

Online Delivery in Higher Education during Pandemics: Students' Perspective

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Abstract –Although various researches have been published regarding e-learning worldwide, there are not enough studies performed in the Balkan countries. This study aims to explore the students' perception of e-learning during pandemics and build a model for predicting students' satisfaction in North Macedonia. We collected data through a questionnaire and received 290 responses. The results reveal that most students are satisfied with e-learning. However, face-to-face classes are still preferred. Moreover, the proposed model successfully predicts students' satisfaction with 88.4% accuracy where technology is the most essential factor for the prediction, followed by building relationships, then students' interaction, then finally students' engagement.

Keywords – online learning, pandemics, higher education, COVID-19, students' satisfaction

1. Introduction

The expansion of online learning (or e-learning) has increased its popularity in the last two decades as an effective option for enriching the learning environment [1].

However, in the current situation of the COVID 19 pandemic, e-learning has become the one and only alternative route for continuing the educational process [2], [3]. E-learning is a mode of teaching outside the class with the help of internet utilization, digital devices, and other distribution technologies through networked interactivity [4], [5]. It mainly depends on the use of electronic resources for its effective delivery. E-learning has roots in the tradition of distance education, which dates back to a century ago during the early correspondence of courses [6]. A correspondence course is a course of study in which students and educators communicate by post.

The transaction from traditional classrooms to e-learning comes with many opportunities [7]. E-learning allows both instructors and students to communicate from a global perspective [8]. It offers flexibility in working schedules [9], [10], [11] and enables the learners to study at their own pace due to readily prepared lecture materials [12], [9]. It also offers fewer costs in terms of the development of curriculums and maintenance compared to traditional learning [13].

Despite the multiple advantages of e-learning, it has its challenges, especially the challenges associated with the quality of education [14]. Moreover, online examinations are challenging to control [9]. In addition, some students may face difficulties accessing technology [7], and some may lack digital capabilities [14], [10]. Also, some institutes may lack adequate preparedness for online classes [10]. All these challenges may stand in the way of students' satisfaction.

Electronic platforms, electronic services, and online software are obtainable by the Southeast European University (SEEU). The SEEU offers its students and staff many online services for efficient communication and management of the e-learning process. However, both instructors and students were not sufficiently prepared for the sudden transaction to exclusive e-learning. Therefore, it was essential to investigate the impact of such transactions on students.

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The definition of satisfaction in e-learning is complicated as it consists of many aspects, e.g., communication, student's involvement in virtual discussions, flexibility, workload, technical support, instructors' academic skills, and their feedback [15], [16]. Therefore, this study aims to build a model that predicts students' satisfaction with e-learning. Furthermore, we try to determine the substantial factors in creating a high-quality e-learning experience from students' perspectives at the SEEU. To be more specific, we address the following research questions:

R1. Is communication an essential factor in E-learning?

R2. Do technical skills play a significant role in the satisfaction of e-learning?

R3. Is it possible to predict students' e-learning satisfaction?

After introducing our research questions, the rest of the paper is organized as follows: we start by providing work related to our study. Then, we outline our hypothesis. After that, we describe the methodology used in this study. Following that, we outline the results and limitations of our performed study. Finally, we conclude with a summary of our primary outcomes and provide recommendations for future work.

2. Literature Review

The transition from traditional classes to e-learning during Covid-19 is considered a new experience for educational systems [17]. This transaction creates the need of genuinely investigating the perception of all the involved stakeholders in the educational system. As educators represent one of the leading stakeholders, many studies investigated their perception of the e-learning experience. For instance, [18] studied attainment factors by collecting data from 322 online teachers in Mexico, United States, Spain, and China. They found that the course content, social presence, and instruction interactions matter more than technology. Another study by [19] used advanced analysis approaches to examine the hypothesis of instructors' perceptions of e-learning efficiency compared with traditional teaching in eleven countries, including Malaysia, Tunisia, United Arab Emirates, Australia, United Kingdom, and Sudan. Results show that the online teaching system normally does not change based on the studied factors. Additionally, there are no substantial differences in all dimension scales in terms of gender, primary specification, age, country of teaching, and virtual experience. However, significant differences are initiated regarding academic degree and the educator status in

supporting virtual classes and traditional experience dimension scales. Moreover, [20] collected the responses of nearly 500 teachers participating in a large-scale survey in the French speaking Community of Belgium. The analysis focused on teaching practices and observations made by teachers during Covid-19.

Our focus in this study is to investigate student's perspective on e-learning, specifically higher education students in eastern Europe. The literature has shown that the level of effect of e-learning on students closely correlates with certain factors such as teachers' interaction with students, students' engagement with the provided educational program, and the availability of technical skills [21]. Therefore, those factors are critical for measuring students' satisfaction levels during pandemics.

