Towards the Quest for Technology Enabled Teaching and Learning in Higher Education System of Bangladesh: An Observational Study

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Abstract

The main purpose of this research is to examine the technology enabled teaching and learning in higher education system of Bangladesh, which has become a part of the students' and teachers' life after the pandemic. A total number of 120 students and 80 faculties were selected as a sample based on convenient and purposive sampling techniques. To gather primary data, questionnaire survey method was used. The study findings show that in case of students' data, there exists a positive relationship between Technology Enabled Teaching and Learning (TETL) and Teaching-Learning Activity (TLA). TLA are positively associated with Learning Outcome (LO), and TETL has positive impact on LO. Also, the TLA mediated the relationship between TETL and LO. In case of teachers' data, the value indicated that there exists a positive relationship between TETL and TLA, and TETL has positive impact on LO. But it has been found that TLA are negatively associated with LO. Additionally, the TLA didn't mediate the relationship between TETL and LO. This research findings can help the university authorities and government of Bangladesh to take required steps needed to support the students and teachers of higher education system so that their online learning and teaching becomes easier.

Key Words: COVID-19, Online class, Higher education, Online teaching and learning, Faculties, Students, Educational institutions, HEIs, TETL, LO, TLA, ET, ICT.

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Introduction

The COVID-19 affected not only human life and economies but also the whole educational system around the world. In 2020, the schools, colleges, and universities worldwide suddenly closed down due to the pandemic. This led to a halt in education all over the world. Nonetheless, the world quickly responded to this situation by finding an alternative way which was Technology Enabled Teaching and Learning (TETL). For helping the students to continue their education, the higher educational institutions (HEIs) around the globe started taking classes online. This gave rise to TETL. Agormedah *et al.* (2020) state that the pandemic transformed many HEIs in the world into remote learning so that it can work as a substitute of face-to-face learning. Educational institutions started to use online learning platforms that they found easy to use. However, it was found that both teachers and students faced difficulties in using these technologies which they later overcame with the passage of time. Online teaching and learning are gradually becoming a part of the education system all over the world (Nambiar, 2020).

This new normal situation posed varied challenges to university authority, faculty members, and students. Faculties have to ensure delivery of quality education, students need to arrange proper internet access, and gadgets (Tria, 2020). These difficulties of distance learning can be subdued if both parties have the willingness to change.

Higher education has been a hallmark of the education landscape and is a vital requirement for socio-economic development in any countries. As the ADB (Asian Development Bank) puts it: HEIs operate as incubators of the innovation and creative thinking needed for an economically competitive society. Increasingly, technology is being integrated into the HEIs, a factor that brings challenges and opportunities.

Choosing appropriate TETL is the most important and highly discussed issue in recent years specially during the covid period. While adapting technologies is required to squeeze the quality gap between conventional classroom teaching and off-campus distance learning, it is equally important to consider the efficiency issues concerned with adopting a new technology- this paradoxical

situation fits well with the realities in the developing countries like Bangladesh (Kabir *et al.*, 2020).

Perhaps the greatest opportunity is to reach many learners globally at a time and the chance to accelerate learning as never before. This makes the role of HEIs in teaching and learning more important than ever before. Most of the TETL used in developing countries originated from developed countries. TETL uses a variety of platforms and medias for connecting institutions and experts of national, regional, and international levels and creating opportunities of accessing to education for all either free or at very low cost irrespective of nations and regions. The effective use of TETL is essentially focused on the teachers' task of leading or engaging their students in an active, self-engaged, self-directed and motivated ways of learning (Volman & VanEck, 2001; DeCorte *et al*. 2003). Available evidence shows that the use of TETL can facilitate student-centered active learning, engage students in collaborative learning, improve their cognitive development, increase creativity and their problem-solving skills (Fisher *et al.*, 2012).

This study addresses the research gap related the adaptation and impact of TETL (Technology Enabled Teaching and Learning) in developing countries, specifically Bangladesh, where HEIs faced significant hurdles during the pandemic transition. Although frameworks like Technology-Pedagogy-Content-Knowledge (TPCK) have been suggested to support teachers (UNESCO, 2004), there remains limited research on the efficacy and implementation challenges of such models in enhancing technology enabled teaching and learning quality in resource-constrained environments. Additionally, although studies have examined ICT readiness and challenges in Bangladeshi higher education, they blended academic and administrative perspectives. This study, however, is uniquely focused on the academic perspective (Hossain *et al.*, 2016).

Thus, this study contributes to understanding the role of Technology-Enabled Teaching and Learning (TETL) in enhancing education within a developing country context, focusing on the specific needs and challenges faced by educators and learners in Higher Education Institutions (HEIs) in Bangladesh. By highlighting the unique challenges faced by faculties and students, this study

aims to suggest strategies for more effective TETL implementation. Insights from this research could guide the educational policymakers in prioritizing targeted professional development and technological infrastructure improvements, ultimately helping to foster an inclusive, technologically resilient educational framework that benefits both teachers and students.

