

Effectiveness of Online Education System during Covid-19 Pandemic: A Comparative Study between Public and Private Universities in Bangladesh.

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Abstract

The COVID-19 pandemic had caused disruption in each and every sector of daily human life which as well include the education system as students were forced to go through online activities to continue their studies. The effectiveness of the online education system during that period is a matter of concern as recurring disruption caused by another wave of pandemic can hamper the whole education system. Thus, preparedness of educational institutes for another disruption may be required to overcome possible vulnerabilities. This paper conduct analysis on the effectiveness of online education system and its affecting factors with comparison between public and private universities of Bangladesh, based on the data gathered through an online survey (N=357). The effectiveness of online education being a latent variable was measured using the Structural Equation Modeling (SEM) done with the help of SPSS AMOS. From the results it is obvious that factors i.e., student's perception, their technology acceptance have significant impact on the effectiveness of online learning, but the variation of the impact of these factors are not much significant when comparing between public and private universities in Bangladesh in case of their respective effectiveness.

Keywords

COVID-19 Pandemic, Online Education System, Effectiveness, Public versus Private Universities of Bangladesh and Structural Equation Modeling.

1. Introduction

From December, 2019, after the first case of covid-19 was identified in a city named Wuhan in central China, the covid pandemic had caused more than 500 million cases and around 6 million confirmed deaths worldwide, that it is now considered as one of the deadliest in the history of pandemics (COVID-19 pandemic - Wikipedia n.d.). But health sector was not the only matter of concern that get hampered by this pandemic. Most of the governments and respective authorities had to go through tremendous pressure to control this unseen disaster and had to take some serious measure to curve down those rising covid cases. A countrywide lockdown was the only effective choice for most of the governments to stop the spreading which result in a total stagnation in each sector of the country. As part of these lockdown most educational institutions were closed down to prevent the virus from spreading, resulting in the inability of about 1.2 billion students around the world to utilize academic physical facilities. (Chandra 2020, Li and Lalani 2020). But to keep students connected with their academic life the most accepted option was to continue study through online medium which was something new for most of the students as well as teachers and other academic stuffs. So, students, instructors, and institutions are all affected by the abrupt move from physical to virtual classrooms (Chandra 2020). After getting hit by the first wave of covid, Education Ministry of Bangladesh also closed down almost all schools, colleges and universities and moved to online class. During this online learning period, the effectiveness of this online learning system is a matter of concern as different institutes took different initiatives to continue their virtual activities to keep students in academic activities. Now the effectiveness of respective education system is affected by various factors such as factors relating to the psychological, demographical, socio-economic conditions that played an important role influencing the learning activity during the pandemic.

Though after the end of that countrywide lockdown most of the institutes are back in regular facility but that yearlong online learning system gave us a new experience in our academic life. And as there exists some major difference in some aspects between public and private universities in Bangladesh, so there may also exist difference in effectiveness in their respective online learning system. As the covid pandemic is still not fully controllable and we may have to be in the same situation again, so preparedness with an effective virtual learning system is much needed. And the evaluation of the effective online learning system is our main motivation to conduct this study. Online education has opened a new normal to the academic sector in our education system and there is no guarantee that it will not be compulsory again. Bangladeshi Universities can go through a huge exposure from another adaptation process. So, it would be better to be prepared and as there are certain characteristics difference found between public and private universities from Bangladesh. So, a comparison study from both students' and University perspective on various dimensions is needed through which both can find out their lacking and make a way improve on it.

1.1 Objectives

1. To find out the factors affecting the online learning activity and categorize them in major dimensions.
2. To find out how much the dimensions affect the effectiveness of online learning system.
3. To find out the existence of variation in effectiveness between public and private universities of Bangladesh on the basis of major dimensions.

