



Research article

Teaching during a pandemic: do university teachers prefer online teaching?

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ABSTRACT

Universities worldwide have been conducting e-learning during the COVID-19 pandemic to continue education irrespective of faculties are familiar with e-education or not. This study assessed perception and preference for e-teaching amongst 438 faculty members. Results revealed that around half of teachers were conducting e-classes without any training, and they also had conducted examinations using online platforms. Teachers perceived e-teaching as effective during the pandemic, time-efficient, easy to share materials, unsuitable for monitoring or conducting practical classes and less effective for evaluation. More than three-fourths of the teachers preferred online teaching during the pandemic, and most preferred both physical and mixed teaching in the post-pandemic era. Their preferences were influenced by their age, teaching experience, academic discipline, current residency, training on online teaching, hours of online classes taught per week, internet connection used, types of classes and whether they had given online examinations. The major challenges in online teaching during COVID-19 were difficulty in practical work, difficulty in monitoring students and insufficient feedback. This study suggests online teaching during the pandemic and mixed teaching after the pandemic. Training faculty members on online teaching, designing e-platforms suitable for examinations and ensuring stable internet connections are also recommended for effective and smooth e-education.

1. Introduction

COVID-19 is a highly contagious disease caused by the SARS COV-2 coronavirus that started in the Chinese city of Wuhan and has now spread to all continents on the earth (Remuzzi and Remuzzi, 2020). Most countries discontinued all in-person engagements, such as; in-person education, due to the respiratory sickness posed by the COVID-19 pandemic (Hoque et al., 2021; Hossain et al., 2021a,b). The pandemic has brought many changes in our lives to deal with the consequences of pandemic prevention strategies, and our education system was no different. With the state's announcement in the middle of March 2020, the country's academic institutions shut down their activities to prevent the potential spread of the Coronavirus. During the COVID-19 pandemic around the earth, many countries have embraced the virtual learning technique in their schools and colleges. Some institutions in Bangladesh opted for virtual learning platforms, while others could not begin their online teaching activities, particularly in remote areas. Those learners in cities could continue their actions. However, those staying in small

villages could not afford this online learning system due to the inability to purchase the devices and the lack of internet facilities (Salik and Chowdhury, 2020). In response to the pandemic, teachers and learners had to respond rapidly to changing their teaching and learning methods regardless of whether or not they were familiar with online education (Wu, 2021). Online teaching and learning are the only way to solve this pedagogical catastrophe that is sweeping across the globe as a result of the pandemic (Basilaia, 2020).

In-person teaching and virtual or online teaching are fundamentally different, and both the instructors and the students can recognize the differences. Aside from reproducing meaningful instructional materials in the online network, lecturing virtually necessitates additional logistic assistance, such as a device and access to the internet (Khanom et al., 2021). For the future of educational settings, online teaching is a critical breakthrough. This teaching model encourages the learners to be active and is apposite for the students with pictorial thinking style, and delivers a common idea about the subject matter (Serin, 2020). Additionally, the internet has made it possible to provide tutoring at a lesser cost than

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traditional in-person classroom teaching, thereby creating a higher potential for the students to enroll in classes (Murday et al., 2008). Nonetheless, despite the rapid awareness campaign by the government, there are still numerous constraints to the online learning environment in terms of teaching and learning viewpoints, such as establishing a broadband network, support to the organizational system, and the inclination of teachers to capture the online study materials (Meskhi et al., 2019; Sadeghi, 2019).

Several pieces of research were performed to discover the teachers' conduct towards virtual classes. The instructors believe that there needs to be a training and development program that can effectively make an efficient instructor and establish their professional path as a coach (Billings, 2008). From the standpoint of faculty members, Conrad and Donaldson (2011) emphasized the necessity of creating a feeling of togetherness and community in an online learning platform. Previous research has indicated that remote education consumes a lot of time, usually taken away from the time set aside for research and publications (Bussmann et al., 2017; Raffo et al., 2015). As a result, experienced and senior professors are shown to place a lower value on online classes than junior lecturers (Martin et al., 2019). As a result, the willingness of the faculty to reorganize their time and labor may be critical to the accomplishment of virtual tutoring and evaluation (Kabir, 2020). Souleles et al. (2020) in Cyprus stated that virtual learning should not be treated as an alternative to the existing learning techniques and that disciplinary variations should be considered. Although the hastily constructed seminar and workshops can augment the expertise of teachers, they cannot supplant the requirement for continuous training in both didactic and practical domains. Furthermore, from the research of Fauzi and Sastra Khusuma (2020), it was found that the outcomes of the virtual learning platform were poor, with 80% of educators indicating dissatisfaction with online education. They identified problems in implementing virtual teaching, including internet usage and network availability, the availability of facilities, planning and evaluation of learning, and collaboration with the guardians. Assessing how teachers engage in interactive learning behaviors throughout these critical distant study hours can promote online education in the future (Wu, 2021). Despite these researches, little is known about instructors' attitudes about this new form of instruction, and it is equally important to assess how they prefer online instruction. The findings of this study will aid in the creation of appropriate policies for the new era of education, in which teachers can use modern technologies to give lectures to students more efficiently.