Statement of the Problem

In the transition from traditional classrooms to technology-enabled teaching and learning (TETL), Higher Education Institutions (HEIs) worldwide have adapted rapidly, particularly since the COVID-19 pandemic. While developed countries have leveraged robust digital infrastructures to deliver effective TETL experiences, developing countries, including Bangladesh, continue to face considerable challenges. These challenges include inadequate digital infrastructure, limited technology access, and insufficient ICT training for educators, which collectively hinder the effective implementation of TETL (Shohel *et al.*, 2022).

In Bangladesh, significant governmental initiatives, such as the Higher Education Quality Enhancement Project (HEQEP) and Bangladesh Research and Education Network (BdREN), have improved internet accessibility and ICT infrastructure. However, despite these efforts, there remains a substantial gap in achieving quality technology-enabled learning outcomes in HEIs (Mollah, 2021).

Furthermore, although frameworks like Technology-Pedagogy-Content-Knowledge (TPCK) have been introduced (UNESCO, 2004) to support educators in developing TETL skills, their practical application and efficacy in resource-constrained settings remain underexplored. This study seeks to address this gap by focusing specifically on the academic and pedagogical challenges faced by Bangladeshi HEIs in implementing TETL effectively.

Literature Review

According to UNESCO, on 1st April 2020, the educational institutions in 185 countries closed down due to the outbreak of COVID-19. This affected education globally. A detailed report of the impact of this pandemic on higher education system worldwide has been provided by Association of Universities.

UNESCO (Issue Note 2.4 April 2020a) issued a detailed plan for dealing with the effect of COVID-19 in education system. Also, UNESCO (Issue Note 4.3 May 2020b) discussed the strategies that have been adopted by various countries to cope up with this crisis situation. Some parameters for e-learning have also been recommended by UNESCO. So, the pandemic opened up a new dimension of education system by shifting face-to-face education to online mode of teaching and learning. Technology enabled teaching and learning might sound easy, but it was quite a challenge for both faculties and students. Teaching online with the help of new technologies is a big challenge for the faculties as they were never used to this type of teaching method (Bisht *et al.*, 2020).

Dutta (2020) states that to ensure quality online classes, universities all over the world are using various online tools such as Zoom, Google Classroom, Skype for live online classes, YouTube for providing recorded academic and class lectures, EasyClass, and so on. Attending online classes requires high-speed internet networks. As most of the students face poor network connectivity, the attendance rate in online class seemed to be less than that of face-to-face class. Though immediate feedback about the quality of lesson and delivery is possible in face-to-face classroom, it becomes a difficulty in case of online class. Also, in classroom setup, a teacher can observe the students' body language and instantly make adjustments in teaching approach in order to best suit the students' needs (Nambiar, 2020). But such instant response is not possible in case of online class (Dhawan, 2020). Still, to continue the learning of students, it was necessary to make a rapid shift from face-to-face class to online learning system. So, the educational institutions are trying to make an effort to adapt to this change and to choose the right technology for educating the students (Rashid and Yadav, 2020).

Dhawan (2020) states that there exists *a* number of technologies for online education. But it has been found that they sometimes create difficulties such as audio/video problems, downloading errors, installation problems, login issues, and so on. In spite of all these difficulties, the perks of online education in this crisis situation cannot be ignored. According to Agormedah *et al*. (2020), the HEIs realize the pedagogical, technological, and logistical challenges related to these timely actions. In this regard, to ensure the students' high engagement

level, the HEIs need to provide necessary support to them which might include required resources and relevant suggestions.

The process of transforming from one pedagogical tradition into another is quite difficult as it involves many aspects. Technology needs to be arranged and constructed effectively by its users and the worthiness of the selected assistance have to be conveyed to the respective groups. It is recommended to develop and test a prototype in real settings before using a new technological tool. Also, it is necessary for the educators and administrators to ensure that the selected mode of technology fits with the prevailing teaching pedagogy (Chowdhury, 2020).

Research Questions

1. What is the role of TETL (Technology Enabled Teaching and Learning) activities and their learning outcome?
2. What is the mediating role of TLA (Teaching-Learning Activity) in the relationship between TETL and LO (Learning Outcome)?
3. What can be the measures for effective utilization of technology in Higher Education System of Bangladesh?

