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Level and Determinants of Satisfaction with Online Learning: Insights from University Students

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Abstract

The outbreak of COVID-19 has severely impacted classroom-based learning activities in Bangladesh, leading various educational institutions to shift towards online education. Although online learning is a relatively new concept in the country, numerous institutions have adopted this approach to maintain continuity in education during the pandemic. Because of some advantages, even after the pandemic, educational institutions partially continued online teaching-learning practices for quite a considerable period. The success of online education depends on student satisfaction, and it in turns depends on some factors. Therefore, this study is an effort to identify and assess the factors that influence students' satisfaction and determine the extent of satisfaction they derive from online education. The study employs factor analysis to identify the factors that determine students' satisfaction with online learning. Three key factors were found namely the performance of teachers, course evaluations, and university support; the quality of the e-learning environment; and the availability of devices and internet facilities. The descriptive statistics from the study indicate that students generally have neutral perceptions of their overall satisfaction with e-learning. While they appear to be satisfied with the quality of the learning environment, their views are neutral concerning the performance of teachers, course evaluation, university support, and the availability of devices and internet facilities. The findings can provide valuable insights for policymakers and other stakeholders, helping them address the challenges and better prepare for future crises like pandemics.

Keywords: E-learning, Classroom-Based Learning, Student Satisfaction, COVID-19, Bangladesh.

1. Introduction

COVID-19, the most devastating pandemic of the 21st century, resulted in extensive disruption and undermined all phases of development. Hubei province, China, first identified this novel coronavirus in December 2019, and it rapidly disseminated globally, significantly impacting numerous economies (Shahzad *et al.,* 2021). The global working environment has undergone significant changes in one month. Due to its rapid spread, it was recognized as a universal public health concern by the end of January 2020. On March 11, 2020, the World Health Organization (WHO) classified it as a pandemic (WHO, 2020). This pandemic impaired the global healthcare system and influenced each aspect of human life. The primary impact was on the education system, leading 120 countries to

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discontinue their traditional face-to-face learning methods, which in turn affected the education of approximately a billion students worldwide (Azzi-Huck and Shmis, 2020). Therefore, as an alternative learning method, online platforms facilitate higher education.

Like other parts of the world, the pandemic has shown its devastating impacts on every sphere of life in Bangladesh as it forced the country to experience a complete shutdown for a considerable period (IEDCR, 2020). At one stage the government of Bangladesh decided to close all educational institutions to control the infections and they remained closed for around one and a half years (Ahmed, 2020). Because of this closure, all students from primary to tertiary education are forced to remain at home instead of going to educational institutions. However, from the beginning of 2021, the government has massively introduced online learning in all educational institutions, starting initially from the universities. Thus, the COVID-19 pandemic has forced the country to engage in the ubiquitous use of virtual learning in academic institutions and it has facilitated the post-COVID era as well. Nowadays even though COVID is over, the practice of online education is in existence partially within hybrid models where students can attend online or in person, and many tasks of learning are performed in online mode (UNESCO, 2023; WHO, 2022).

In Bangladesh, there are 4.6 million students in various tertiary educational institutions. About 23% of students read in public and private universities (Emon *et al.,* 2020). Under the ICT policy in 2009, around 20,000 institutions in Bangladesh got laptops and multi-media projectors from the government in 2014, and free Wireless connection in public universities (Ahmed, 2020; Dutta & Smita, 2020). Most private universities are equipped with broadband lines. Besides, Bangladesh has a total of 159.780 million subscribers to mobile phones and the majority of students in higher education have a smartphone (Hasan, 2024). This suggests that the majority of students can use devices such as desktops, laptops, phones, and internet facilities. As all of the public and private universities have announced they will close their institutions, it was not possible to continue traditional face-to-face education. Therefore, during this pandemic situation, many universities have started online education.

Online education refers to lessons practiced in a synchronous atmosphere with the help of the internet, having interaction with students and teachers from anywhere (Singh & Thurman, 2019). Regarding online education, there are numerous arguments. Some argue that online education offers greater flexibility and affordability. It is easy for students to attend classes from anywhere (Dhawan, 2020). Having no other option without online learning during the pandemic, educational institutions realized the importance of digitizing their set-ups. However, online education will be favorable when the participants have essential resources and enough technical skills. Otherwise, it will be very challenging (Owusu-Fordjour *et al.,* 2020; Squires, 2019). Participants might face various kinds of technical problems which may make them bored and gloomy (Kim *et al.,* 2005).