Studies have documented students' favorable and unfavorable perceptions of e-learning [22]. The variation in the student's opinion on e-learning may be due to several factors, including cultural and societal factors, and the level of development in the country. For instance, [23] analyzed the opinion of 358 students in India on e-learning during the COVID-19 pandemic. They found that the students had a mixed opinion about e-learning, with 65.9% feeling that learning in physical classrooms is better than online. Nevertheless, most students felt that educators have enhanced their online teaching skills since the beginning of the pandemic and that e-learning is a viable alternative in the current circumstance. Also, [24] performed a qualitative study on medical students in Saudi Arabia using virtual focus group discussions. They found that the overall satisfaction level with e-learning was high and that students were quite positive toward e-learning as a new teaching modality. However, the missing element of its effectiveness was clinical practice. This is also in accordance with the findings of [9], [14] who performed their studies in Ghana and India respectively.

As online environments might limit some aspects of nonverbal communication [25], learners' participation and engagement in online settings are among the significant challenges discussed by researchers since the arising of e-learning. Many instructors struggle with delivering the content and engagement of their students due to a shortage of visual interaction with their students [26]. Therefore, a number of studies specify that the instructors' interaction with their students has a significant effect on students' opinions of e-learning [22]. For instance, [27] explored students' perceptions of their adoption, use, and acceptance of emergency e-learning in the United States. They analyzed many factors including cognitive engagement and found that students prefer face-to-face interaction with professors. [28] studied

students' perception on numerous engagement strategies used in e-learning in the United States. They found that the instructor's presence is the most important to online learners. [29] also performed a study in the United States to measure students' perceptions and satisfaction in online courses. They found that social presence has a significant effect on students' satisfaction. [30], explored whether e-learning negatively affects communication between instructors and students. They found that students still prefer traditional classes over e-learning due to problems related to understanding course material, decreased communication between the students and their instructors, and their sense of isolation.

Instructors' comfort level with technology and their perceptions of the value of e-learning play significant roles in their willingness to teach online [31], [32] and [33] analyzed the skills required for teaching online courses in higher education in Saudi Arabia. They found that there are many required skills that the instructor needs, including technological skills. However, the issue of technology is not limited to instructors but also concerns the students. [34] conducted a survey by distributing an online questionnaire to medical students in Poland. They found that over 60% of the participants had never practiced in any form of e-learning before the COVID-19 pandemic, which might be why technical matters were considered one of the significant drawbacks of e-learning in their study.

By viewing the studies above, one can notice that there have not been enough studies performed in the Balkan countries (south eastern Europe). This shows the need for further investigation regarding students' perspective on e-learning in the Balkan societies. In this study we aim to analyze and discuss students' perception regarding the factors that affect the use and adoption of e-learning in terms of emergence transfer from traditional learning to e-learning.

3. Hypothesis

Based on the viewed literature, we determine our research hypothesis as follows:

H1: Communication between the members of the e-learning platforms plays an essential role in the success of e-learning.

H2: Technical skills play a significant role in the satisfaction of e-learning.

H3: Students at the SEEU are satisfied with their e-learning experience.

4. Methodology

In this section, we present the type of data that has been collected, the statistical methods, and the tools that we have used to perform this study.

4.1. Data Collection

To perform this study, we adopted a quantitative approach by sending an online survey invitation to undergraduate students from the SEEU in North Macedonia. The survey was administered when students learned exclusively online during the Covid-19 pandemic in 2020 and 2021. In the surveys, we conducted a baseline study of student satisfaction with e-learning using the same conceptual framework as [21]. Their framework for determining the factors influencing student satisfaction has been created based on the literature indicators found. The survey is designed to collect five types of factors, (1) Building relationships, (2) Student interaction, (3) Student Engagement, (4) Technology, and (5) Student satisfaction. The questions related to each factor are described and listed in Table 1. The answer to each question in the survey was on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Students' collected data

Attribute type	Description	Questionnaire
Building relationships	Students' opinion about their ability to initiate relationships with their instructors.	(BR1) Teachers' connections with students lead to the joy of learning
		(BR2) E-learning contributes to improving teacher-student relationships
		(BR3) More online communication between teachers and students lead to their closer links
		(BR4) Building relationships should be a primary concern in the online learning process
		(BR5) E-learning is a user-friendly environment for improving the relationship between teachers and students.
Student's interaction	A measure of students' communication with their instructors.	(SI1) Teachers engage more in delivering the course content in online teaching
		(SI2) Online platforms diminish barriers of communication between teachers and students
		(SI3) E-Learning Management Systems enable students to have closer contacts with their teachers