Research Model

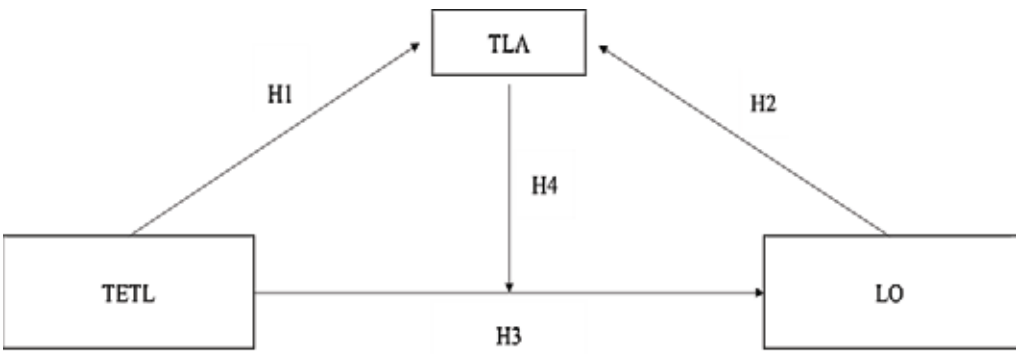

Figure: Conceptual Model

Research Hypothesis

The hypotheses formulated for this study are given below:

H_1: There is a positive relationship between TETL and TLA.

H_2: TLA are positively associated with LO.

H_3: TETL has positive impact on LO.

H_4: TLA mediates the relationship between TETL and LO.

Methods

Study Design

This study is empirical in nature. A survey method is used to collect data for the study.

Sampling Procedure and Sample Size

To conduct the study, convenient and purposive sampling techniques have been used. A total of 250 structured questionnaires were distributed among different universities' students and teachers. From them, 200 valid questionnaires were returned for the study's analysis of which 120 are from students and 80 from the faculties of different universities. So, the data type is cross-sectional in nature.

Period of the Study

The survey is conducted between December 2020 to May 2021.

Survey Instrument

The scale used in this study is adapted from Parasuraman *et al.* (1985) so that consistency is ensured. Five-Point Likert Scale has been used for this study ranging from very low (1) to very high (5). The survey instrument was

structured having first part consisted of the respondents' profile and later parts concentrated on the variables related to technology enabled education.

Data Collection Procedure

For conducting the study, both primary and secondary data have been used. For collecting primary data, direct contact was made with the respondents via emails and phone calls in which the survey purpose and general outlines were introduced. Then, the online survey link was emailed to the respondents which contained cover page introducing the study, and assurance of confidentiality. Secondary data was collected from relevant articles to provide a comprehensive literature base for this study and to identify the research gap.

Reliability

The reliability is checked via Cronbach's Alpha.

Data Analysis

All collected data were tabulated, interpreted, and simplified in order to make them suitable for research purpose. The collected raw data were inputted into SPSS (Version 20) for statistical analysis.

Findings

The findings of this study have been discussed under the subsequent headings.

Sample Profile

Table I exhibits the respondents' profiles by using the information gathered from questionnaire.

Table I: Profile of the Respondents (Students, n=120; Teachers, n=80)

List of Variables Attributes		Frequency		Percent		Valid Percent		Cumulative Percent	
		S	T	S	T	S	T	S	T
Gender	Male	44	41	36.7	51.3	36.7	51.3	36.7	51.3
	Female	76	39	63.3	48.8	63.3	48.8	100.0	100.0

Age	18-30 years	120	43	100.0	53.8	100.0	53.8	100.0	53.8
	31-40 years	0	7	0	8.8	0	8.8	0	62.5
	41-50 years	0	18	0	22.5	0	22.5	0	85.0
	51-60 years	0	4	0	5.0	0	5.0	0	90.0
	Above 60 years	0	8	0	10.0	0	10.0	0	100.0
Education Level	Under-Graduation	56	1	46.7	1.3	46.7	1.3	46.7	1.3
	Post-Graduation	64	64	53.3	80.0	53.3	80.0	100.0	81.3
	MPhil/PhD	0	15	0	18.8	0	18.8	0	100.0
Institution Type	Public University	92	38	76.7	47.5	76.7	47.5	76.7	47.5
	Private University	28	42	23.3	52.5	23.3	52.5	100.0	100.0

Note: S=Students; T=Teachers
Source: Field Survey, 2021

The total number of respondents of this study are 200, out of which the number of students is n=120 and teachers is n=80. In case of students, most of the respondents are female (63.3%). All the respondents (100%) are found to be under the age of 30 and most of them hold post graduation degree (53.3%). Most of the respondents are students at public university (76.7%). In case of teachers, majority of the respondents are male (51.3%) and aged under 30 (53.8%). Most of them hold post graduation degree (80%) and are teachers at private university (52.5%).