Although technological improvement and the tremendous expansion of the internet have made a remarkable change in education (Wei & Chou, 2020), many developing countries like Bangladesh were compelled to engage in online education with the scarcity of technical support. With inadequate technical knowledge and limited access to information technology and internet infrastructure, most teachers and students have

been compelled to perform online classes through Zoom, Google Classroom, Hangouts, Microsoft Team, etc.. While the siding of an instructor, the interaction of students, and their teamwork, styles of teaching, individual inspiration, and facilities of infrastructure are leading factors for smooth online education (Eom *et al.,* 2006) and also a way of determining students' satisfaction (Bolliger, D. U & Martindale, 2004).

Therefore, it is critical to determine whether or not students are satisfied with their online education and identify the key factors that influence students' satisfaction levels. The findings of this study will assist policymakers in deciding whether the country should continue with online education or explore alternative options during any future pandemic situation.

2. Literature Review

Student satisfaction is defined as the reflection of the attitude of students toward their learning experience (Alqurashi, 2016). It can also be defined as the sentiment of the learners toward pedagogical activities (Gee, 2018). In other words, students' satisfaction is a short-term attitude resulting from amends of learners' learning experiences, services, and facilities (Weerasinghe, I. S., & Fernando, 2017). Student satisfaction is crucial to achieving the university's vision and mission (Muhsin *et al.,* 2020), and it is also regarded as a key factor in the success of online education (Soffer & Nachmias, 2018). Whereas, student satisfaction is considered a multidimensional procedure that is affected by various factors (Weerasinghe, I. S., & Fernando, 2017). The most identified factors are outlooks, intelligence, manner and services, inspiration, learning atmosphere, and learning outcomes. In addition, teachers' quality, course evaluation, and interaction of learners with a teacher have a significant impact on learners' satisfaction (Ali *et al.,* 2011).

Although there are various methods of teaching, we are very much used to the face-to-face education system as it has been going on from time immemorial (Tan *et al.,* 2016). Another popular way of teaching and an alternative way to the conventional face-to-face education system is online education, also known as, e-learning, distance learning, or distance education. Online education started many years ago, but this concept is somewhat newer in Bangladesh. It gained popularity in Bangladesh during the period of COVID-19 as the only way of continuing education. During the shutdown, several educational institutions started online education to combat the demerge of the students. To explore the success of online education during this pandemic situation several studies on student satisfaction have been conducted in different countries. Considering the focus of this study, a large number of works are reviewed to understand the key factors that determine the student satisfaction level.

Existing literature identifies various factors that influence student satisfaction levels in online education. Gopal *et al.,* (2021) used exploratory factor analysis to identify students' satisfaction level with online education during the COVID-19 epidemic and found teacher expertise, course plan, timely feedback, and expectations to be important factors. All of these factors have a significant positive influence on the overall satisfaction level of the students. The study also found that the strongest predictor is the quality of the instructor. Another study, using primary data from undergraduate students in both South Korea and

India during this COVID-19 epidemic, concluded that interaction in the classroom, course structure, student motivation, instructor knowledge, and facilitation are the key factors that determine student satisfaction level, and the estimated result was similar for both countries (Baber, 2020). The study by Chen *et al.,* (2020) identified platform availability, interaction quality, service quality, and certain personal features as influential factors in determining student satisfaction. Furthermore, the quality of interaction and service does not impact student satisfaction. Once again, researchers collected data from 280 undergraduate students at Egyptian public and private universities to identify the factors influencing students' satisfaction with online learning. The study concludes that factors such as online learning platforms, availability of internet facilities, class duration, lack of interest, inspiration, self-motivation, and course evaluation procedures significantly influence online learning satisfaction in Egypt (Basuony *et al.,* 2020).

Besides the above studies, some studies used mean statistics to estimate student satisfaction levels. Almusharraf & Khahro, (2020) conducted a study to assess students' satisfaction with their online learning experiences during the COVID-19 pandemic. According to the study, students are satisfied with the levels of course engagement undertakings, teachers' follow-up, evaluation processes, teacher's assistance, offering of online lectures, and achievement of course learning outcome, and their estimating mean scores are AMS 3.90/Agree, AMS 3.99/Agree, AMS 3.91/Agree, AMS 3.95/Agree AMS 3.89/Agree and AMS 3.89/Agree respectively. The study also found that the students were highly satisfied with the teacher's most active follow-up strategies. Again, John, (2020) performed an online survey to explore Ghanaian international students' satisfaction levels. The study also used mean statistics to interpret the result and the estimated mean value is 3.76. This result indicates that students are satisfied with the online learning resources. Besides, Agarwal & Kaushik, (2020) conducted a study to find out the perception of medical students regarding online education during this pandemic situation. They conducted a 12-day experiment on these students who used the Zoom platform for performing online classes. The students are satisfied with online education and said this one is the most effective way of keeping up with their studies. However, it was a very short time to interpret and this study provides no clear guidelines about how they were measured the student satisfaction level.