		(SI4) Students receive more individual feedback during online courses. (SI5) Traditional face-to-face courses make students feel disconnected.
Student's engagement	A measure that reflects the quantity and quality of a learner's participation in their educational program.	(SE1) Online delivery leads to more student-centered classes (SE2) E-learning engages more students in their course management (SE3) Student-centered efficacy is reached with online platforms (SE4) I can organize the pace of learning with online courses (SE5) E-learning encourages a student-centered learning approach (SE6) Uploaded course materials on the system help understand the course (SE7) Conventional face-to-face classes put teachers at the center of the stage.
Technology	Students' opinion about the techniques, skills, methods, and processes used in the educational process	(T1) Investment in new technology to support e-learning is important (T2) Teachers require new skills for delivering online contents (T3) Students need to be supported by IT experts to facilitate the learning process (T4) E-learning platforms are favorable for organizing learning (T5) E-learning platforms make it more convenient for publishing materials
Student's satisfaction	The favorability of students' subjective assessment of the various educational outcomes	(S1) Teacher presence in an e-learning environment creates students satisfaction (S2) I am satisfied with online course delivery during this pandemic time (S3) The relationship between students and teachers affects their satisfaction (S4) E-learning is the best learning method during pandemics (S5) E-learning is just a short term alternative to traditional classroom instruction

Source: Table constructed by authors using the conceptual framework from Zeqiri et al. (2021)

4.2. Research Sample

After cleaning the collected data by removing missing values, the database contained 290 complete responses with which participants reported subjectively on attitudes and perceptions about e-learning. It is essential to note that the grades at the SEE University are issued on a grade-point basis. A Grade Point Average (GPA) is calculated and displayed on the transcript in accordance with the grading system detailed in Table 2.

Table 2. Grading System at the SEE University

Grade Scale	Grade Description	Grade Points	Letters
95% - 100%	Outstanding	10.0	A/A+
85% - 94%	Excellent	9.0	A-/B+
75% - 84%	Very Good	8.0	B-
65% - 74%	Good	7.0	C
51% - 64%	Satisfactory	6.0	D
0%-50% - below	Fail	5.0	F
	Incomplete (IN)	IN	
	No Record (NR)	NR	

Table 3. provides detailed information about the characteristics of the students who participated in this study. It shows that the female respondents (54.1%) are slightly higher than the male (45.9%). It also shows that most of the students who participated in this study have "very good" to "excellent" computer skills representing 75.2% of the dataset. Also, most participants have a "very good" GPA (31.4%), followed by an "excellent" and "good" GPA (29.3%). Regarding the students' e-learning experience, 66.9% of the students had less than a year of experience. This shortage of experience is because most respondents (46.2%) are in their first year of bachelor studies and have not experienced e-learning in secondary school.

Table 3. Participants' demographic information

Variables	Values	Percentage
Gender	Male	45.9
	Female	54.1
Computer Skills	Poor	2.4
	Good	22.4
	Very good	36.2
	Excellent	39.0
	Less than 1 year	66.9
Online Learning Experience	1-2 year	21.0
	2-3 year	5.2
	More than 3 years	6.9
	First year	46.2
Year of Study	Second year	30.7
	Third year	22.8
	6-6.9	10.0
GPA	7-7.9	29.3
	8-8.9	31.4
	9-10	29.3

4.3. Procedure

To build our predictive model, we used the odds ratio in logistic regression.

4.3.1. Logistic regression with binary response

The logistic model (or logit model) is performed to model the likelihood of a particular class or event. The dependent variable has two levels in a binary logistic regression model. For further explanation, let Y be a binary response variable coded as 0 or 1. The logit model is set as follows:

$$\pi(x) = \frac{e^{\beta_0 + \beta_1 x}}{1 + e^{\beta_0 + \beta_1 x}}$$

$\pi(x)$ is the conditional mean of Y given x, i.e., $E(Y \setminus x)$. The value of the response variable given x can be presented as $y = \pi(x) + \varepsilon$, ε is the error term. If $y = 1$, then $\varepsilon = 1 - \pi(x)$ with probability $\pi(x)$ and if $y = 0$, $\varepsilon = -\pi(x)$ with probability $1 - \pi(x)$. Thus, ε follows a binomial distribution with mean 0 and variance $\pi(x)[1 - \pi(x)]$. A transformation of $\pi(x)$ which is known as logit function is needed:

$$g(x) = \ln \left[\frac{\pi(x)}{1 - \pi(x)} \right] = \beta_0 + \beta_1 x$$

The unidentified parameters are estimated by the maximum probability estimation procedure with a given likelihood function for $\beta = (\beta_0, \beta_1)$ given as

$$L(\beta) = \prod_{i=1}^n \pi(x_i)^{y_i} [1 - \pi(x_i)]^{1-y_i}$$

4.3.2. Fitting the logistic model with binary explanatory variables

For interpreting the coefficients for the logit model with the event where descriptive variables are at the nominal level of measurement. Suppose that X is coded as either 0 or 1. Then the difference between the logit function when $x=1$ and $x=0$ is set as $g(1) - g(0) = \beta_1$. To understand this result, we use a measure of an association known as odds ratio (OR):

$$OR = \frac{\pi(1) / [1 - \pi(1)]}{\pi(0) / [1 - \pi(0)]} = e^{\beta_1}$$

The odds ratio estimates how much more possible or impossible it is for the response variable to occur among those with $x = 1$ than those with $x = 0$. For more details, one can see [35].