2. Literature Review

The usefulness of online courses has been widely researched by many authors i.e., in various periods. But their studies have incorporated a situation in which students could attend both online and face-to-face classes. But in the recent COVID-19 outbreak many institutions, including universities, are being forced to give lessons online. The effectiveness of online education system majorly depends upon a number of factors including learner's motivation, satisfaction and interaction, the uniformity of course design, the potential of student-teacher interactions to foster information processing and critical thinking, the flexibility of online learning, competencies required to use the technology, well-prepared instructors, feedback and clear instructions and around 15 others (Bignoux and Sund 2018; Sun and Chen 2016; Muthuprasad et al. 2021). All these major factors directly affecting the effectiveness of online education can be brought under 4 major dimensions as well as we can develop hypotheses for those dimensions as followings:

2.1 Students' Perception towards Online Education

Online education has demonstrated a number of benefits due to increased flexibility and learning opportunities, including easy access to specialists, exposure to educational environments, a varied range of course types, and engagement in student communities. However, there are certain disadvantages to online schooling as while compared to classroom learning, online learning is seen as weak in engagement (Bali and Liu 2018) and a human resource management discovered that when comparing one conventional face-to-face on-campus course with two entire online MBA courses, the traditional one is just marginally superior in terms of student performance and satisfaction (Gibson 2008).

Certain initiatives to strengthen the effectiveness of online learning must take into account student's perception as there have been found both positive and negative student perceptions of online education system (Muthuprasad et al. 2021). Student's positivity towards online learning increases student satisfaction as well as results in an incentive to learn, reduces their feeling of being isolated, and improves the overall performance in that learning environment (Khan et al. 2020)

From this the study proposes to test the following hypotheses:

Hypothesis H1: Student's positive perception towards online education in public universities has a positive impact on the effectiveness of online education system of public universities

Hypothesis H2: Student's positive perception towards online education in private universities has a positive impact on the effectiveness of online education system of private universities.

Hypothesis H3: No difference exists between students from public and private universities on their perception towards online education system.

2.2 Technology acceptance

Perceived Usefulness (PU) of technologies used during online learning, refers to the subjective assessment that involvement in online educational activities by university students would enhance or improve the learning effects means an increase in learning effectiveness and active learning. Where perceived ease of use of technologies has a major impact on student's perceived usefulness of online education systems as it also impacts their attitudes towards online learning (Wang et al. 2021). Teo et al. (2015) stated that attitude toward technology usage has always been a matter of concern which was investigated in several models that seek to explain individuals' intention for technology use. And according to Xiaoguang Pan (2020) the attitude itself influences the behavioral desire to utilize a specific technology, which predicts actual system usage. Enhancing the impact of technology in student learning by optimizing curriculum design, especially improving the way in which technology is used for independent language study outside of the classroom, and boosting students' learning motivation.

Therefore, this study proposes to test the following hypotheses:

Hypothesis H4: Student's perceived usefulness (PU) and perceived ease of use (PEU) of technologies used during online learning in public universities has a positive impact on the effectiveness of online education system of public universities.

Hypothesis H5: Student's perceived usefulness (PU) and perceived ease of use (PEU) of technologies used during online learning in private universities has a positive impact on the effectiveness of online education system of private universities.

Hypothesis H6: No difference exists between the students from public and private universities on the subject of perceived usefulness (PU) and perceived ease of use (PEU) of technologies.

2.3 Socio-economic conditions and Technical Infrastructure

The disparities and inequalities in social groups' ability to access equitable learning opportunities have grown as there was a sudden change from the conventional face-to-face learning to that online learning system (Fung et al. 2022). As the essential criteria for online education include the availability of equipment for online learning, such as PCs or mobile phones, as well as an internet connection (Emmungil and Akleyek 2021). But in Bangladesh, according to a study conducted by BRAC Institute of Governance and Development, in rural households, 59 percent do not have access to a smartphone, and 49% do not have access to computers. Which indicate that the country's digital infrastructure will continue to be hampered by the country's persistent 'digital gap' between rural and urban families (Jahan et al. 2019). The report also suggests that both students and instructors from remote areas suffer with poor network connectivity and a device shortage which, undeniably, denied comparable opportunities for those students in this new learning environment.

Therefore, the study proposes to test the following hypotheses:

Hypothesis H7: Student's socio-economic condition and the overall technical infrastructure of public universities has an impact on the effectiveness of online education system of public universities.

Hypothesis H8: Student's socio-economic condition and the overall technical infrastructure of private universities has an impact on the effectiveness of online education system of private universities.

Hypothesis H9: No difference exists between the students from public and private universities on their socio-economic condition and the technical infrastructure they belong in.