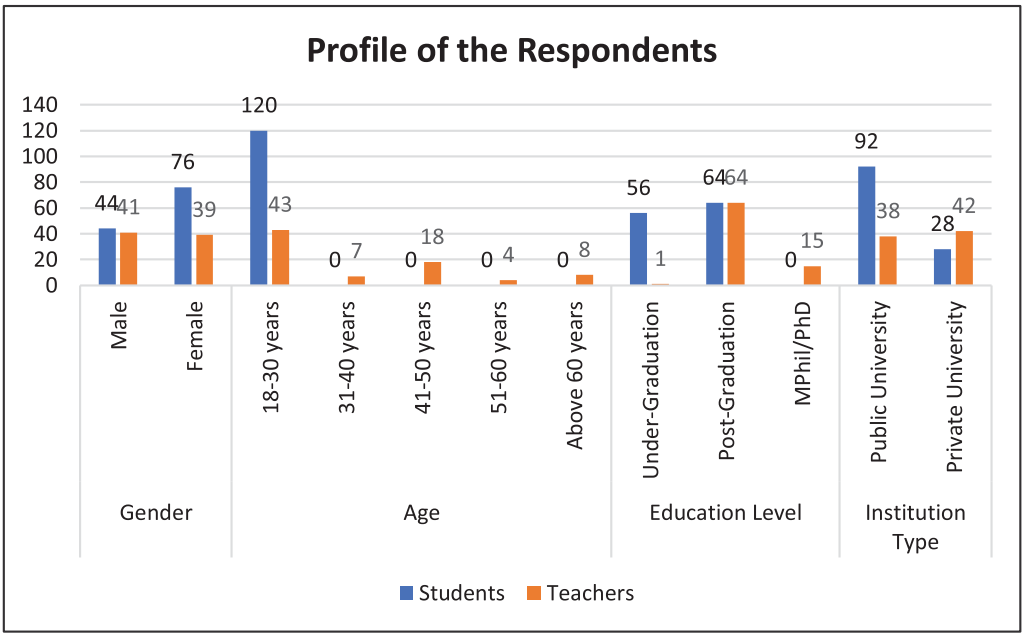

Figure I. Profile of the Respondents

Reliability Test:

Cronbach's Alpha has been used to conduct the reliability test for measuring internal consistency of the study instrument i.e., the questionnaire, as well as its stability. Reliability test indicates the extent to which the study instrument (questionnaire) is without error or bias and thus ensures consistent measurement across various items in the study instrument. For ensuring the reliability, the value of the coefficient must range between 0 to 1 and must cross 60% (0.60). Then the result of the value will be regarded as having satisfactory internal consistency reliability (Cronbach, 1970).

Table II shows Cronbach's Alpha test for each item in the questionnaire which was at a minimum acceptable level (Alpha $\geq$ 0.60).

Table II : Cronbach's Alpha Value (S=Students, T=Teachers)

Particulars	Cronbach's Alpha	
	S	T
Perceptions on Online Class		
Class structure	.846	.481
Teachers' teaching/ students' learning quality	.780	.604
Scope of learning/ teaching	.806	.712
Support of teachers/ university	.842	.702
Types of Online Classes According to Usage		
Video call	.934	.932
Audio call	.937	.934
Lecture notes	.929	.933
Lecture recordings	.933	.933
Live class	.934	.933
Assignment and term paper submission online	.931	.928
Quiz and final exams for assessment	.931	.927
Providing/getting assignment and term paper marks	.932	.927
Tracking progress/ grades	.930	.928
Lecturer feedback	.929	N/A
Audio comments for assignment/ quiz feedback	.932	N/A
Online library resources	.934	.933
Access to online resources at any time	.931	.927
Access to lectures	.929	.925
Access to fellow students	.928	N/A
Announcements	.928	.929
Email notifications	.930	.925
Subject outlines	.929	.925
Online readings	.929	.926
Chat room	.931	.928
Online meeting	.930	.928
Links to other web resources	.932	.927
Online sharing of materials among the students	.929	.930
Any information on mobile device	.930	.926

Teaching-Learning Activity (TLA): Educational Media		
Media of Online Class According to Usage		
Google Classroom	.612	.200
Google Meet	.674	.347
Zoom	.743	.552
Coursera	.590	.403
Facebook live	.742	.410
Educational institutes' websites	.594	.437
Features of Online Class Software Based on Experience of Using Them		
Usability	.872	.718
Functionality	.863	.763
User-friendliness	.876	.804
Availability	.868	.753
Internet usage	.922	.763
Security	.884	.838
Educational Technology (Environment Variable)		
Qualities		
Teaching/ learning quality	.888	.715
Enjoying the class anywhere	.894	.749
Content quality relative to face-to-face learning/ teaching	.887	.711
Scope to revisit the lecture/ work, if missed/ not understood	.898	N/A
Classrooms configured in a way that aids students' learning/ teachers' teaching	.878	.748
Functionality of ET	.873	.728
Quality of online learning/ teaching above face-to-face learning/ teaching	.900	.753
Interaction		
ET ensures more interaction between teachers and learners	.916	.927
ET brings opportunities to use own skills/ abilities	.933	.918
ET ensures the meaning fulness of learning/ teaching	.911	.906