5. Results and Discussion

This section analyzes the student's responses and proposes a model for predicting students' satisfaction.

5.1. Perception of Students at the SEEU about e-Learning During Pandemics

Table 4. shows the responses obtained from the questionnaire. It also shows the mean score, which is calculated as the average of student's survey scores for each factor. For further readability, we have combined the respondents who disagree and strongly disagree under one column labeled as "Total (1+2)" and combined those who agree and strongly agree under another column labeled as "Total (4+5)".

Table 4. Respondents overview on e-learning (N= 290)

Indicator	Percentage of respondents							Mean score	
	Strongly disagree (1)	Disagree (2)	Total (1+2)	Neutral (3)	Agree (4)	Strongly agree (5)	Total (4 +5)	Mean	Std. Deviation*
BR1	2.8	3.4	6.2	20.3	31.7	41.7	73.4	4.06	1.00
BR2	13.4	21.4	34.8	26.9	22.8	15.5	38.3	3.06	1.27
BR3	9.0	14.8	23.8	28.3	28.3	19.7	47.9	3.35	1.21
BR4	5.2	9.3	14.5	31.7	35.9	17.9	53.8	3.52	1.05
BR5	11.7	20.7	32.4	24.8	26.6	16.2	42.8	3.15	1.25
SI1	6.9	13.8	20.7	32.8	29.3	17.2	46.6	3.36	1.13
SI2	12.8	20.0	32.8	25.9	26.9	14.5	41.4	3.10	1.25
SI3	11.7	20.0	31.7	30.3	25.2	12.8	37.9	3.07	1.20
SI4	10.3	14.8	25.2	25.9	32.1	16.9	49.0	3.30	1.21
SI5	27.6	25.5	53.1	22.4	17.2	7.2	24.5	2.51	1.26
SE1	10.3	20.3	30.7	37.9	21.0	10.3	31.4	3.01	1.17
SE2	11.4	22.4	33.8	21.4	29.7	15.2	44.8	3.15	1.25
SE3	13.8	20.0	33.8	26.6	24.8	14.8	39.7	3.07	1.26
SE4	18.6	24.5	43.1	28.3	17.9	10.7	28.6	2.78	1.25
SE5	19.7	23.1	42.8	24.5	19.0	13.8	32.8	2.84	1.32
SE6	7.2	10.0	17.2	19.3	35.9	27.6	63.4	3.67	1.19
SE7	6.2	12.1	18.3	22.4	33.8	25.5	59.3	3.60	1.17
T1	4.8	8.6	13.4	22.4	30.3	33.8	64.1	3.80	1.14
T2	3.8	7.6	11.4	21.4	33.8	33.4	67.2	3.86	1.09
T3	11.0	17.6	28.6	31.4	23.8	16.2	40.0	3.17	1.22
T4	9.0	11.0	20.0	30.0	29.3	20.7	50.0	3.42	1.19
T5	9.3	8.6	17.9	24.1	32.4	25.5	57.9	3.56	1.22
SS1	9.0	12.8	21.7	30.7	27.2	20.3	47.6	3.37	1.20
SS2	9.7	11.0	20.7	17.6	31.0	30.7	61.7	3.62	1.29
SS3	5.2	6.2	11.4	23.8	33.4	31.4	64.8	3.80	1.11
SS4	7.2	5.9	13.1	13.8	22.4	50.7	73.1	4.03	1.24
SS5	7.6	9.0	16.6	31.0	31.4	21.0	52.4	3.49	1.14

*: standard deviation at 1 σ

If we look at the results of the questions related to the instructors' relationship with students during e-learning, we can notice that the highest response rate throughout the questionnaire was 73.4%, regarding students agreeing that teachers' connections with students lead to the joy of learning. Moreover, 53.8% of the students believe that building relationships should be a primary concern in the e-learning process, and 47.9% think that more online communication between teachers and students leads to closer links. Also, 42.8% believe that e-learning is a user-friendly environment for improving the relationship between teachers and students. Those results support our first hypotheses and further highlights the findings of [22] who stressed on the importance of the student-instructor relationship in the e-learning platforms. To further enhance learners' engagement in e-learning, instructors are indorsed to mix audio or video discussion with online text discussions [36], [37] and [38].