However, as the pandemic prolonged and the students' learning loss increased, this prompted educational institutions to enter into the virtual teaching platform. Due to this newly introduced platform, some educators took it as the necessary and fruitful option, while others had different perceptions of this system. Thus, this study has threefold objectives. First, it assessed the university teachers' perceptions of online teaching in light of their experience during the pandemic. Second, their preference for teaching methods is examined, including the influencing factors affecting their decisions. Lastly, the challenges faced by the faculty members are investigated and ranked.

2. Materials and methods

2.1. Study design and sampling

To evaluate the perception and preferences of online teaching among the university teachers of Bangladesh amid the COVID-19 pandemic, a study using a cross-sectional online survey was conducted among university teachers from public and private universities. 'Google Form' (an online self-administered data collection tool by 'Google LLC') was used as a survey tool, and the link of the questionnaire was sent to participants via emails. About 31,594 teachers in Bangladesh teach in 151 public and private universities in Bangladesh (UGC, 2019). Every teacher in these universities was identified as the

population for our study. Following the previous studies (Hossain et al., 2021a; 2021b), assuming 50% response distribution and 95% confidence interval, the required sample size for the study was calculated to be 380, where a 5% margin of error was permitted. Approximately 3,000 teachers of different universities and designations were reached through email with the questionnaire link during May and June 2021. A total of 438 teachers consented to participate in the study and filled out the online questionnaire, which was enough to draw conclusions about the population according to the calculated sample size. Notably, no duplicate submission was found during the analysis. A pre-tested structured questionnaire was developed for the study and formatted into the 'Google Form' for the online survey. The questionnaire included demographic information of the university teachers, their academic backgrounds, experiences in teaching online, perceptions, challenges and preferences about e-learning.

2.2. Empirical methods

2.2.1. Assessing perception of online teaching

Online classrooms may become a part of the present educational system, but they will not be sustainable unless teachers accept them. A five-point Likert scale was created for 12 statements to investigate university teachers' perceptions of online classes. To reduce researcher bias, the statements were prepared after a thorough assessment of the literature (Muthuprasad et al., 2021; Kulal and Nayak, 2020; Jelińska and Paradowski, 2021; Louwrens and Hartnett, 2015) and consultation with experts in the relevant field. The perception scale ranges from highly agree to highly disagree, and we have denoted value to the respective perception scale in increasing order, namely, 5 for highly agree, 4 for agree, 3 for neutral, 2 for disagree, 1 for highly disagree. Finally, the cumulative perception score was summarized and we calculated the mean value of statements. The mean value ranges from 1 to 5, where 1 represented the most negative perception of the particular statement about online teaching, and 5 addressed the most positive perception of the particular statement.

2.2.2. Examining preference for online teaching

The binary logistic regression and multinomial logistic regression models were employed to determine the teachers' preference for online classes during the COVID-19 pandemic and following the pandemic. The validation of using a different model for preference analysis in two situations lay in respondents' responses. During data collecting, respondents were asked which teaching style (i.e., online, physical or combination of both) they preferred during and after the pandemic. Respondents preferred online and a combination of online and physical teaching during the pandemic situation. No respondents preferred continuous physical teaching during the pandemic situation. As respondents provided two preferences during the COVID-19 situation, we performed the deterministic analysis on the binary logistic model. The binary logit model is considered the best choice for investigating binary variables since regular linear regression models (whether simple or multiple) are not appropriate for binary responses (Fritz and Berger, 2015). Due to these reasons, this model has been used in a fast range of studies such as Al-Azzam et al. (2020), Sultana et al. (2022), Hossain et al. (2021b), Mozid et al. (2021), Zakaria et al. (2021), Mulat et al. (2021) and so on.

On the other hand, the dataset demonstrates that some teachers preferred continuous physical teaching, some of them online teaching and some of them a mix of both during the post-pandemic new normal situation. Now, we have three preferred teaching methods in the new normal situation. Thus, we choose the multinomial logistic regression model to determine the factors affecting the university teacher choosing the teaching method. The multinomial logistic regression model has the advantage of allowing the study of decisions in more than two categories and the determination of choice probabilities for several categories (Wooldridge, 2002). This model was also employed for similar situations

in studies by Stratton et al. (2008), Prado et al. (2019), Nevo and Egenti (2019), Vuong et al. (2019) and so on.

In the binary logit model, y is a binary variable indicating teachers' preference for the online teaching, which takes the value, $y = 1$ when a teacher preferred online teaching and $y = 0$ when otherwise. The dependent value was regressed by thirteen explanatory variables, where six dummy variables were used for analysis purposes. There were two categorical variables, namely, academic discipline (arts, science, and commerce) and type of class (theoretical, practical and both). In our study, we treated arts as the base variable for the academic discipline dummy variable and theoretical class as the base variable for the type of class.