ET service meets my expectations as usual	.908	.925
ET makes my learning/ teaching scope broader and more flexible	.913	.917
ET makes it easier for me to interact with my teachers and classmates/ colleagues and students	.919	.910
ET provides hassle-free services in learning/ teaching process	.922	.909
Educational Technology (Individual Variable)		
Motivation		
Your overall motivation level on the online learning/ teaching above face-to-face learning/ teaching	.900	.775
Your positive attitude level towards the use of ET	.956	.881
Your preference level on the online learning/ teaching above face-to-face learning/ teaching	.919	.834
Technological Ability/ Orientation		
Ability of university to help the students/ teachers with ET if they face any problem during their learning/ teaching	.893	.759
My teachers/ students meet the expectation that I have about online teaching/ learning	.852	.757
My confidence in using ET for my study/ teaching	.813	.730
Technological ability of our online class teachers/ students	.837	.738
Learning Outcome (LO)		
Users' Class Satisfaction		
Satisfaction with the different tools of ET (zoom etc.) available for studying/ teaching and communication	.821	.870
Availability of ET facilities (class recordings etc.)	.879	.865
Satisfaction with ET services provided by university in learning/ teaching process	.849	.782
Academic Achievement		

Confidence about succeeding in online learning/ teaching	.819	.501
Get quicker feedback on my online classes' learning/ teaching outcomes from the teachers/ students	.833	.596
The use of ET will be helpful for me in the future	.844	.810

Note: S=Students; T=Teachers

Source: Field Survey, 2021

From the above table it can be inferred that in terms of students' data, most of the items have more than satisfactory level of internal consistency as they are greater than the accepted percent 60% (0.60). The items that don't have more than satisfactory level of internal consistency are- Coursera and educational institutes' websites (under the heading "Media of Online Class"). Also, in terms of teachers' data, most of the items have more than satisfactory level of internal consistency as they are greater than the accepted percent 60% (0.60). The items that don't have more than satisfactory level of internal consistency are- Class structure (under the heading "Perceptions on Online Class"), all the items under the heading "Media of Online Class", and confidence about succeeding in online learning/ teaching and get quicker feedback on my online classes' learning/ teaching outcomes from the teachers/ students (under the heading Academic Achievement).

So, in both the cases of students and teachers, as the number of items having less than satisfactory level of internal consistency is few so it can be said that the internal consistency reliability can be considered to be good, acceptable, and reliable for achieving the objectives of this research study.

Table III: ANOVA Table

H_1: There is a positive relationship between TETL and TLA.

ANOVA[a]											
Model		Sum of Squares		df		Mean Square		F		Sig.	
		S	T	S	T	S	T	S	T	S	T
1	Regression	1283.985	229.530	1	1	1283.985	229.530	180.474	51.455	.000[b]	.000[b]
	Residual	839.513	347.942	118	78	7.115	4.461				
	Total	2123.498	577.472	119	79						
a. Dependent Variable: TLA											
b. Predictors: (Constant), TETL											

Source: Field Survey, 2021

H_2: TLA are positively associated with LO.

ANOVA[a]											
Model		Sum of Squares		df		Mean Square		F		Sig.	
		S	T	S	T	S	T	S	T	S	T
1	Regression	563.203	20.911	1	1	563.203	20.911	161.307	7.893	.000[b]	.006[b]
	Residual	411.997	206.639	118	78	3.491		2.649			
	Total	975.200	227.550	119	79						
a. Dependent Variable: LO											
b. Predictors: (Constant), TLA											

Source: Field Survey, 2021

H_3: TETL has positive impact on LO.

ANOVA[a]											
Model		Sum of Squares		df		Mean Square		F		Sig.	
		S	T	S	T	S	T	S	T	S	T
1	Regression	806.762	81.988	1	1	806.762	81.988	565.179	43.933	.000[b]	.000[b]
	Residual	168.438	145.562	118	78	1.427	1.866				
	Total	975.200	227.550	119	79						
a. Dependent Variable: LO											
b. Predictors: (Constant), TETL											

Source: Field Survey, 2021

The above ANOVA tables show the Mean Square, the F-statistics and the significance level. In this study, the null hypotheses of both the students' and

teachers' data were rejected as their significance levels were found to be less than .05 (.000<.05).

Table IV: Analysis of Coefficients

H_1: There is a positive relationship between TETL and TLA.

Coefficients[a]											
Model		Unstandardized Coefficients				Standardized Coefficients		t		Sig.	
		B		Std. Error		Beta					
		S	T	S	T	S	T	S	T	S	T
1	(Constant)	6.556	7.437	.913	1.721			7.180	4.320	.000	.000
	TETL	.755	.656	.056	.092	.778	.630	13.434	7.173	.000*	.000*
a. Dependent Variable: TLA											

**Significant in 95% confidence level*

Source: Field Survey, 2021

H_2: TLA are positively associated with LO.

Coefficients[a]											
Model		Unstandardized Coefficients				Standardized Coefficients		t		Sig.	
		B		Std. Error		Beta					
		S	T	S	T	S	T	S	T	S	T
1	(Constant)	-.165	7.432	.765	1.345			-.216	5.528	.829	.000
	TLA	.515	.190	.041	.068	.760	.303	12.701	2.809	.000*	.006*
a. Dependent Variable: LO											

**Significant in 95% confidence level*

Source: Field Survey, 2021

H_3: TETL has positive impact on LO.