As for Student Interaction, many (46.6%) of the students agree that teachers engage more in delivering the course content in e-learning. This might be due to the fact that the teaching methods used in e-learning are different from the traditional

learning as instructors started using innovative strategies to reach their students through online platforms. Moreover, 41.4% of the students agree that Online platforms diminish communication barriers between teachers and students. This might be because some students may struggle to express themselves orally and feel more at ease in expressing their thoughts using written words in the forums provided by online platforms. Also, 37.9 agree that E-learning Management Systems enable students to have closer contact with their teachers, and 49% agree that students receive more individual feedback during online courses. However, most students (53.1%) disagree that traditional face-to-face courses make students feel disconnected. Those results contradict the findings of [30]. To conclude, students' interaction has a considerable impact on the student's perceptions of e-learning, which is in line with the findings of [22].

Regarding student engagement, many students (43.1%) do not agree that online courses help in organizing the pace of learning. This surprisingly contradicts the findings of [12] and [9]. Students also disagree that e-learning platforms encourage a student-centered learning approach. However, most students (63.4%) agree that the course materials

uploaded on the system help them understand the course. The reason behind this is that in e-learning, instructors are more motivated to use videos, share resource links, and recorded their lectures to be viewed over time whenever needed. Moreover, 59.3% of the students agree that conventional face-to-face classes put teachers at the center of the stage. Also, 44.8% consider that e-learning engages more students in their course management.

Regarding technology, we have found that the technical proficiency of instructors and learners related to the usage of technology is a significant feature determining the effectiveness and satisfaction of e-learning. This supports our second hypothesis, and it is in line with the findings of [31] and [32]. E-learning demands the instructors to be technology-friendly, which, unfortunately, is not always the case. To go into more detail, 67.2% of the students believe that teachers require new skills for delivering online content. This supports the findings of [33]. Moreover, 64.1% agree that investment in new technology to support e-learning is very important. Also, 57.9% agree that e-learning platforms make it more convenient for publishing materials. Furthermore, half of the participating students favor e-learning platforms for organizing learning. This is not surprising as there are fewer chances of students missing out on classes (i.e., they can access easily anytime anywhere). Moreover, 40% generally agree that students need to be supported by IT experts to facilitate the learning process. This percentage indicates that many students face issues when dealing with new technologies and supports the findings of [34].

Regarding students' satisfaction, 73.1% of the students believe that e-learning is the best learning

method during pandemics. In fact, this represents the second-highest response in the survey. We found that 64.8% believe that the relationship between students and teachers affects their satisfaction with their e-learning experience. Moreover, 47% consider that teacher presence in an e-learning environment creates students' satisfaction. This is in line with the findings of [28] and [29]. Where the general question on satisfaction "I am satisfied with online course delivery during this pandemic time", 61.7% agree. This reveals that the students are satisfied with their e-learning experience at the SEEU. This supports our third hypothesis and follows the findings of [24]. However, many students (52.4%) believe that e-learning is just a short-term alternative to traditional classroom instruction.

5.2. Mathematical Model for Predicting Students' Satisfaction

To see the ratio of students' satisfaction, we have built a mathematical model. In our model, the dependent variable is (Student Satisfaction) equal to 0 if the sum of student's responses were low (less than 15 - indicating disagree) and equal to 1 if the sum of the responses were high (greater than or equal to 15 - indicating agree). On the other hand, the independent variables, which are "Building relationships", "Student interaction", "Student engagement", and "Technology", are set to 1 if the student's responses were low (less than 15- indicating disagree) and set to 2 if the sum of the responses were high (greater than or equal to 15- indicating agree). Table 5. is a descriptive block diagram to illustrate the proposed dependent variable and one of the independent variables, which is BR.

Table 5. Example of the proposed binary variable

	<i>Student Satisfaction (Dependent variable)</i>					Sum	Code
5-point Likert scale	S1	S2	S3	S4	S5		
Strongly disagree (1)	1	1	1	1	1	5	0 if sum<15 1 if sum≥15
Disagree (2)	5	5	5	5	5	25	
	<i>Building Relationships (Independent variables)</i>						
	BR1	BR2	BR3	BR4	BR5		
Agree (4)	1	1	1	1	1	5	1 if sum<15 2 if sum≥15
Strongly agree (5)	5	5	5	5	5	25	

Table 6. demonstrates the results of the estimation of coefficients of the logit model using the program MedCalc.