The following empirical model was used:

$$\log \left[\frac{P}{(1-P)} \right] = \beta_0 + \beta_1 X_g + \beta_2 X_a + \beta_3 X_{ed} + \beta_4 X_{te} + \beta_5 X_{ad} + \beta_6 X_{ut} + \beta_7 X_{cr} + \beta_8 X_{noc} + \beta_9 X_{hoc} + \beta_{10} X_t + \beta_{11} X_i + \beta_{12} X_c + \beta_{13} X_e + \quad (1)$$

Where, X_g = Gender (1 for female, 0 for otherwise), X_a = Age (years), X_{ed} = Education (years of schooling), X_{te} = Teaching experience (years), X_{ad} = Academic discipline (categorical variable; base = arts), X_{ut} = University type (1 for private, 0 for otherwise), X_{cr} = Current residence (1 for urban, 0 for otherwise), X_{noc} = Numbers of online courses conducted (number), X_{hoc} = Hours online classes taken per week (number), X_t = Training on online teaching (1 for yes, 0 for otherwise), X_i = Internet connection used (1 for mobile/cellular, 0 for otherwise), X_c = Types of class (categorical variable; base = Theoretical), X_e = Conducted online examinations (1 for yes, 0 for otherwise).

The parameters of the logistic regression model are usually not directly interpretable. Instead of measuring the impact on a single conditional mean, marginal effects that quantify the impact on the chance of seeing each of numerous outcomes are more meaningful and interpretable. Hence, marginal impacts were calculated as well. The problem of heteroscedasticity was addressed via robust regression estimation.

The multinomial logit model is used to analyze the determinants of university teachers' teaching preference after the pandemic situation in this study. By following Deressa et al. (2009) to describe the multinomial logit model, let y represent a random variable with values 1, 2, ..., J, where J is a positive integer, and X represent a set of explanatory variables. In this study, y indicates teacher's preference on teaching method (online, offline and mix), and X includes gender, age, education, teaching experience, academic discipline, university type, current residence, numbers of online courses taken, hours online classes taught per week, training on online teaching, internet connection used, types of class, conducting online examinations.

The findings are intended to reveal how changes in X affect response probabilities ($P(y = j/X)$, where $j = 1, 2, \dots, J$). Let X be a 1 K vector with unity as the first member. The multinomial logit model has response probabilities:

$$P(y = j/X) = \frac{\exp(X\beta_j)}{[1 + \sum_{h=1}^J \exp(X\beta_h)], j = 1, \dots, J} \quad (2)$$

Where β_j is $K \times 1$, $j = 1, \dots, J$.

The multinomial logit model can be thought of as estimating binary logits for all potential outcomes compared at the same time. The following equation specifies the multinomial logit model used for identifying factors influencing teachers' preferences in this study.

$$\ln \left[\frac{P_r \left(y = \frac{1}{x} \right)}{1 - P_r \left(y = \frac{1}{x} \right)} \right] = \beta_0 + \beta_1 X_g + \beta_2 X_a + \beta_3 X_{ed} + \beta_4 X_{te} + \beta_5 X_{ad} + \beta_6 X_{ut} + \beta_7 X_{cr} + \beta_8 X_{noc} + \beta_9 X_{hoc} + \beta_{10} X_t + \beta_{11} X_i + \beta_{12} X_c + \beta_{13} X_e \quad (3)$$

There were three preferred teaching methods described above in the multinomial logit model for teachers' preference, where physical teaching was considered the base response. We used the same explanatory variable with the same valuation in Eq. (3) from Eq. (1).

To provide unbiased and consistent features of parameter estimations in the multinomial logit model, the assumption of independence of irrelevant alternatives (IIA) must be satisfied. The options in our investigation were not mutually exclusive. However, the survey question in this study called for the principal approach to be chosen, and only one option could be the primary strategy. As a result, the options were self-contained. We employed the well-known Hausman test in addition to the IIA assumption. The multinomial logit model's parameters are rarely clearly interpretable. Instead of measuring the impact on a single conditional mean, marginal effects (MEs) that quantify the impact on the probability of seeing each of numerous outcomes are more meaningful and interpretable (Cameron and Trivedi, 2009).

2.2.3. Problem confrontation index (PCI)

Constraints faced by teachers in this study were analyzed using Problem Confrontation Index (PCI). A four-point rating scale was used for measuring the problem confrontation score. The respondents were asked to respond against 15 major constraints they faced in online teaching during university lockdown. Each response was given a weight: 3 for a high level of confrontation, 2 for a medium level of confrontation, 1 for a low level of confrontation, and 0 for no confrontation. Then, for each constraint, the Problem Confrontation Index (PCI) was calculated using the following formula:

$$PCI = (P_H \times 3) + (P_M \times 2) + (P_L \times 1) + (P_N \times 0) \quad (4)$$

Where,

PCI = Problem Confrontation Index; P_H = No. of the respondents expressed constraint as 'high'; P_M = No. of the respondents expressed constraint as 'medium'; P_L = No. of the respondents expressed constraint as 'low', and P_N = No. of the respondents expressed constraint as 'not at all'. Thus, the PCI of individual constraint could range from 0 to 1314, where 0 indicates 'no' constraint confrontation and 1314 indicates 'highest' constraint confrontation. Finally, the constraints were ranked based on their respective PCI.