Coefficients[a]				
Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.

		B		Std. Error		Beta					
		S	T	S	T	S	T	S	T	S	T
1	(Constant)	-.072	3.865	.409	1.113			-.176	3.471	.861	.001
	TETL	.599	.392	.025	.059	.910	.600	23.773	6.628	.000*	.000*
a. Dependent Variable: LO											

**Significant in 95% confidence level*

Source: Field Survey, 2021

From the Coefficients tables, all of the coefficient values of both students' and teachers' data were found to be less than .05 and thus indicating their significance. So, from the above Coefficients tables and their analyses, it has been found that TETL strongly influences TLA (H_1). The other 2 variables: TLA (H_2) and TETL (H_3) facilitates active and positive LO. As the significance levels of H_1, H_2, and H_3 are below the cut-off value .05, so it can be concluded by saying that H_1, H_2, and H_3 are found to be significant. That is, H_1, H_2, and H_3 are accepted with significance at 95% confidence level.

Table V: Sobel Test

H_4: TLA mediates the relationship between TETL and LO.

	Input			Test Statistic		Std. Error		P-Value	
	S	T		S	T	S	T	S	T
a	.755	.656	Sobel test:	2.16659229	-1.05669501	0.03136262	0.04842268	0.03026596	0.2906508
b	.090	-.078	Aroian test:	2.16080966	-1.04667583	0.03144655	0.0488862	0.03071005	0.29524911
s_a	.056	.092	Goodman test:	2.17242159	-1.06700754	0.03127846	0.04795468	0.02982388	0.28596843
s_b	.041	.073							

Source: Field Survey, 2021

To find out the mediation relationship, we did Sobel Test. The above table shows that in case of students' data, the p-value is below the cut-off value .05. On the other hand, in case of teachers' data, the p-value is above the cut-off value .05. So, it can be said that the H_4 of students' data is found to be significant. This means that TLA mediates the relationship between TETL and LO. That is, H_4 is accepted with significance at 95% confidence level. Whereas the H_4 of the teachers' data is found to be insignificant and for this it is rejected. So, in this case it can be said that TLA doesn't mediate the relationship between TETL and LO.

Ranking of Problems Related to TETL Vis-a-Vis Online Class in Higher Education of Bangladesh:

The students and faculties of different universities in Bangladesh ranked the problems that they are facing in online class. The problems are listed in the below table according to their rank:

Table VI: Problems Related to TETL Vis-a-Vis Online Class in Higher Education of Bangladesh

Problems Identified by the Respondents	Weighted Average	Ranking
Technical difficulties like low bandwidth and weak internet.	45.469	1
Level of maturity and motivation.	23.953	2
Limited options of presenting class materials.	21.48	3
Time management.	16.598	4
No face-to-face interaction.	16.349	5
Lack of technological proficiency.	12.815	6
Attitude of learners/ teachers.	12.763	7
Lack of self-motivation to complete tasks, stay engaged, and make progress.	10.951	8
Adaptability struggle.	8.421	9

Source: Field Survey, 2021

Table VI shows that the TETL problem- technical difficulties like low bandwidth and weak internet received the highest weighted average score (45.469) followed by level of maturity and motivation (23.953); limited options of presenting class materials (21.48); time management (16.598); no face-to-face interaction (16.349); lack of technological proficiency (12.815); Attitude of learners/ teachers (12.763); lack of self-motivation to complete tasks, stay engaged, and make progress (10.951); and adaptability struggle (8.421). To minimize these problems related to TETL vis-a-vis online class in higher education of Bangladesh, some suggestions are provided in the succeeding section that will help to enhance the effectiveness of TETL.

Discussion

Recapitulation

The aim of the study was to examine the present condition of online education system in higher education of Bangladesh after the COVID-19 pandemic started and provide necessary strategies for its improvement. The study demonstrated the experience and satisfaction level of different universities' students and teachers, with their online classes and the problems they are facing related to TETL. It has been observed from the results of this study that the students are more satisfied with online education than that of the teachers. From the Cronbach's Alpha table, it has been found that in both the cases of students and teachers, the number of items having less than satisfactory level of internal consistency is few. For this reason, the internal consistency reliability has been considered to be good, acceptable, and reliable for achieving the objectives of this research study. After doing the regression analysis, the researchers found out that the students' data indicated that there exists a positive relationship between TETL and TLA, TLA are positively associated with LO, and TETL has positive impact on LO. In case of teachers' data, the value indicated that there exists a positive relationship between TETL and TLA, and TETL has positive impact on LO. But it has been found that TLA are negatively associated with LO. From the ANOVA tables the researchers obtained that the null hypotheses of both the students' and teachers' data were rejected as their significance levels were found to be less than .05. The Coefficients tables showed that all the coefficient values of both students' and teachers' data are less than .05 and thus indicated their significance. So, it has been concluded that H_1, H_2, and H_3 are found to be significant, that is, they are accepted with significance at 95% confidence level. The Sobel Test found out the mediation relationship where it was seen that in case of students' data, the TLA mediated the relationship between TETL and LO. Whereas, in case of teachers' data the TLA did not mediate the relationship between TETL and LO.