Table 6. Logistic regression model

	Dependent Y			SS
	Method			Enter
	Sample size			290
	Cases with Y=0			74 (25.52%)
	Cases with Y=1			216 (74.48%)
Overall Model Fit	Null model -2 Log Likelihood			329.409
	Full model -2 Log Likelihood			193.542
	Chi-square			135.867
	Degree of freedom			4
Significance level			P < 0.0001	
Coefficients and Standard Errors	Variable	Coefficient	Std. Error	P-value
	BR	0.7713	0.3833	0.04
	SE	1.3148	0.5034	0.01
	SI	1.6035	0.5041	0
	T	1.8934	0.3661	0.0000
Constant		-6.994		
Odds Ratios and 95 % Confidence Intervals	Variable	Odds Ratio	95% CI	
	BR	2.1625	1.0202 to 4.5836	
	SE	3.724	1.3884 to 9.9888	
	SI	4.9705	1.8505 to 13.3513	
T	6.6422	3.2412 to 13.6122		
Classification table (cut-off value p= 0.5)	Actual group	Predicted group		Percentage of correct predictions
		0	1	
	Y = 0	49	25	66.22%
	Y = 1	15	201	93.06%
Percentage of correctly classified cases			86.21%	

Source: Table constructed by authors

From Table 6., we can confirm that the estimated logistic model is well consistent with the ratio of students' satisfaction relationship with the rest of the variables. The estimated output (Y) of the undertaken logistic regression model is given by:

$$Y = \text{logit}(p) = \ln \frac{p}{1-p} = -6.99 + 0.77X_{BR} + 1.31X_{SE} + 1.60X_{SI} + 1.89X_T$$

Analyzing the logit model, one can observe that: (a) the number of cases in which students' disagree (Y = 0) is 74 (or 25.52%), whereas the number of cases in which students' agree (Y = 1) is 216 (or 74.48%); (b) all coefficients of the predictors are positive; hence, have a positive effect on student's satisfaction; (c) increasing (BR, SE, SI, and T) by one will improve the opportunity of the logit by 0.77, 1.31, 1.60 and 1.89, respectively; (d) all the odds ratios of the predictors are greater than 1, i.e., any variables related to the teaching and learning process (BR, SE, SI, and T) showed a significantly positive effect by 2.16, 3.72, 4.97 6.64, respectively.

From the above results, we conclude that the overall model is significant (the Chi-Square for the

model fit is 135.867 with a p-value of 0.001). The classification percentage is 86.2% which means that the fitted model can predict dependent variable categories correctly within 88.4% accuracy with technology being the most important factor. The odds ratio for this variable is (Xt=6.64>1), which means that for any student who agrees to better conditions in technology, the chances are 6.64 times greater to be satisfied.

6. Limitations of the Study

There are several limitations in this study that are worth noting. Due to time constraints, the sample size is relatively small as the study was restricted only to students from the SEEU. Performing the study on students from different universities with different backgrounds could give us a more comprehensive view. Also, the scope of this study covered only students' points of view on e-learning and excluded instructors' opinions. It is vital to have a complete overview of the E-learning approach by considering the viewpoint of all members of the organization. The study was performed at the

beginning of the Covid-19 pandemic. The students' perspective could have changed by now as e-learning is no longer new for them. Moreover, we used only logistic regression to build the predictive model. Exploring other statistical methods might improve the results.

7. Conclusion and Recommendations

Although the future of higher education lies in e-learning [39], [40], the education system is facing challenges transitioning to it, primarily due to insufficient preparation. This study analyzed the perception of university students towards e-learning during the ongoing COVID-19 pandemic and proposed a model for predicting students' satisfaction with e-learning at the SEEU. The findings of our study support the evidence regarding the efficiency of e-learning as the majority of students happened to be satisfied with the online course delivery to cope with the curriculum during the lockdown.

To answer our first research question of whether communication is an essential factor in e-learning, students believe that the course materials uploaded on the system can help them understand the courses better. However, conventional face-to-face classes are still preferred as they put teachers at the center of the stage. To answer our second research question of whether technical skills play a significant role in the satisfaction of e-learning, most students feel that it is essential to invest in new technologies to support e-learning and that teachers require new skills for delivering online content. Finally, to answer our third research question of whether it is possible to predict the satisfaction level of students' e-learning experience, our predictive model successfully predicted students' satisfaction at the SEEU with 88.4% accuracy. Moreover, we found that technology is the most critical factor for the prediction, followed by building relationships, then students' interaction, then finally students' engagement.

For better adoption of e-learning during pandemics, we highly recommended investigating the instructors' point of view on e-learning. We also believe that educators should have a comprehensive understanding of the challenges and opportunities presented by online platforms. Moreover, higher education institutions need to focus on better comprehensive E-learning platforms for the effective delivery of virtual content to all their users. Correspondingly, e-learning material should be provided in ways that improve the learning experience. This requires a more in depth understanding of the features that influence e-learning. For future work, we strongly suggest

exploring different statistical approaches for predicting students' satisfaction with e-learning. We also suggest that this study be performed using a larger dataset to produce more robust results. Furthermore, we recommend that the same participants retake the survey as they may have a different point of view at this stage.