2.3. Ethics approval

Ethical approval was not required for this study since human participants were ensured following local legislation and institutional requirements. All proceeds of this research were carried out following the Helsinki Declaration principles of human subject investigation. Participation in this survey was anonymous and voluntary, assuring consent of prospective respondents before participation. Data accumulated for this research was treated confidentially.

3. Results and discussion

3.1. Demographic profile of university teachers

The overall socio-demographic composition of the participants is described in this section. As depicted in Table 1, out of 438 university teachers, more than half (59.23%) of the respondents are aged up to 35 years, 36.15% were aged between 36-50 years, and only 4.62% were aged above 50 years. This study included a disproportionate ratio of male and female teachers, which was 63.85% and 36.15% of total respondents, respectively. The educational status of the participants showed that most of the participants (66.92%) completed their master's level of education, followed by 30% with a Ph.D. However, it was interesting that only 3.08% of participants had completed a bachelor's degree. The profession of teaching is varied according to academic

Table 1. Demographic characteristics of studied participants (N = 438).

Characteristics	Level	% of respondents	Mean	SD
Age (years)*	Young (18–35)	59.23	34.64	7.37
	Middle (36–51)	36.15		
	Old (above 51)	4.62		
Gender	Male	63.85		0.48
	Female	36.15		
Education (years of schooling)	Honor's/BSc/BS	3.08	19.18	1.98
	Master's/MSc/MS/M.Phil.	66.92		
	Ph.D	30.00		
Academic discipline	Science	62.31		0.78
	Arts	20.00		
	Commerce	17.69		
Teaching experience (years)	Below 02 years	27.69	7.49	6.77
	02–05 years	18.46		
	06–10 years	27.69		
	Above 10 years	26.15		
Current designation	Lecturer	42.31		1.03
	Assistant Professor	28.46		
	Associate Professor	17.69		
	Professor	11.54		
Type of university	Public	66.92		0.47
	Private	33.08		
Current place of residence	Semi-urban	14.62		0.43
	Urban	85.38		

* Age is categorized according to the National Youth Policy of Bangladesh (2017).

discipline, i.e., science, arts, and commerce. Results elicited that more than half of the participants (62.31%) were from a science background. The average teaching experience of the participants was found to be 7.49 years, while the majority of them had 6–10 years (27.69%) and less than two years (27.69%) of teaching experience, respectively. In addition, 26.15% of participants had more than ten years of teaching experience, and 18.46% had 2–5 years of teaching experience. It was found that most of the university teachers considered for this study were at the position of lecturer (42.31%), and the smallest proportion of the participants are in a higher position like professor (11.54%). It is difficult to reach senior teachers because they are allocated to several academic activities in addition to giving lectures. The majority of the participants belong to public universities (66.92%) and resided in an urban area (85.38%).

3.2. Online teaching experiences

According to the findings, almost every participant engaged in online teaching (Table 2). On average, 10.35 online classes were conducted by a university teacher during the pandemic, while 52.31% of respondents taught fewer than five classes. In this study, a university teacher spent an average of 7.30 hrs per week teaching online classes, while 30.77% of participants spent 6–10 hrs and 28.46% spent 3–5 hrs. Further, 53.08% of participants mentioned that they participated in training on online teaching. The majority of participants (96.92%) used a laptop or personal computer, and 93.85% of participants used broadband internet connection for teaching online classes. Regarding the type of classes taught by the teachers, most of the participants answered theoretical (50.77%), followed by both theoretical and practical (47.69%). The study found that 40% of online classes had a 60–80% attendance level, and more than 80% of students attended 36.15% of online classes. The online platform was not only used for conducting classes but also for giving examinations. Results reported that 76.26% of participants conducted an examination during this pandemic using an online platform.

Table 2. Online teaching experiences of participants (N = 438).

Variables	Categories	% of respondents	Mean	SD
Teaching online	Yes	99.23		0.09
	No	0.77		
Numbers of online courses taught	Below 05	52.31	10.35	11.73
	06–10	16.92		
	11–15	8.46		
	Above 15	22.31		
Hours online classes taught per week	Below 02 h	17.69	7.30	5.81
	03–05 h	28.46		
	06–10 h	30.77		
	Above 10 h	23.08		
Training on online teaching	Yes	53.08		0.50
	No	46.92		
Gadget used for teaching online classes	Laptop/Desktop computer	96.92		0.23
	Smartphone	2.31		
	Tab	0.77		
Internet connection used for online classes	Broadband	93.85		0.24
	Mobile/Cellular	6.15		
Type of classes taught	Theoretical	50.77		0.53
	Practical	1.54		
	Both	47.69		
Attendance level of students	Below 40%	3.08		0.83
	41–60%	20.77		
	60–80%	40.00		
	Above 80%	36.15		
Conducted online examination	Yes	76.26		0.43
	No	23.74		

Note: SD indicates standard deviation.