However, what are the challenges in online education were described by several studies. Faize & Nawaz (2020) tried to estimate the challenges faced by university students and provide suggestions for the improvement of online learning quality. Besides the study tried to measure students' satisfaction levels with modified instructional practices. To fulfill the research objectives the study collected data from undergraduate university students in the federal capital of Pakistan. The most identified challenges reported by the students were lack of interaction during online classes, lack of resources and internet services, distraction at home, and problems in maintaining an online routine. With the challenges, the mean satisfaction level of the students was 2.03. However, after modification practices, students' satisfaction levels became much higher. The mean satisfaction level of the students was 3.76. So, we can say that the study provides a strong guideline for educational institutions, teachers, and others, on how to increase the satisfaction level of the students.

Sultana & Khan, (2019) used principal component analysis to investigate the university student's satisfaction level with online education in Bangladesh. The study identified three factors namely the quality of the e-platform, facilitating conditions, and teachers' performance which are most important to estimate how satisfied the students are with online education. The study found that students are relatively pleased with the quality of the e-platform and teacher performance but dissatisfied with the facilitating condition. Besides the study concluded that e-platform quality is the leading interpreter of students' satisfaction levels. The study of Alqurashi, (2019) found self-efficacy, student-teacher interaction, and student–content interaction, as the most important predictor of student satisfaction.

Multiple studies explore student satisfaction with online education globally, but there is limited research focusing on specific challenges and conditions in developing countries like Bangladesh. Most studies, such as those from Egypt, South Korea, and the United States, overlook the unique constraints of internet infrastructure, digital literacy, and the availability of online learning platforms that are particularly relevant in developing nations. Most studies fail to deeply analyze how technological limitations in rural areas affect student outcomes and satisfaction. There is also inconsistency in the methods used to measure student satisfaction, with varying approaches such as factor analysis and mean statistics, which hinder cross-regional comparisons. Furthermore, a standardized framework for evaluating student satisfaction in online education is lacking which is essential for future learning advancement. These gaps highlight the need for more focused research on the specific challenges where this online learning concept is comparatively new like in Bangladesh. Therefore, this study aims to identify the key factors that influence students' satisfaction in Bangladesh.

3. Research Methodology

3.1 Sampling and Data Collection

The study is based on primary data and adopts a quantitative approach to attain the research objectives. The target population comprises students from both public and private universities who participated in online classes during the COVID-19 pandemic. Universities are selected purposively to ensure representation from both public and private universities and then random sampling was maintained to pick up students from two types of universities for avoiding selection bias.

The research questionnaire consists of 25 variables that include a variety of items, such as single generalized questions, demographic questions, multiple-choice questions, and 5-point Likert scale statements (1 indicating strongly dissatisfied and 5 indicating strongly satisfied, respectively). We distributed 400 questionnaires online via email to students. The study included 300 fully completed responses in the analysis, excluding those that were incomplete.

The collected data are analyzed using SPSS Software. We performed factor analysis to identify the underlying dimensions that could accurately measure the independent variables. The study also used descriptive statistics to evaluate student satisfaction and analyze the differences between public and private universities.

3.2 Factor Analysis

Factor analysis aims to examine a large number of variables with several new dimensions. The model displays the covariance among the unobservable, random variables in a matrix format (Olmer *et al.,* 1954; Xitao, 1995). The model demonstrates a robust correlation between variables within a specific group and a weaker relationship with other groups (Ponnam *et al.,* 2014). We used this method to restrict the variables only to describe the patterns of relationships.

The general form of the factor analysis model is:

$$Y_i = aX_i + \varepsilon_i \ldots (i)$$

Where, Y_i is the vector observable variables; X_i is the vector of unobservable factors; a is called the factor loading of the matrix; ε_i is the error vector.