Data Availability Statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

References

- [1]. Serrano, D. R., Dea-Ayuela, M. A., Gonzalez-Burgos, E., Serrano-Gil, A., & Lalatsa, A. (2019). Technology-enhanced learning in higher education: How to enhance student engagement through blended learning. *European Journal of Education*, 54(2), 273-286. <https://doi.org/10.1111/EJED.12330>.
- [2]. Dubey, P., & Pandey, D. (2020). Distance learning in higher education during pandemic: challenges and opportunities. *Int. J. Ind. Psychol*, 8(2), 43-46. <https://doi.org/10.25215/0802.204>.
- [3]. Yusuf, B. N., & Ahmad, J. (2020). Are we prepared enough? A case study of challenges in online learning in a private higher learning institution during the Covid-19 outbreaks. *Advances in Social Sciences Research Journal*, 7(5), 205-212. <https://doi.org/10.14738/assrj.75.8211>
- [4]. Kate, F. (2001). E-learning markets and providers: some issues and prospects. *Education+ Training*, 43(4-5), 233-239. <https://doi.org/10.1108/EUM0000000005484>
- [5]. Gurme, V. M. (2019). Challenges and opportunities facing e-learning for the higher education sector in pune during covid19. *International Journal of Scientific Development and Research*, 6(2), 2455-2631.
- [6]. Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington DC: US Department of Education, Office of Planning, Evaluation, and Policy Development.
- [7]. Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. *Interactive learning environments*, 1-13. <https://doi.org/10.1080/10494820.2020.1813180>
- [8]. Jena, P. K. (2020). Challenges and Opportunities created by Covid-19 for ODL: A case study of IGNOU. *International Journal for Innovative Research in Multidisciplinary Field (IJIRMF)*, 6. <https://doi.org/10.31235/osf.io/jy2td>
- [9]. Arkorful, V., & Abaidoo, N. (2015). The role of e-learning, advantages and disadvantages of its adoption in higher education. *International Journal of Instructional Technology and Distance Learning*, 12(1), 29-42.