When physical classes are halted during this pandemic, access to secure and safe online learning platforms is paramount for effective education and learning. With the blessings of ICT, the internet avails varied options to facilitate online education. Various online platforms utilized by teachers for teaching classes during the COVID-19 pandemic are depicted in Figure 1. Since Zoom apps has the greatest participant capacity and more flexibility compared to similar apps and services, the majority of the participants (79.70%) preferred Zoom apps for online classes during the pandemic. Previous research has found that an online learning platform has a number of advantages, including flexibility (Stern, 2004) and the removal of space and time restrictions (Arkorkor and Abaidoo, 2014), all of which encourage students and teachers to participate in discussions and exchange ideas. Further findings showed that 43.61% of the respondents used Google Classroom, followed by 35.34% of the respondents who used Google meet (Figure 1).

Teachers who took part in the study were asked what type of online exam they had given. The majority of teachers (85.44%) preferred to give assignments or projects during online teaching (Figure 2). Further, more than half of the participants were found to give a quiz (66.02%) and written exam (51.46%), respectively. Assessment can possibly be considered the most challenging part of the transition to distance learning for an institution used to the face-to-face oral or written exam, as the lack of control over the students makes it hardly possible to ensure that students are not using any unethical means Munoz and Mackay, 2019.

3.3. University teachers' perception of online teaching

Despite the fact that the COVID-19 pandemic halted educational operations worldwide at the start of the lockdown phase, most

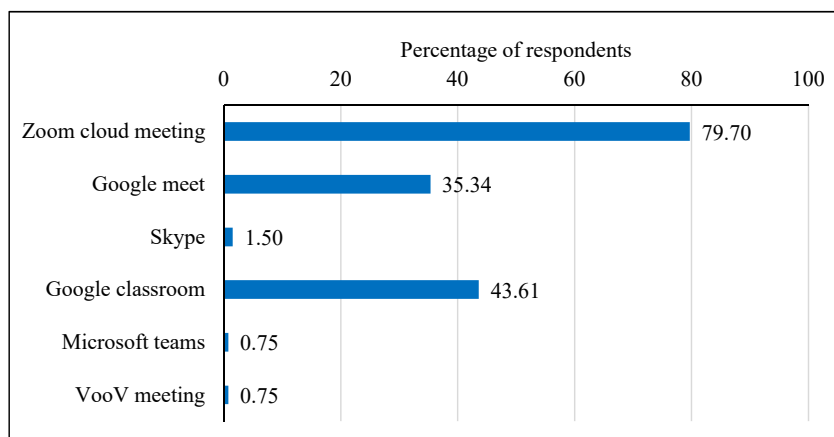


Figure 1. Platforms used for online teaching by studied participants (N = 438).

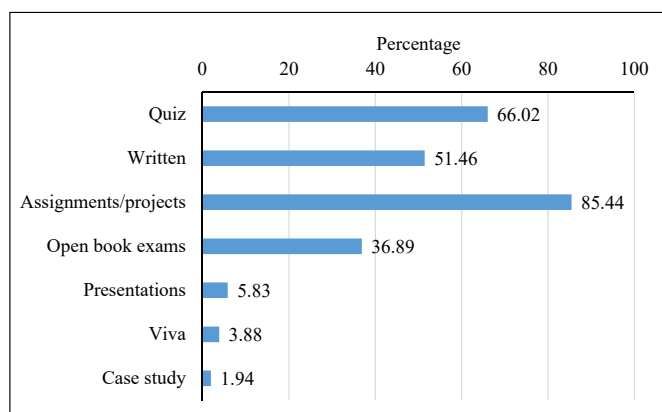


Figure 2. Types of examination conducted by the teachers (N=334).

educational institutions throughout the world have already resumed their academic activities via online platforms. Under this circumstance, the perception of online teaching among university teachers is assessed using psychometric techniques (self-reporting evaluation based on a Likert scale) whereby participants assess their perception of online teaching in relation to their past experience. Participants' responses to twelve statements are measured using a five-point Likert type scale. In addition, each statement about respondents' perceptions of the effectiveness of online teaching compared to classroom teaching was scored

against the five-point Likert type scale, and finally, a mean score was determined.

According to the average score, the overall perception of university teachers toward online instruction was determined to be more or less neutral (Table 3). The participants had more positive perceptions of online teaching effectiveness during the COVID-19 pandemic (average rating 4.12) and shareability of study materials (average rating 3.95). Results showed that most of the teachers disagreed with the statement that there is no difficulty in monitoring students and practical work, higher interest among the students, increased effectiveness compared to conventional learning, better student-instructor interaction, useful for evaluation, and better communication with students during online teaching. The online teaching process during the COVID-19 helped the teachers keep in touch with the students outside the four walls of the classroom and created an alternative for the completion of the syllabus. However, teachers noticed a lack of enthusiasm and attention from pupils during online classes. As the students are not accustomed to online learning with smartphones and computers, it turned into a major setback for them. Additionally, conducting practical classes and evaluating the students learning had been crucial challenges for the teachers.