2.4 Strategies favoring the online education system

Universities' strategies in conducting online education have an impact on students' attitude toward online education. Study suggest that lack of effective learning strategies has created substantial difficulties for delivering online education, which has caused students to be reluctant to participate in online classes during this unprecedented epidemic as well as in the post-pandemic period as poor strategies has affected their attitudes towards online education (Wang et al. 2021). During covid crisis, universities had to make a quick transition to e-learning and as per Bao (2020) the unexpected transition of traditional teaching systems to online-based systems have created various hurdles for faculty members, including a lack of online teaching expertise, early preparation, and technical assistance and ultimately affecting effectiveness of online education by those socio-economic conditions as attitude impacts effectiveness.

Therefore, the study proposes to test the following hypotheses:

Hypothesis H10: Public universities' quality of strategies favoring online learning has an impact on the effectiveness of online education system of public universities.

Hypothesis H11: Private universities’ quality of strategies favoring online learning has an impact on the effectiveness of online education system of private universities.

Hypothesis H12: No difference exists between public and private universities on their quality strategies taken for online education system.

Now at last to reach to a conclusion, the study proposes to test the following hypothesis:

Hypothesis H13: No difference exists between public and private universities on the overall effectiveness of online education system.

Now to conduct the study the following variables are used described in Table 1

Table 1. Description of Latent Variables

Variable Name	Description	Variable Type
PTOE	Perception of participants towards the online education	Ordinary
TA	Technology Acceptance of the participants of online education	Ordinary
SEC	Socio-economic condition of participants of online education	Ordinary
SFOE	Quality of strategy taken by universities for online education activities	Ordinary
EOES	Effectiveness of online education system	Ordinary
University Type	Represents the type of university (Public or Private University) of the respondents’	Binomial

From the developed hypotheses we can conceptualize a model representing the effectiveness of online education system

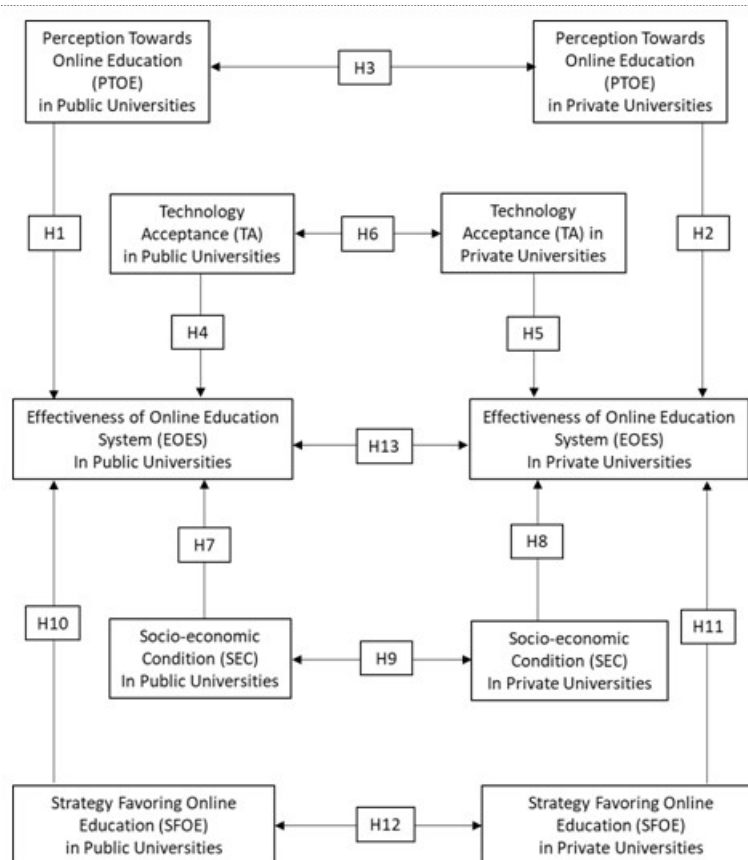


Figure 1. Conceptual Model Representing the Effectiveness of Online Education System

Under those latent variables mentioned earlier these following observed variables are used to

Table 2. Description of Observed Variables

Latent Variable		Observed Variable	Label
Exogenous Variable	PTOE	P1	Student-teacher interaction in online class
		P2	Physical surrounding during online class
		P3	Likeness for online class
		P4	Likeness for offline (physical) class
	TA	T1	Devices using status
		T2	Duration of daily devices uses
		T3	Internet network strength
		T4	Online class experience with existing device
		T5	Frequency of technical interruption during online class
	SEC	SE1	Type of living area (during online class)
		SE2	Cost increasement for attending online class
		SE3	Solvency to continue online class
		SE4	Annual family income
		SE5	Dependency on family for academic expenditure
	Exogenous Variable	SFOE	S1
S2			Satisfaction with the feedback system
S3			Providing of recorded version of online classes
S4			Providing of class material of online classes
S5			Quality of evaluation system during online classes
Endogenous Variable	EOES	Ef1	Increase in student's outcome during online sessions
		Ef2	Reliability of online examinations
		Ef3	Attentiveness in online classes
		Ef4	Status of attendance in online classes

Among the observed variables mentioned in Table 2, P4 and SE2 will be used as reversed variable as these 2 variables will negatively impact the effectiveness of online education system.