- [10]. Sharma, D., & Singh, A. (2021). E-Learning In India During covid-19: Challenges And Opportunities. *European Journal of Molecular & Clinical Medicine*, 7(7), 6199-6206.
- [11]. Smedley, J. (2010). Modelling the impact of knowledge management using technology. *OR insight*, 23(4), 233-250. <https://doi.org/10.1057/ori.2010.11>
- [12]. Adeoye, I. A., Adanikin, A. F., Adanikin, A. (2020). COVID-19 and E-Learning: Nigeria Tertiary Education System Experience. *International Journal of Research and Innovation in Applied Science -IJRIAS*. 5(5), 28-31.
- [13]. Guragain, N. (2016). E-learning benefits and applications. [Doctoral thesis]. Helsinki Metropolia University of Applied Sciences.
- [14]. Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of educational technology systems*, 49(1), 5-22. <https://doi.org/10.1177/0047239520934018>
- [15]. Öztürk, G., Karamete, A., & Çetin, G. (2020). The Relationship between Pre-Service Teachers' Cognitive Flexibility Levels and Techno-Pedagogical Competencies. *International Journal of Contemporary Educational Research*, 7(1), 40-53. <https://doi.org/10.33200/IJCER.623668>
- [16]. Wei, H. C., & Chou, C. (2020). Online learning performance and satisfaction: do perceptions and readiness matter?. *Distance Education*, 41(1), 48-69. <https://doi.org/10.1080/01587919.2020.1724768>
- [17]. Smetackova, I., & Stech, S. (2021). The first wave of the COVID-19 pandemic in primary schools in the Czech Republic: Parental perspectives. *European Journal of Education*, 56(4), 564-577. <https://doi.org/10.1111/EJED.12478>
- [18]. Barberà, E., Gómez-Rey, P., & Fernández-Navarro, F. (2016). A cross-national study of teacher's perceptions of online learning success. *Open Learning: The Journal of Open, Distance and e-Learning*, 31(1), 25-41. DOI: 10.1080/02680513.2016.1151350
- [19]. Shambour, M. K. Y., & Abu-Hashem, M. A. (2022). Analysing lecturers' perceptions on traditional vs. distance learning: A conceptual study of emergency transferring to distance learning during COVID-19 pandemic. *Education and Information Technologies*, 27(3), 3225-3245. <https://doi.org/10.1007/S10639-021-10719-5>
- [20]. Duroisin, N., Beauset, R., & Tanghe, C. (2021). Education and digital inequalities during COVID-19 confinement: From the perspective of teachers in the French speaking Community of Belgium. *European Journal of Education*, 56(4), 515-535. <https://doi.org/10.1111/EJED.12475>
- [21]. Zeqiri, J., Kareva, V., Alija, S., & Bach, M. P. (2022). Challenges and opportunities for higher education in North Macedonia during the COVID-19 pandemics: a survey of student satisfaction and gender-related anxiety. *International Journal of Technology Enhanced Learning*, 14(2), 163-179. DOI: 10.1504/IJTEL.2022.121815
- [22]. Muthuprasad, T., Aiswarya, S., Aditya, K. S., & Jha, G. K. (2021). Students' perception and preference for online education in India during COVID-19 pandemic. *Social Sciences & Humanities Open*, 3(1), 100101. <https://doi.org/10.1016/j.ssaho.2020.100101>
- [23]. Chakraborty, P., Mittal, P., Gupta, M. S., Yadav, S., & Arora, A. (2021). Opinion of students on online education during the COVID-19 pandemic. *Human Behavior and Emerging Technologies*, 3(3), 357-365. <https://doi.org/10.1002/hbe2.240>
- [24]. Khalil, R., Mansour, A. E., Fadda, W. A., Almisnid, K., Aldamegh, M., Al-Nafeesah, A., ... & Al-Wutayd, O. (2020). The sudden transition to synchronized online learning during the COVID-19 pandemic in Saudi Arabia: a qualitative study exploring medical students' perspectives. *BMC medical education*, 20(1), 1-10. <https://doi.org/10.1186/s12909-020-02208-z>
- [25]. Song, H., Kim, J., & Luo, W. (2016). Teacher-student relationship in online classes: A role of teacher self-disclosure. *Computers in Human Behavior*, 54, 436-443. <https://doi.org/10.1016/J.CHB.2015.07.037>
- [26]. Crawley, F. E., Fewell, M. D., & Sugar, W. A. (2009). Researcher and Researched: The Phenomenology of Change from Face-to-Face to Online Instruction. *Quarterly Review of Distance Education*, 10(2), 165-176.
- [27]. Aguilera-Hermida, A. P. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *International Journal of Educational Research Open*, 1, 100011. <https://doi.org/10.1016/j.ijedro.2020.100011>
- [28]. Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning*, 22(1), 205-222. <https://doi.org/10.24059/OLJ.V22I1.1092>
- [29]. Strong, R., Irby, T. L., Wynn, J. T., & McClure, M. M. (2012). Investigating Students' Satisfaction with eLearning Courses: The Effect of Learning Environment and Social Presence. *Journal of Agricultural Education*, 53(3). <https://doi.org/10.5032/JAE.2012.03098>
- [30]. Alawamleh, M., Al-Twait, L.M. and Al-Saht, G.R. (2022), The effect of online learning on communication between instructors and students during Covid-19 pandemic, *Asian Education and Development Studies*, 11(2), 380-400. <https://doi.org/10.1108/AEDS-06-2020-0131>
- [31]. Fein, A. D., & Logan, M. C. (2003). Preparing instructors for online instruction. *New Directions for Adult and Continuing Education*, 2003(100), 45-55. <https://doi.org/10.1002/ace.118>
- [32]. Osika, E. R., Johnson, R. Y., & Buteau, R. (2009). Factors influencing faculty use of technology in online instruction: A case study. *Online Journal of Distance Learning Administration*, 12(1), 1-14.
- [33]. Albrahim, F. A. (2020). Online teaching skills and competencies. *Turkish Online Journal of Educational Technology-TOJET*, 19(1), 9-20.

- [34]. Bączek, M., Zagańczyk-Bączek, M., Szpringer, M., Jaroszyński, A., & Woźakowska-Kapłon, B. (2021). Students' perception of online learning during the COVID-19 pandemic: a survey study of Polish medical students. *Medicine*, 100(7). <https://doi.org/10.1097/MD.0000000000024821>
- [35]. Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (Vol. 398). John Wiley & Sons.
- [36]. Ching, Y. H., & Hsu, Y. C. (2015). Online Graduate Students' Preferences of Discussion Modality: Does Gender Matter?. *Journal of Online Learning and Teaching*, 11(1), 31.
- [37]. Hara, N., & Hew, K. F. (2007). Knowledge-sharing in an online community of health-care professionals. *Information Technology & People*, 20(3), 235-261. <http://doi.org/10.2139/ssrn.1522515>
- [38]. Olesova, L., Richardson, J., Weasenforth, D., & Meloni, C. (2011). Using asynchronous instructional audio feedback in online environments: A mixed methods study. *MERLOT Journal of Online Learning and Teaching*, 7(1), 30-42.
- [39]. Allen, I. E., & Seaman, J. (2010). *Learning on demand: Online education in the United States, 2009*. Sloan Consortium. PO Box 1238, Newburyport, MA 01950.
- [40]. Kebritchi, M., Lipschuetz, A., & Santiago, L. (2017). Issues and challenges for teaching successful online courses in higher education: A literature review. *Journal of Educational Technology Systems*, 46(1), 4-29. <https://doi.org/10.1177/0047239516661713>