3.4. University teachers' preferences for online teaching

At this point, the extent to which COVID-19 will cause educational institutions like schools, colleges, and universities to be closed down or merge is unknown. However, COVID-19 mandated a shift from classroom to universal remote teaching. The study compares the preferences of

Table 3. Perception of online teaching among university teachers (N = 438).

Statement	N (%)					Mean
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	
Online teaching is attractive	13 (2.97)	115 (26.26)	135 (30.82)	142 (32.42)	33 (7.53)	3.15
Online teaching is effective during pandemic	7 (1.60)	17 (3.88)	51 (11.64)	206 (47.03)	157 (35.84)	4.12
Better communication with students	35 (7.99)	168 (38.36)	111 (25.34)	104 (23.74)	20 (4.57)	2.79
Better student-instructor interaction	61 (13.93)	168 (38.36)	135 (30.82)	67 (15.30)	7 (1.60)	2.52
More time efficient	17 (3.88)	98 (22.37)	67 (15.30)	202 (46.12)	54 (12.33)	3.41
Effective compared to conventional learning	74 (16.89)	165 (37.67)	135 (30.82)	51 (11.64)	13 (2.97)	2.46
Easy to share the materials	17 (3.88)	40 (9.13)	57 (13.01)	158 (36.07)	166 (37.90)	3.95
No difficulty faced delivering content	37 (8.45)	155 (35.39)	67 (15.30)	118 (26.94)	61 (13.93)	3.03
No difficulty in monitoring students	152 (34.70)	192 (43.84)	51 (11.64)	40 (9.13)	3 (0.68)	1.97
No difficulty in practical work	175 (39.95)	152 (34.70)	67 (15.30)	24 (5.48)	20 (4.57)	2.00
Useful for evaluation	67 (15.30)	148 (33.79)	138 (31.51)	61 (13.93)	24 (5.48)	2.61
Higher interest among students	71 (16.21)	192 (43.84)	138 (31.51)	37 (8.45)	0 (0)	2.32
Overall mean score						2.86
Cronbach's alpha						0.8717

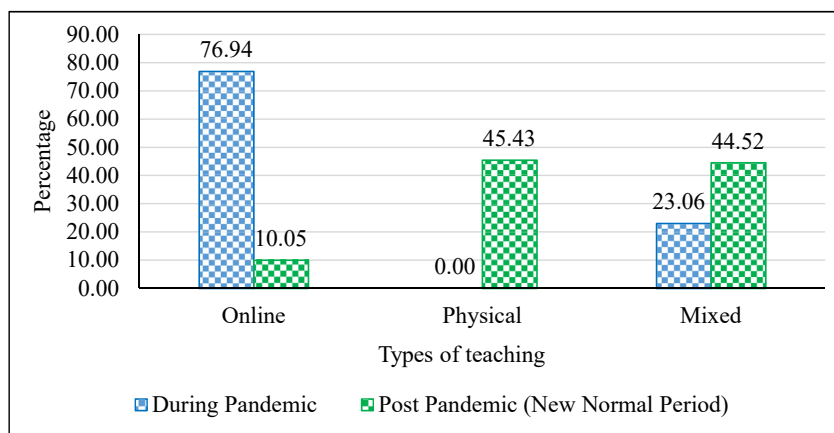


Figure 3. University teachers' preference for teaching methods.

university teachers for online instruction during COVID-19 to the typical scenario (Figure 3). It has been observed that more than three-fourth of participants preferred online teaching during the pandemic, whereas only about 10.05% of selected teachers preferred online teaching after the pandemic. During the pandemic, everyone is going through one of the most difficult times they have ever experienced, and the majority of people are opting to stay at home; as a result, teachers preferred online instruction. Additionally, it was found that none of the participants preferred to take classes physically during the pandemic, while almost half of the participants preferred to teach classes physically after the pandemic. Also, 23.08% and 44.62% of teachers preferred a combination of online and physical teaching during and after the pandemic or normal situation, respectively (Figure 3).

In addition, the study identified the factors influencing university teachers' preference for online teaching during the pandemic and new normal situation. Two separate logistic regression models are employed for teachers' preference of online teaching during the COVID-19

pandemic and the new normal situation after the pandemic. The estimated results are presented in Table 4. The study also estimated the marginal effects of the explanatory variables in order to gain a better grasp of the factors that influence the teachers' preferences. Results showed that several factors are affecting the teacher's preference. For instance, the age of the participant teachers negatively and significantly affected their preference for teaching both online and classroom classes in the normal situation. That means young university teachers prefer to teach online and classroom classes in the post COVID-19 period. This is because the young teachers are more familiar with modern technologies. Since online teaching allows teachers to share their knowledge with the rest of the world while also allowing them to improve their teaching skills as a consequence of student feedback, young teachers prefer online teaching. Nazu et al. (2021) also reported young people's tendency towards new and modern technologies. The findings revealed that participants' teaching experience negatively impacted their preference for teaching online classes during the pandemic and had a favorable impact

Table 4. Determinants of university teachers' preferences.