3. Methodology

In our case study, we aim to find the effectiveness of online education system based on various affecting factors and make a comparison analysis between public and private universities on their effectiveness of online education system. After problem defining, to reach the goal, at first hypotheses are developed by figuring out factors affecting online education from recently published journals and articles. Then conceptual structural equation model (SEM) is developed based on those hypotheses. Then by using IBM SPSS Statistical and AMOS software the ‘Measurement Model’ is developed based on sample data and its model fit, model reliability and normality is tested. Then, data was categorized in multi-group using SPSS AMOS and invariance across group is tested. Then hypotheses assessment is done based on the constructed SEM model.

4. Data Collection

Students from different university were invited to take part in a Google Forms online survey designed to assess their opinions on online education. No personal information was asked from the participants so that they can share their opinion anonymously and without being biased.

4.1 The Sample

Although there isn't any universal approach for calculating the appropriate sample size, academics have suggested recommendations and guidelines for suitable sample sizes when doing a factor analysis. Two recent simulation studies suggest that small sample numbers are sufficient. They discovered sample size needs varying from 30 instances (for a simple CFA with four indicators and loadings around 0.80) to 450 cases (mediation models)(Wolf et al. 2013).

In our study almost 385 undergraduates’ participants from different cities and localities of Bangladesh shared their view about online education and 357 responses could be labeled as valid.

Some demographic view of the sample based on participants’ age, their type area and type of university they are studying are shown below.

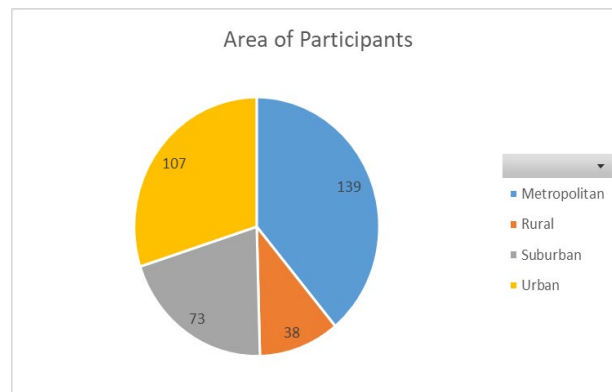


Figure 2. Demographic view of participants based on their area of living

From Figure 2 we can see that the greatest number of participants are from metropolitan area which is 139, where the lowest number of participants are from rural area.