As stated earlier, factor analysis seeks to take into consideration the covariance between the independent variables in terms of a smaller number of latent variables or factors. Therefore, the process also aims to identify the factors influencing students' satisfaction with online education. The factor analysis of student satisfaction in this model is specified as follows:

$$\begin{aligned}
Y_1 &= a_{11}X_1 + a_{12}X_2 + \ldots + a_{1n}X_n + \varepsilon_1 \\
Y_2 &= a_{21}X_1 + a_{22}X_2 + \ldots + a_{2n}X_n + \varepsilon_2 \\
Y_3 &= a_{31}X_1 + a_{32}X_2 + \ldots + a_{3n}X_n + \varepsilon_3 \\
&\vdots \quad \vdots \quad \vdots \quad \ddots \quad \vdots \quad \vdots \\
Y_n &= a_{n1}X_1 + a_{n2}X_2 + \ldots + a_{nn}X_n + \varepsilon_n
\end{aligned}$$

Where,
$Y_1, Y_{2, \ldots,} Y_n$ is a set of observed variables of student satisfaction with online education;
$a_{11,} a_{12,} \ldots, a_{nn}$ is factor loading or correlation coefficients;
$X_1, X_2, \ldots, X_n$ is a set of unobserved factors affecting students' satisfaction.

3.3 Measurement of Student Satisfaction

To measure student satisfaction with online education, the study includes four key questions. The first question assesses whether students perceive the outcome of online classes as good. The second evaluates the overall quality of the online classes. The third question focuses on general satisfaction with the online classes. Lastly, the fourth question investigates students' willingness to recommend online classes in the event of a future pandemic. Each of these variables is measured using a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree."

4. Results and Discussion

4.1. Reliability & Validity of Data

Cronbach's Alpha is used to estimate the initial reliability of the items. George and Mallery provided rules of thumb regarding the value of Cronbach's Alpha which is as follows "≥ 9 - Superb, ≥ 0.8 - Good, ≥ 0.7 - Acceptable, ≥ 0.6 - Questionable, ≥ 0.5 - Poor, and ≤ 0.5 – non-acceptable."

Table 1: Reliability Statistics

Cronbach's Alpha	Number of Items
0.950	25

In this study, the Cronbach's Alpha value of 0.950 significantly exceeds the acceptable threshold of 0.70, as shown in Table 1, indicating strong reliability. Furthermore, the variables in Table A1 in the appendix demonstrate a high level of internal reliability and stability (Thorndike, 1995). Since Cronbach's Alpha values, if item deleted, surpass both Nunnally and Bernstein's recommended minimum of 0.7 and Bagozzi & Yi, (1988) recommendation of 0.6, we can confidently conclude that the scales are sufficiently reliable for further analysis.

4.2 Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

The Kaiser-Meyer-Olkin test is a measure of the suitability of sample data for Factor analysis. It is also known as a measure of sample adequacy. The value of KMO lies between 0 to 1.

Table 2: KMO and Bartlett's Test Interpretation

KMO	Interpretation
Under 0.5	Non-acceptable
0.5 - 0.6	Poor
0.6 - 0.7	Measurable
0.7 - 0.8	Moderate
0.8 - 0.9	Meritorious
0.90 and above	Incredible

Kaiser (1974) classified the values of KMO into five categories which are indicated in Table 2. From Table 2 it is found that if the KMO test value is less than 0.50, we cannot go further analysis, which indicates the data are not fit for factor analysis. That means a minimum KMO of 0.50 is acceptable. The higher the KMO in number the better the data is for factor analysis. The lower the KMO value, the less acceptable the data for factor analysis. In this study, the Kaiser-Meyer-Olkin test result is 0.946, presented in Table 3, which implies that our data is suitable for performing factor analysis.

Table 3: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test Result

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.946
Bartlett's Test of Sphericity	Approx. Chi-Square	4931.69
	degree of freedom	300
	Significance	0.000

Bartlett's Test of Sphericity is another indicator to estimate the strength of association among the variables. Here, we test the null hypothesis that the correlation matrix is an identity matrix. The sphericity test rejects the null hypothesis at the significance level. Since the test of sphericity implies that it is not an identity matrix, there exists a relationship among the variables, which also indicates that factor analysis is convenient with our data.

4.3 Student Locations, Software, and Device Preferences in Online Learning

Because of the closure of educational institutions, most of the university students move from university areas to their local areas. The study found that about 60% of respondents are performing online classes from rural areas and 40% from urban areas. The primary data for this study has been collected from both public and private universities and it is found that 42% of respondents are from public universities and 58% from private universities. The estimated results are shown in Table A2 in the appendix. Though the journey of online education is new in Bangladesh, it's not new for many others. So different types of software are developed around the globe with various distinguishing characteristics namely, Zoom, Google Classroom, Google Meet, Microsoft Team, etc. Our analysis found that university students used three types of software for performing their online classes.