Explanatory variables	During Pandemic		Post Pandemic (New Normal Period)			
	Online		Online		Mixed	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Gender (0 = male, 1 = female)	0.006	0.050	0.024	0.031	0.039	0.052
Age (years)	0.010	0.007	0.004	0.003	-0.012*	0.006
Education (years of schooling)	0.021	0.014	0.004	0.007	-0.020	0.014
Teaching Experience (years)	-0.013**	0.006	-0.004	0.003	0.023***	0.007
Academic discipline (Arts = base)						
Science	-0.098*	0.050	-0.130***	0.034	0.169***	0.058
Commerce	-0.053	0.059	-0.0311	0.043	0.064	0.077
University type (0 = public, 1 = private)	-0.045	0.049	0.008	0.027	0.047	0.071
Current residence (0 = semi-urban, 1 = urban)	0.276***	0.053	-0.022	0.041	0.042	0.074
Numbers of online courses taught (number)	0.001	0.001	-0.001	0.001	-0.001	0.001
Hours online classes taught per week (number)	0.003	0.004	0.009***	0.002	-0.002	0.006
Training on online teaching (0 = no, 1 = yes)	0.073*	0.039	-0.022	0.022	-0.029	0.047
Internet connection used (0 = broadband, 1 = mobile/cellular)	-0.074	0.081	-0.831***	0.118	0.470***	0.105
Type of Classes (Theoretical = base)						
Practical	-0.437**	0.211	-0.123***	0.018	0.339***	0.112
Both	-0.003	0.042	-0.073***	0.022	0.056	0.049
Conducted Online Examination (0 = no, 1 = yes)	-0.077*	0.041	-0.089***	0.023	0.135***	0.047
Observations (N)	438		438			
Wald χ^2	77.88***		2307.63***			
Pseudo R ²	0.1580		0.1399			
Log pseudolikelihood	-197.09843		-352.35904			

[*, **, *** indicates significates level at 1%, 5% and 10% respectively].

on their preference for teaching both online and classroom classes following the pandemic. Being a teacher of science discipline has a negative and significant impact on university teachers' preference to teach online classes during and post pandemic situation. Since science disciplines require more practical work like laboratory activities, it is difficult for the teachers to carry those practical work online. In a similar vein, the result is consistent with the findings of Mishra et al. (2020) and Sahu (2020). E-learning is not thought to encompass all fields. The disciplines with theoretical topics are more flexible to conduct online than those with practical experiments (Husain et al., 2021).

University teachers' current domicile had a strong positive effect on their preference for online classes during COVID-19. The results indicated that the probability of taking an online class during COVID-19 increased by 27.6% for instructors who currently live in an urban region. During the COVID-19 lockdown, teachers taught online classes from their homes and many lived in suburban areas near the universities. In Bangladesh, sub-urban areas have little access to highspeed internet or broadband services and an uninterrupted power supply. Due to these reasons, they had frequent obstacles during online teachings, such as internet and video troubles. The study by Mishra et al. (2020) also revealed similar results among teachers and students during the pandemic who expressed dissatisfaction with the incompatibility of two-way interaction owing to the distance. The findings also showed that the hours of online classes taught per week are positively and significantly related to the teacher's preference for online classes in the regular situation. In the normal situation, if a teacher continues to teach using online platforms, they will develop a stronger relationship with it and finally become accustomed to it. However, teachers with training on online teaching from their institution preferred online platforms for teaching classes. Training faculty members would help them adapt quickly to novel technologies needed for delivering classes in changing situations, especially like this pandemic. Tandon (2020) also reported the necessity of training of the faculty members. Classes taught through mobile data had a negative and significant effect on teachers' preference for online teaching, but it had a favorable and significant effect on teachers' preference for mixed teaching. This is due to Bangladesh's unstable mobile networks, which have low speed and poor connectivity, making it impossible to set up an online class using the cellular network. Nambiar (2020) found that 64.2% of teachers reported technical issues like poor connectivity, power outages, broadband issues, and poor audio and video quality as key drawbacks of online classes, indicating that they do not prefer online teaching. Valentina and Nelly (2015) reported some technical issues, including the availability of electronic devices and

reliable internet access, were the key conditions that needed to be met before implementing an e-learning class. Similar situations of introducing e-learning classes were discussed by Al Zumor et al. (2013).

The study revealed that university teachers' preference for online teaching during and following the pandemic was negatively and strongly associated with practical classes. On the other hand, the practical class had a significant positive effect on teachers' preference for mixed teaching after the pandemic. In a similar vein, Sahu (2020) found that there are different courses like practical laboratory classes and works, field works, music and art courses that are impossible to continue through online classes because it necessitates comprehensive participation of both teachers and students. Additionally, the teachers who taught both theoretical and practical classes had a significant negative effect on preferring online classes after the pandemic in new normal situation. This might be because online teaching is comparatively a new concept for the Bangladeshi people. Whether they offer theoretical or practical classes, teachers are unaccustomed to online instruction. On the other hand, online courses place a greater focus on the theoretical aspects of learning and require less interaction between the teacher and the students. Online learning lacks practical learning features and encourages passive learning. As a result, the theoretical portion of the course can be delivered via online platforms, but the actual classroom setting must be enhanced in order to deliver efficient and effective practical learning. However, conducting an online examination has negatively and significantly affected teachers' preference for online teaching during and after the pandemic. On the other hand, the study found that the teachers who gave online examinations were more likely to prefer mixed classes in the post-pandemic normal situation.