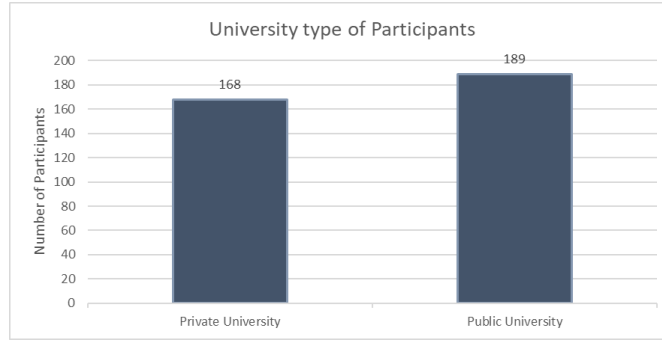


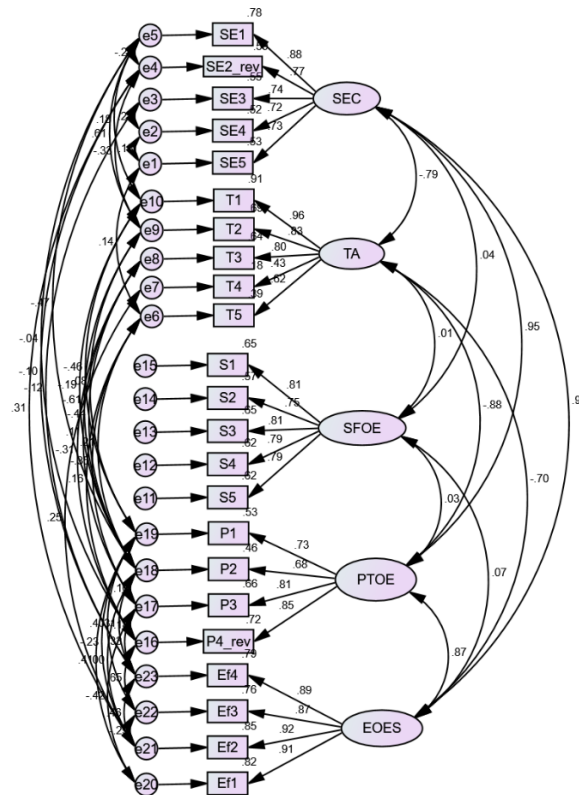
Figure 3. Demographic view of participants based on their type of university

Figure 3 shows that the number of participants from public and private university are almost same (Public University: 189; Private University: 168)

5. Results and Discussion

5.1 Measurement Model

The measurement model is the part of the model that examines relationship between the latent variables and their measure. It is used to assess the quality criteria of the constructs that is the reliability, validity of the construct, normality assessment and biasness of the data. Our five latent variables were shown in the constructed measurement model and it shows how well our indicators/observed variables measure our unobserved/latent variables and whether the unobserved constructs are different from one another. The model fitness of this measurement model was achieved using modification indices as Modification indices may often be utilized to achieve model fit (Murat and Toplu 2020).



Source: Our own calculation based on IBM SPSS Amos software

Figure 4. Measurement Model

From the measurement model outputs shown in Figure 4, we can see all the factor loadings are above 0.5 and are positives. Though SE2 and P4 variables were placed in reversed form as these have inverse impact on their latent variables. Relation between the error variables were set using modification indices.

5.2 Model Fit

AMOS was used to calculate Confirmatory Factor Analysis (CFA) in order to test the measurement models. The model's overall goodness of fit was evaluated using the model-fit measures (CMIN/df, GFI, CFI, TLI, SRMR, and RMSEA), and the majority of results fell within each measure's respective common acceptability thresholds [55, 50]. The data were well fit by the five-factor model (Table 3): CMIN/df = 4.022, GFI = 0.858, CFI = 0.930, TLI = 0.905, SRMR = 0.049, and RMSEA = 0.082.

Table 3. Obtained fit indices values

Fit Indices	Recommended Value	Obtained Value
P	Insignificant	.000
CMIN (Chi square/df)	3-5	4.022
GFI	>0.90	0.858
CFI	>0.90	0.930
TLI	>0.90	0.905
SRMR	<0.08	0.049
RMSEA	<0.08	0.082

Source: Our own calculation based on IBM SPSS AMOS software ([APPENDIX A](#))

5.3 Reliability Test

Composite Reliability: Composite Reliability was used to evaluate Construct Reliability. From Table 4, we can see that composite reliabilities were above the norm of 0.70, ranging from 0.852 to 0.943 [65]. As a result, construct dependability for each construct in the study was established.

Table 4. Composite Reliability Values of Latent Variables

Latent Variable	PTOE	SFOE	SEC	TA	EOES
Composite Reliability	0.852	0.892	0.879	0.858	0.943

Source: Our own calculation based on IBM SPSS AMOS software

Convergent Validity: Using average variation extracted (AVE), scale item convergence validity was assessed. From Table 5, we can see that the average values of variance extraction exceeded the criterion of 0.50 [66]. The scales utilized for the current investigation thus exhibit the necessary convergent validity.

Table 5. AVE Values of Latent Variables

Latent Variable	PTOE	SFOE	SEC	TA	EOES
AVE	0.593	0.623	0.594	0.563	0.805

Source: Our own calculation based on IBM SPSS AMOS software

5.4 Normality Assessment

The measure of skewness for each item is used to determine normality. A skewness of 1.0 or less shows that the data is normally distributed. However, if the sample size is high and the Critical Region (CR) for the skewness does not exceed 8.0, SEM employing the Maximum Likelihood Estimator (MLE) like AMOS is rather resilient to skewness greater than 1.0 in absolute value (SEM). Normally a sample size greater than 200 is considered large enough in MLE even though the data distribution is slightly non-normal and as our sample size is greater than 200 so we could proceed further analysis with the absolute skewness up to +/-2 (Ghasemi and Zahediasl 2012). Based on our results, we can see that the skew ranges from -0.793 to 0.466. So, the value is in an acceptable range to be considered "Normal".