Table A2 in the appendix shows that 95% of public university students use Zoom and only 5% of students use Google Meet for performing their online classes. Whereas private university students use Zoom, Microsoft Teams, and Google Meet. In the case of private universities, more than half of the students use Microsoft Teams, 43% use Google Meet, and 5% of students use Zoom platforms for performing their classes. To perform online classes both teachers and students need some materials, the most important one is a desktop, laptop, or any kind of smartphone. The study found that university students use four types of devices namely desktop, laptop, smartphone, and tab. Most of the students (63%) use smartphones and about 27% of students use laptops for performing their online classes. Whereas a small number of students such as 3% and 7% students use tabs and desktops for performing their online classes which are presented in the appendix in Table A2.

4.4 Determinants of Satisfaction in E-Learning: PCA Analysis

Factor analysis is performed to confirm the determinants of student satisfaction in an e-learning environment. To investigate the underlying constructs of student satisfaction, the study uses Principal Component Analysis (PCA) and performs Varimax rotation. The finding of PCA with varimax rotation for commonalities is shown in Table A3 in the appendix. Conferring to commonalities, the availability of internet facility (0.739) is the most significant independent variable, the second most important variable is the easiest learning and using procedure of software (0.734), the third most important variable is teachers' various online teaching approaches (0.690) and the fourth key variable is the availability of necessary device (0.689).

4.4.1 Explanation of Eigen-value

Table 4 shows the total variance explained by each factor. Any variables having an eigenvalue of less than one do not have adequate total variance explained to be a single factor and are therefore omitted. Table 4 shows that only three components have an eigenvalue of more than one accounting for almost 61% of the variance. Here we see that component 4 down has an eigenvalue less than 1 and, therefore excluded from the rest of the analysis. Here the cumulative percentage is not equal to one. The total variance is not explained because only some factors are taken for further analysis when some of the variables are excluded (4 through 25 are excluded, although these variables together explained 39% of variance but variance explained by any one of the factors is not remarkable).

Table 4: Total Variance Explained

Components	Initial Eigen-values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	11.901	47.604	47.604	11.901	47.604	47.604	8.45	33.779	33.779
2	1.899	7.597	55.200	1.899	7.597	55.200	4.28	17.134	50.912
3	1.456	5.825	61.025	1.456	5.825	61.025	2.53	10.113	61.025
4	.918	3.672	64.697						
5	.848	3.394	68.091						
6	.786	3.142	71.233						
7	.685	2.741	73.974						
8	.608	2.434	76.408						
9	.562	2.249	78.657						
10	.532	2.128	80.785						
11	.516	2.063	82.848						
12	.461	1.843	84.691						
13	.440	1.759	86.450						
14	.415	1.659	88.110						
15	.374	1.496	89.606						
16	.359	1.435	91.042						
17	.339	1.355	92.396						
18	.326	1.303	93.699						
19	.299	1.197	94.896						
20	.269	1.077	95.973						
21	.248	.992	96.966						
22	.220	.879	97.845						
23	.190	.762	98.606						
24	.186	.744	99.350						
25	.163	.650	100.00						
Extraction Method: Principal Component Analysis									

Source: Survey Data

The graphical presentation of the Eigenvalues against all the factors is known as the scree plot which is shown in Figure A1 in the appendix. Here the horizontal axis displays all the factors and the vertical axis shows the eigenvalues. The Scree plot helps us to determine the number of components. From the scree plot, we see that only three factors have an eigenvalue greater than one, which means only three components have been retained.

4.4.2 Explanations of Rotated Component Matrix

Principle component analysis with rotated factor loading is presented in Table 5. Principle component analysis (PCA) is the most common procedure for categorizing the variables into a small number of latent variables. The process of rotation helps us to limit the number of factors on which the variables under study have high loading. Rotation does not

affect anything yet facilitates the interpretation. Variables having a factor loading greater than 0.5 are classified as a factor (De Winter & Dodou, 2016). Factor loading can be defined as a correlation between the original variable and the particular factor and it's crucial to understanding the nature of that specific factor (Balasundaram, 2009). Table 5 shows the rotating factor loadings for the 25 variables that have been observed. Furthermore, applying Varimax rotation, factor analysis yields 3 derived factors.