Policy Implications

This paper highlighted the TETL problems faced by the students and teachers of higher education in Bangladesh. Thus, based on the findings, the study places the following suggestions for enhancing the effectiveness of TETL in Bangladesh:

1) The policy makers, government, and stakeholders should sit together to develop a blended learning system.
2) UGC (University Grants Commission) needs to be more proactive in framing the new policies for the changing situations in HEIs, and to ensure outcome-based education for all.
3) Arrange training for the faculty members to make them equipped with TETL strategies.
4) Ensure good internet connection accessible from remote areas.
5) Universities can record lectures of varies faculties from home and abroad, and can share them to different educational platforms so that the students can get chance to watch the lectures later repeatedly who missed it on time.
6) Digital conversion of education is essential.
7) Universities should give more preference to introducing tailor-made programs, co-op programs, or sandwich courses to develop skilled manpower.
8) Redesign the curriculum considering OBE Template to cope with the global standard.
9) Students and teachers must skill themselves to cope with the latest educational tools and technologies.

Limitations

This study has a number of limitations. Firstly, the study was based on the data collected from a small number of sample size which has been taken from small geographical area. This makes the implications of the study restricted. Secondly, the survey instrument was mainly constructed with Likert scale. So, there exist chance of central tendency bias and social desirability bias. Thirdly,

the questionnaire can be developed by discussing it with relevant field experts. Finally, this research study was confined to students and teachers of public and private universities located in Dhaka and Mymensingh of Bangladesh. Hence it may not be the representative one in other developing countries.

Directions for Future Research

Based on the literature review, data produced, findings, and references of the existing studies, the following further researches may be considered:

- Impact of higher education's technology enabled teaching and learning on human psychology.
- Capability of universities in Bangladesh for providing required support to improve TETL.
- Influencing factors for using educational technology in higher education system of Bangladesh.
- Choosing technologies for online education in developing countries: Efficiency and Efficacy issues.

Conclusion

The findings of this study have provided required answers to the research questions and may contribute to the literature of TETL in Bangladesh and other developing countries. The findings also provide insights about the shortcomings in online education system of Bangladesh's higher education and the areas where improvements are needed. Detailed suggestions have been provided by the researchers to mitigate the existing challenges of TETL and enhance its effectiveness in Bangladesh.

Technology was the only hope for the educational institutions of Bangladesh to resume the education system that came to a halt due to the COVID-19 pandemic. ET made it possible for a greater number of students to continue gaining knowledge sitting at home. Though this transition to online teaching and learning system was a challenge for a country like Bangladesh, the educational institutions managed to make the best use of it. Needless to say, ET

is addressing the needs of global people to obtain high quality teaching and learning opportunities that are either free or at very reduced cost. It is also ensuring a greater equity in access to learning.

Notes

1. The public universities are University of Dhaka, Institute of Business Administration of University of Dhaka, Bangladesh University of Professionals (BUP), and Jatiya Kabi Kazi Nazrul Islam University.
2. The private universities are BRAC University, North South University, Independent University, Bangladesh (IUB), International Standard University (ISU), Southeast University, Green University of Bangladesh, Daffodil International University, Shanto-Mariam University of Creative Technology, and Medical College for Women and Hospital.

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Appendix

Survey Instrument

"Towards the Quest of Technology Enabled Teaching and Learning in Higher Education System of Bangladesh: An Observational Study"

It would be very much appreciated if you could fill out this survey as objectively as possible. The information given here is solely for research purpose and would be treated as confidential. Thank you in advance for your nice cooperation and participation.

Select the appropriate response to each of the questions.

Part I: Personal Data

1. Gender: Male [ ] Female [ ]

2. Age: 18-30 yrs. [ ] 31-40 yrs. [ ] 41-50 yrs. [ ] 51-60 yrs. [ ] Above 60 yrs. [ ]

3. Occupation: Teacher [ ] Student [ ]
4. Education level: Under-Graduation [ ] Post-Graduation [ ] MPhil/PhD [ ] Post-doctoral [ ]
5. Institution type: Public University [ ] Private University [ ] College affiliated with National University [ ]

Part II: Online Class

1. Write in short about your beliefs and opinions regarding online class.

_____

2. Write in short about your feelings regarding online class.

_____

3. Write in short about your intentions regarding online class.

_____

4. Please rate your following perceptions on online class (1- Extremely poor, 2- Below average, 3- Average, 4- Above average, 5- Excellent)

Particulars	**1**	**2**	**3**	**4**	**5**
Class structure					
Teachers' teaching/ students' learning quality					
Scope of learning/ teaching					
Support of teachers/ university					