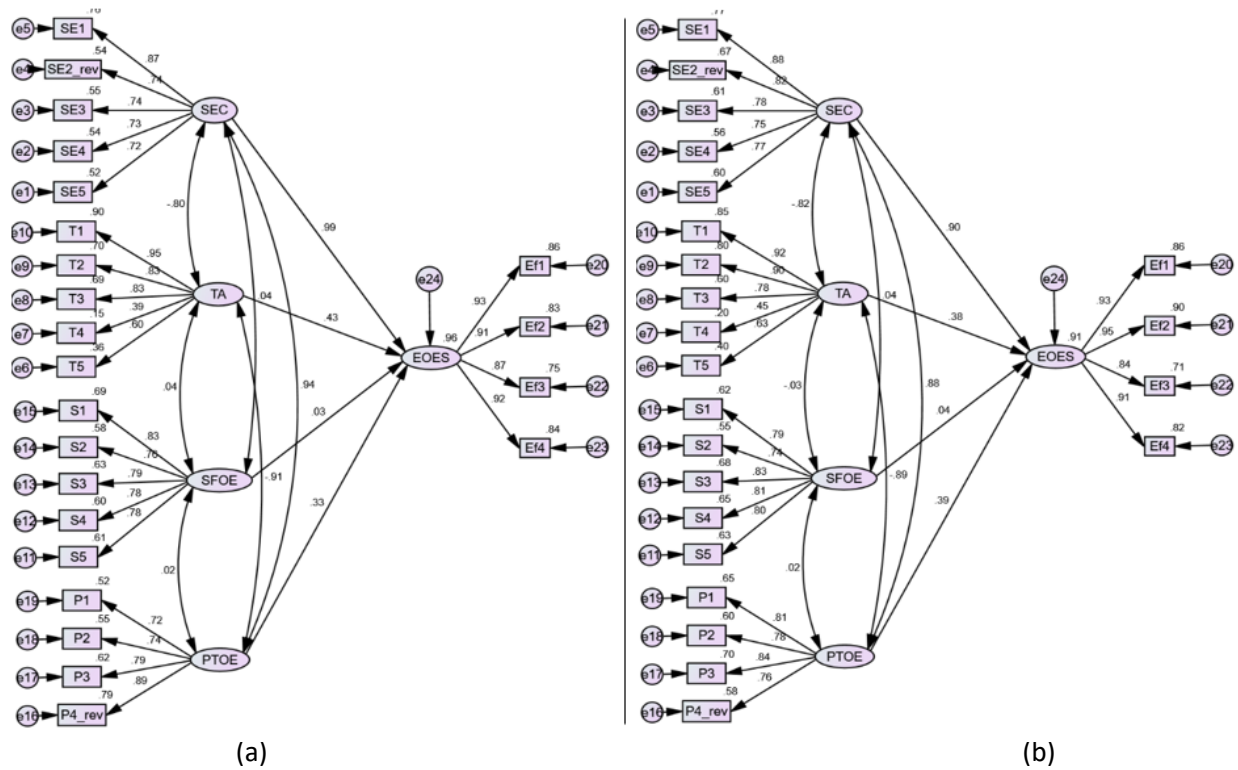
5.5 Measurement Model Invariance Across Groups

For testing our Hypothesis using SEM, we need to perform a Measurement Model Invariance Test Across Groups which will determine if the indicators are actually meaning the same thing across groups.

Measurement Model Invariance Across Groups can be determined in various ways but we are using the simple one, that is Configural Invariance. In this Configural Invariance the Model fit is tested with unconstrained conditions in the measurement model constructed after declaration of the groups. There is a good model fit (CMIN=2.622, GFI=0.827, CFI=0.926, TLI=0.899, RMSEA=0.068) which shows we have achieved measurement model invariance using a configural invariance test.

5.6 Multi-group Structural Equation Model Assessment

A structural equation model generated through AMOS was used to test the relationships. The squared multiple correlation was 0.97 for Effectiveness of Online Education for Public University students and 0.91 for Private University students, this shows that 97% and 91% variance in Effectiveness of Online Education for Public and Private University students respectively is accounted for by Perception Towards the Online Education (PTOE), Technology Acceptance (TA), Socio-economic condition (SEC) and Strategy Favoring Online Education (SFOE).