Table: 5 Rotated Component Matrix

	1	**2**	**3**
Teachers' multifarious online teaching styles	0.805		
Satisfactory guidance and follow-up of teachers through either online meet, email delivery or phone calls, or anything else.	0.768		
Satisfied with arranged seminars, webinars, and other extracurricular activities.	0.753		
Satisfied with the online learning outcomes.	0.751		
Available support from the teachers during COVID-19.	0.745		
Pleased with the acquired diversified knowledge and proficiency	0.738		
Teachers' delivery is easy to understand during these online classes.	0.725		
Teachers' efforts to enhance online learning compared to the off-line learning	0.723		
During this period of the program, Students' suggestions and comments are listed and acted upon appropriately.	0.686		
Satisfactory alternative assessment procedure of faculty members	0.685		
Gratified to the academic advisor for their follow-up, monetary and mental facilitation	0.637		
Satisfactory multimodal delivery system during online classes.	0.629		
I can interact with the teachers during the course discussions	0.625		
Teachers can use all features of the software appropriately.	0.615		
Teachers' inspiration to perform online classes	0.612		
The Testing and evaluation procedures are fair.	0.602		
It is easy to learn and use.		0.767	
Soft communication system with course instructors and friends when required.		0.749	
The course resources and materials are easily accessible.		0.722	
The used Software has the required features for conducting the class.		0.628	
In this software, it is very easy to retain various information.		0.600	
Required devices are available			0.799
Available internet facility			0.798
Compatible space to perform online classes attentively			0.608
Buying data is cost-effective.			0.531
Extraction Method: Principal Component Analysis. **Rotation Method: Varimax with Kaiser Normalization.** ***Rotation converged in 5 iterations***			

Source: Survey Data

4.4.3 Identification and Naming of Key Factors Affecting Student Satisfaction

Table A4 in the appendix shows the latent unobserved variables also known as factors that are derived from the observable variables. Initially, there are 25 variables, with the help of the data reduction technique the study identifies 3 latent variables which may represent all the variables.

Factor 1 named “Teachers’ performance, course evaluation, and university support” consists of 16 variables. The name of these variables is teachers' multifarious online teaching styles (0.805), satisfactory guidance, and follow-up of teachers through either online meet, email delivery or phone calls, or anything else (0.768), satisfied with arranged seminars, webinars, and other extracurricular activities (0.753), satisfied with the online learning outcomes (0.751), available support from the teachers during the COVID-19 (0.745), pleased with the acquired diversified knowledge and proficiency (0.738), teachers’ delivery is easy to understand during these online classes (0.725), teachers efforts to enhance online learning compare to the off-line learning (0.723), students suggestions and comments are listed and acted upon appropriately (0.686), satisfactory alternative assessment procedure of faculty members (0.685), gratified to the academic advisor for their follow up, monetary and mental facilitation (0.637), satisfactory multimodal delivery system during online classes (0.629), I can interact with the teachers during the course discussions (0.625), teachers can use all features of the software appropriately (0.615), teachers inspiration to perform online classes (0.612), and finally the testing and evaluation procedures are fair (0.602).

Factor 2 named “Quality of e-learning environment” consists of five variables namely, it is easy to learn and use (0.767), soft communication system with course instructors and friends when required (0.749), the course resources and materials are easily accessible (0.722), the used software has required features for conducting class (0.628) and the final one is, in this software, it is very easy to retain various information (0.600).

Factor 3 named “Device & internet facilities” consists of four variables namely, required devices are available (0.799), available internet facility (0.798), compatible space to perform online class attentively (0.608), and buying data is cost-effective (0.531).

4.5 Measures of Satisfaction Level

After performing the principal component analysis, we get three principal factors named ‘Teachers’ performance, course evaluation, and university support”, “Quality of e-learning environment”, and “Device & internet facilities’” which are used for the rest of the analysis.

The mean and standard deviation of the student's overall satisfaction level and satisfaction level for each factor are presented in Table 6 for both public and private universities. Among the three key factors which are affecting the student's overall satisfaction level, the students seem to be satisfied with the quality of the learning environment (mean 3.613). These composites are also rated high in both categories of students as compared to the other factors. The value of the Teachers’ performance, course evaluation, and university support (3.287), and Device & internet facilities (3.450) indicate that students are neither satisfied nor dissatisfied regarding these two factors.

