			
3. Describing functions of Internet hardware.	ISE2	0.875			
4. Explaining why a task will not run on the Internet.	ISE4	0.872			
5. Using the Internet to gather data.	ISE6	0.857			
6. Troubleshooting Internet hardware.	ISE7	0.783			
Learner-Learner Interaction	LLI1	0.886	0.864	0.865	0.616
1. I got lots of feedback from my classmates.	LLI3	0.868			
2. Overall, I had numerous interactions related to the course content with fellow students.	LLI2	0.833			
3. Class projects led to interactions with my classmates.	LLI4	0.817			
4. Group activities during class allowed me to interact with my classmates.	LLI6	0.798			
5. I answered questions of my classmates through different electronic means, such as email, discussion board, instant messaging tools, etc	LLI5	0.794			
6. I comment on other students' thoughts and ideas	LLI7	0.735			
Learner-Instructor Interaction	LII1	0.954	0.977	0.978	0.816
1. I replied to messages from the instructor.	LII2	0.938			
2. I asked the instructor my questions through different electronic means, such as email, discussion board, instant messaging tools, etc	LII4	0.928			
3. I received enough feedback from my instructor when I needed it	LII5	0.917			
4. I had numerous interactions with the instructor during the class.	LII3	0.833			
5. The instructor replied to my questions in a timely fashion	LII16	0.723			
Learner-Content Interaction	LCI3	0.912	0.896	0.922	0.695
1. Online course materials stimulated my interest in this course.	LCI4	0.851			
2. Online course materials helped me to understand better the class content.	LCI2	0.832			
3. It was easy for me to access the online course materials.	LCI1	0.796			