Source: Our own calculation based on IBM SPSS AMOS software
 Figure 5. Factor Loadings of constructed SEM for (a)Public University&(b)Private University

The study assessed the impact of student’s perception, technology acceptance, strategies favoring online class and socio-economic conditions on effectiveness of online education. From Figure 5, we can see thatthe impact of PTOE on Effectiveness of Online Education (EOE) was positive but insignificant for Public University students (b =0.827, t = 1.949, p = 0.051), hence H1 is not supported but was positive and significant for Private University students (b =0.323, t = 2.088, p < 0.05), supporting H2. The impact of TA on EOE was positive and significant for both Public University students (b =0.651, t = 2.853, p < 0.05) and Private University students (b =0.341, t = 2.794, p < 0.05), supporting H4 & H5. The impact of SEC on EOE was positive and significant for both Public and Private University students, supporting both H7 and H8, where values are (b =0.699, t = 2.770, p < 0.05) and (b =0.935, t = 7.095, p < 0.05) respectively. On the other hand, the impact of SFOE on EOE was positive but insignificant for both Public and

Private University students, hence H10 and H11 both null are not accepted, values are (b =0.024, t = .573, p = 0.567) and (b =0.034, t = .832, p = 0.406) respectively.

The study also found that though there is difference present between Public and Private Universities in impact of all the latent variables on Effectiveness of Online Education but no one is significant enough to support the hypothesis.

Table 6. Hypotheses Assessment (Impact of Factors on Effectiveness)

University Type	Hypothesized Relationship	Standardized Regression Weights	t-value >1.96	p-value <0.05	Decision
Public	H1: PTOE → EOES	0.827	1.949	0.051	Rejected
Private	H2: PTOE → EOES	0.323	2.088	0.037	Accepted
Public	H4: TA → EOES	0.651	2.853	0.004	Accepted
Private	H5: TA → EOES	0.341	2.794	0.005	Accepted
Public	H7: SEC → EOES	0.699	2.770	0.006	Accepted
Private	H8: SEC → EOES	0.935	7.095	0.000	Accepted
Public	H10: SFOE → EOES	0.024	0.573	0.567	Rejected
Private	H11: SFOE → EOES	0.034	0.832	0.406	Rejected

Source: Our own calculation based on IBM SPSS AMOS software

The difference on the impact of PTOE and TA on EOE is present between Public University (b = 0.827& b = 0.651) and Private University (b = 0.323& b = 0.341) but insignificant (p = 0.181& p = 0.156) respectively, thus H3 & H6 not supported.

Table 7. Hypotheses Assessment (Difference of impact across universities)

Hypothesized Relationship	Standardized Regression Weights (Public University)	Standardized Regression Weights (Private University)	p-value <0.05	Decision
H3	0.827	0.323	0.181	Accepted
H6	0.651	0.341	0.156	Accepted
H9	0.699	0.935	0.613	Accepted
H12	0.024	0.034	0.902	Accepted

Source: Our own calculation based on IBM SPSS AMOS software

In Case of the impact of SEC and SFOE on EOE is also same as previous. The difference is present but insignificant. The values are shown in Table 7.

6. Conclusion

From this study we can see that there is difference present between public and private universities in Bangladesh but the difference is insignificant. The study also finds that though there is a positive relation between strategy of educational institutions favoring online education but the relation is insignificant. Theoretical background proved

that online education has a significant relation with university strategy still it was insignificant in Bangladesh. This may be due to the fact that there is not much variation in varsity strategy or implementation of effective measures in both public and private universities. The reliability of this study was measured and in those indexes the data performed well.

In the end this study displays most of the factors under this four dimensions' students' perception, their technology acceptance, their university strategy and their socio-economic condition and found that all of them need to be improved to make online education more effective in university students of Bangladesh.

This study will be useful to both educational academics and policymakers. This study has some limitations as well. In this study, the effectiveness of online education is measured only on the basis of students' perspective but the response of the university administration and teachers could not be reflected. Therefore, it is necessary to focus on teacher and administration feedback to measure the effectiveness of online education in the future in a more effective way. Also using the extract of this study both public and private universities can conduct their SWOT analysis and find out their strengths and weaknesses and take action accordingly.

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