Table 6: Student Satisfaction Level

Component	Total Population (Both Private and Public)		Private		Public	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Teachers' performance, course evaluation, and university support	3.287	0.872	3.454	0.764	3.055	0.957
Quality of e-learning environment	3.613	0.836	3.729	0.784	3.452	0.882
Device & internet facilities	3.450	0.889	3.408	0.867	3.508	0.919
Overall satisfaction	3.437	0.708	3.534	0.677	3.301	0.729

Source: Survey Data

Our analysis also displays that the students have a neutral perception of their online learning experience (mean 3.437 and Std. deviation 0.708). When split into private and public universities, the satisfaction rating for private universities (3.534) is somewhat higher than for public universities (3.301).

5. Conclusion and Policy Implications

The study findings enrich the existing body of knowledge by contextualizing student satisfaction within a developing country, where challenges such as limited infrastructure, inadequate resources, and varying institutional capacities hinder effective online education. Unlike studies from developed nations with robust digital ecosystems, this research underscores the unique difficulties faced by students and institutions in regions where online learning is a relatively new practice. This makes research on online education crucial to understanding student satisfaction, factors influencing it and uncovering the difficulties faced by both students and educators. The study took three hundred students of which the majority of the respondents are 20-24 years of age. The reliability of all subscales and overall scale were found higher, which substantiated the instrument's reliability. This study identified three critical factors relating to the students' online learning experiences: Teachers' performance, course evaluation, and university support; Quality of the e-learning environment; and Device & internet facilities. The findings align with previous studies highlighting the importance of factors such as teacher performance, course evaluation, and the overall learning environment in shaping student satisfaction (e.g., Ali *et al.,* 2011; Sultana & Khan, 2019; Gopal *et al.,* 2021). The study found that while students express moderate satisfaction with the e-learning environment supported by (Sultana & Khan, 2019), they exhibit neutral feelings toward other factors, such as teacher performance and the availability of devices and internet facilities. These findings contrast with global trends, where higher satisfaction with teacher-student interaction and the use of technology is often reported (Almusharraf & Khahro, 2020; John, 2020). This discrepancy could be due to infrastructural challenges and the abrupt transition to online learning during the pandemic in Bangladesh. However, this study adds a local perspective by examining both

public and private university students in Bangladesh. One key finding is that private university students reported higher satisfaction levels compared to public university students. This may be attributed to better infrastructure and access to resources in private institutions, suggesting a potential divide in the quality of online learning experiences between these sectors.

To address the satisfaction level identified in this study, several policy implications emerge. Policymakers must prioritize investment in digital infrastructure, including expanding internet connectivity and ensuring the availability of affordable devices, particularly in underserved rural areas. Institutions should focus on enhancing teacher training programs to improve digital literacy and pedagogical effectiveness in online settings. There is also a need to develop blended learning models that integrate online and face-to-face instruction, allowing for greater flexibility and inclusivity. Financial support mechanisms, such as subsidized data packages, can alleviate the economic burden on students, while universities should strengthen student support services, including academic advising and mental health resources, to foster a more supportive online learning environment. Implementing these strategies will enhance student satisfaction and prepare educational systems for future crises, ensuring continuity and equity in learning opportunities. Despite providing valuable insights, this study leaves several questions unanswered, particularly regarding the long-term effectiveness and sustainability of online education in Bangladesh. Further research is needed to explore how these findings evolve as in-person learning resumes and identify specific challenges public university students face in accessing resources.

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Appendix

Table A1: Item-Total Statistics

	Scale Mean if Item deleted	Scale Variance if Item deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Teachers' inspiration to perform online classes	80.3033	309.550	.592	.948
Teachers' multifarious online teaching styles	80.6833	300.933	.726	.947
Teachers' efforts to enhance online learning compare to the off-line learning	80.5300	308.016	.557	.949
Teachers' delivery is easy to understand during these online classes.	80.6700	300.750	.730	.947
I can interact with the teachers during the course discussions	80.4833	304.077	.686	.947
Available support from the teachers during COVID-19.	80.5433	300.904	.783	.946
Satisfactory guidance and follow-up of teachers through either online meet, email delivery or phone calls, or anything else.	80.5167	302.398	.728	.947
Teachers can use all features of the software appropriately.	80.4233	304.780	.717	.947
During this period of the program, Students' suggestions and comments are listed and acted upon appropriately.	80.5767	304.499	.710	.947
The used Software has the required features for conducting a class.	80.2267	316.477	.473	.949
It is easy to learn and use.	80.3433	305.176	.671	.947
Soft communication system with course instructors and friends when required.	80.2900	307.745	.596	.948
In this software, it is very easy to retain various information.	80.3233	308.039	.674	.947
The course resources and materials are easily accessible.	80.3800	307.420	.625	.948
Satisfactory multimodal delivery system during online classes.	80.5933	301.740	.748	.946