5. Please rate the following types of online classes according to your usage. (1- Never used, 2- Sometimes used, 3- Moderately used, 4- Frequently used, 5- Always used)

Particulars	**1**	**2**	**3**	**4**	**5**
Video call					
Audio call					
Lecture notes					
Lecture recordings					
Live class					
Assignment and term paper submission online					
Quiz and final exams for assessment					

Providing/getting assignment and term paper marks					
Tracking progress/ grades					
Lecturer feedback					
Audio comments for assignment/ quiz feedback					
Online library resources					
Access to online resources at any time					
Access to lectures					
Access to fellow students					
Announcements					
Email notifications					
Subject outlines					
Online readings					
Chat room					
Online meeting					
Links to other web resources					
Online sharing of materials among the students					
Any information on mobile device					
Others (Please specify)					

Teaching-Learning Activity: Educational Media

6. Please rate the following media of online class according to your usage. (1- Never used, 2- Sometimes used, 3- Moderately used, 4- Frequently used, 5- Always used)

Particulars	**1**	**2**	**3**	**4**	**5**
Google Classroom					
Google Meet					
Zoom					
Coursera					
Facebook live					
Educational institutes' websites					
Others (Please specify)					

7. Please rate the following features of online class software based on your experience of using them. (1- Very low, 2- Low, 3- Medium, 4- High, 5- Very high)

Features	1	2	3	4	5
Usability					
Functionality					
User-friendliness					
Availability					
Internet usage					
Security					

8. Do the media and types of online classes used by your faculties/ you align with your preference? (a) Yes [ ] (b) No [ ]

9. If no, then please mention your preference _____

10. Please rank the following problems related to education technology as well as online class in higher education of Bangladesh.

- Technical difficulties like low bandwidth and weak internet_____
- Lack of technological proficiency _____
- Adaptability struggle _____
- Time management _____
- No face-to-face interaction _____
- Lack of self-motivation to complete tasks, stay engaged, and make progress _____
- Limited options of presenting class materials _____
- Level of maturity and motivation _____
- Attitude of learners/ teachers _____
- Others (if any) _____

Educational Technology (Environment Variable)

11. Please rate the following qualities (1- Extremely poor, 2- Below average, 3- Average, 4- Above average, 5- Excellent)

Quality	1	2	3	4	5
Teaching/ learning quality					
Enjoying the class anywhere					
Content quality relative to face-to-face learning/ teaching					
Scope to revisit the lecture/ work, if missed/ not understood					
Classrooms configured in a way that aids students' learning/ teachers' teaching					
Functionality of ET					
Quality of online learning/ teaching above face-to-face learning/ teaching					

12. Please rate the following interactions (1- Strongly disagree, 2- Disagree, 3- Uncertain, 4- Agree, 5- Strongly agree)

Interaction	1	2	3	4	5
ET ensures more interaction between teachers and learners					
ET brings opportunities to use own skills/ abilities					
ET ensures the meaningfulness of learning/ teaching					
ET service meets my expectations as usual					
ET makes my learning/ teaching scope broader and more flexible					
ET makes it easier for me to interact with my teachers and classmates/ colleagues and students					
ET provides hassle-free services in learning/ teaching process					

Educational Technology (Individual Variable)

13. Please rate the followings (1- Extremely poor, 2- Below average, 3- Average, 4- Above average, 5- Excellent)

Motivation	1	2	3	4	5
Your overall motivation level on the online learning/ teaching above face-to-face learning/ teaching					
Your positive attitude level towards the use of ET					
Your preference level on the online learning/ teaching above face-to-face learning/ teaching					

14. Please rate the followings (1- Very low, 2- Low, 3- Medium, 4- High, 5- Very high)

Technological Ability/ Orientation	1	2	3	4	5
Ability of university to help the students/ teachers with ET if they face any problem during their learning/ teaching					
My teachers/ students meet the expectation that I have about online teaching/ learning					
My confidence in using ET for my study/ teaching					
Technological ability of our online class teachers/ students					

Learning Outcome

15. Please rate the followings (1- Very dissatisfied, 2- Dissatisfied, 3- Neither satisfied nor dissatisfied, 4- Satisfied, 5- Very satisfied).

Users' Class Satisfaction	1	2	3	4	5
Satisfaction with the different tools of ET (zoom etc.) available for studying/ teaching and communication					
Availability of ET facilities (class recordings etc.)					

Satisfaction with ET services provided by university in learning/ teaching process					

16. Please rate the followings (1- Very low, 2- Low, 3- Medium, 4- High, 5- Very high)

Academic Achievement	**1**	**2**	**3**	**4**	**5**
Confidence about succeeding in online learning/ teaching					
Get quicker feedback on my online classes' learning/ teaching outcomes from the teachers/ students					
The use of ET will be helpful for me in the future					

17. Further information/ recommendation regarding the survey (if any): _____

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