Satisfactory alternative assessment procedure of faculty members	80.7500	298.516	.745	.946
The Testing and evaluation procedures are fair.	80.7333	302.557	.721	.947
Satisfied with the online learning outcomes.	80.7233	299.211	.766	.946
Pleased with the acquired diversified knowledge and proficiency	80.6733	300.154	.745	.946
Compatible space to perform online classes attentively	80.5967	306.161	.611	.948
Required devices are available	80.5500	314.469	.370	.951
Available internet facility	80.8200	307.680	.486	.950
Buying data is cost-effective.	80.4233	319.696	.208	.953
Gratified to the academic advisor for their follow up, monetary and mental facilitation	80.8867	300.910	.728	.947
Satisfied with arranged seminars, webinars, and other extracurricular activities.	80.8767	301.807	.697	.947

Table A2: Demographic Characteristics of the Respondents

			Percentage
Types of University	Public		42
	Private		58
Location	Urban		40
	Rural		60
Types of Software Used	Public	Zoom	95
		Microsoft team	0
		Goggle meet	5
	Private	Zoom	5
		Microsoft team	52
		Goggle meet	43
Types of Devices Used	Desktop		7
	Laptop		27
	Smartphone		63
	Tab		3

Table A3: Communalities

Factors	Initial	Extraction
Teachers' inspiration to perform online classes	1.000	.448
Teachers' multifarious online teaching styles	1.000	.690
Teachers' efforts to enhance online learning compare to the off-line learning	1.000	.533

Teachers' delivery is easy to understand during these online classes.	1.000	.621
I can interact with the teachers during the course discussions	1.000	.530
Available support from the teachers during COVID-19.	1.000	.686
Satisfactory guidance and follow-up of teachers through either online meet, email delivery or phone calls, or anything else.	1.000	.650
Teachers can use all features of the software appropriately.	1.000	.572
During this period of the program, Students' suggestions and comments are listed and acted upon appropriately.	1.000	.575
The used Software has the required features for conducting a class.	1.000	.444
It is easy to learn and use.	1.000	.734
Soft communication system with course instructors and friends when required.	1.000	.650
In this software, it is very easy to retain various information.	1.000	.579
The course resources and materials are easily accessible.	1.000	.643
Satisfactory multimodal delivery system during online classes.	1.000	.639
Satisfactory alternative assessment procedure of faculty members	1.000	.613
The Testing and evaluation procedures are fair.	1.000	.577
Satisfied with the online learning outcomes.	1.000	.683
Pleased with the acquired diversified knowledge and proficiency	1.000	.639
Compatible space to perform online classes attentively	1.000	.641
Required devices are available	1.000	.689
Available internet facility	1.000	.739
Buying data is cost-effective.	1.000	.469
Gratified to the academic advisor for their follow up, monetary and mental facilitation	1.000	.581
Happy with arranged seminars, webinars, and other extracurricular activities.	1.000	.633
Extraction Method: Principal Component Analysis.		

Table A4: Factors Set

	Factors Name	Loaded Factors
1.	Teachers' performance, Course Evaluation, and University support	Teachers' multifarious online teaching styles
		Satisfactory guidance and follow-up of teachers through either online meetings, email delivery or phone calls, or anything else.
		Satisfied with arranged seminars, webinars, and other extracurricular activities.
		Satisfied with the online learning outcomes.
		Available support from the teachers during COVID-19.
		Pleased with the acquired diversified knowledge and proficiency
		Teachers' delivery is easy to understand during these online classes.
		Teachers' efforts to enhance online learning compare to the off-line learning
		During this period of the program, Students' suggestions and

		comments are listed and acted upon appropriately.
		Satisfactory alternative assessment procedure of faculty members
		Gratified to the academic advisor for their follow up, monetary and mental facilitation
		Satisfactory multimodal delivery system during online classes.
		I can interact with the teachers during the course discussions
		Teachers can use all features of the software appropriately.
		Teachers' inspiration to perform online classes
		The Testing and evaluation procedures are fair.
2.	Quality of e-learning Environment	It is easy to learn and use.
		Soft communication system with course instructors and friends when required.
		The course resources and materials are easily accessible.
		The used Software has the required features for conducting the class.
		In this software, it is very easy to retain various information.
3.	Device & Internet facilities	Required devices are available
		Available internet facility
		Compatible space to perform online classes attentively
		Buying data is cost-effective.

Figure A1: Scree Plot