3.5. Challenges in online teaching during COVID-19

In the context of Bangladesh, online teaching is a new method of teaching classes for teachers. During the COVID-19 outbreak, physical distancing is recommended, while remote learning is encouraged. In order to continue teaching and learning, university teachers were obliged to move their classes online. However, they had numerous difficulties because they are accustomed to working in physical classrooms where they have direct interactions with the students. This study identified and ranked several challenges of online teaching are shown in Table 5. Difficulty in practical work (ranked 1), followed by difficulty in monitoring students (ranked 2) and insufficient feedback (ranked 3) were the most significant challenges reported by the teachers. A classroom is a vibrant learning environment where teachers have direct interaction with students, but online classes lack the opportunity for meaningful interaction. Other apparent challenges faced by the teachers were less student-instructor interaction, poor internet connectivity, lack of student engagement, students' low-interest, less usefulness for evaluation, less participation of students, lack of proper guideline, lack of ICT infrastructure, lack of training, limited technological experience, difficulty in delivering content, time consuming, and others (Table 5).

4. Conclusion

The COVID-19 pandemic has affected each and every aspect of daily life, including our education system. All the educational institutions of Bangladesh were closed in March 2020 and conducting e-learning to continue education. This study assessed university teachers' perceptions and preferences for online teaching through an online survey. The results revealed that about half of the teachers were conducting online classes without any training on online teaching. Although e-teaching was perceived to be effective, time-efficient and easy to share content during the pandemic, it was not suitable for monitoring or conducting practical classes and less effective for evaluating the students. However, the teachers mostly preferred online teaching during the pandemic to avoid the spread of the virus and no one preferred physical teaching. Contrarily, they preferred both physical and mixed teaching in a post-pandemic new normal situation. Their preference of teaching type during the pandemic was affected by the experience, academic discipline,

Table 5. Challenges faced in online teaching (N = 438).

Challenges	Extent of challenge				Total PCI	Rank
	No	Low	Medium	High		
Difficulty in practical work	30	37	115	256	1035	1
Difficulty in monitoring students	24	54	121	239	1013	2
Insufficient feedback	10	81	232	115	890	3
Less student-instructor interaction	17	88	225	108	862	4
Poor internet connectivity	57	64	169	148	846	5
Lack of student engagement	17	101	216	104	845	6
Students' low-interest	24	77	260	77	828	7
Less useful for evaluation	37	91	195	115	826	8
Less participation of students	40	94	216	88	790	9
Lack of proper guideline	61	88	195	94	760	10
Lack of ICT infrastructure	74	84	169	111	755	11
Lack of training	61	138	158	81	697	12
Limited technological experience	104	125	152	57	600	13
Difficulty in delivering content	128	121	149	40	539	14
Time consuming	145	118	121	54	522	15

current residency, training on online teaching, types of classes and whether they had conducted any online examinations. On the other hand, teaching preference post-pandemic was affected by age, experience, academic discipline, hours of online classes taught per week, internet connection used, types of classes and whether they had conducted any online examinations. Difficulty in practical work, difficulty in monitoring students, insufficient feedback and so on were reported as the major challenges by the teachers in online teaching during COVID-19.

After the COVID-19 pandemic, the education system needs to be reformed in order to maintain proper and timely teaching to the students. The insights of this study would be useful in policy implications in education, especially higher studies. This study suggests continuing online learning during any pandemic for the safety of both teachers and students. However, theoretical classes can also be taught online after opening institutions as they are suitable to conduct using various platforms. Practical works and examinations can be done physically in the classroom, maintaining proper distance. Since current online platforms are not suitable for evaluating students, designing new platforms suitable for conducting examinations could be the potential solution. For effective use of the technologies, all faculty members must be trained on using the online platforms for teaching. Most importantly, stable internet connections should be ensured for both teachers and students for effective and smooth e-learning; otherwise, online teaching will not be able to deliver quality education whatsoever.

Declarations

Author contribution statement

Jaber Rana and Sourav Mohan Saha: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Sadia Afrin Pranty: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Md Jahurul Islam: Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Md. Emran Hossain: Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data will be made available on request.

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The authors declare no conflict of interest.

Additional information

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References

- Al Zumor, A.W.Q., Al Refaai, I.K., Bader Eddin, E.A., Aziz Al-Rahman, F.H., 2013. EFL students' perceptions of A blended learning environment: advantages, limitations and suggestions for improvement. *Engl. Lang. Teach.* 6 (10), 95–110.
- Al-Azzam, N., Elsalem, L., Gombedza, F., 2020. A cross-sectional study to determine factors affecting dental and medical students' preference for virtual learning during the COVID-19 outbreak. *Heliyon* 6 (12), e05704.
- Arkorful, V., Abaidoo, N., 2014. The role of E-learning, the advantages and disadvantages of its adoption in higher education. *Int. J. Educaon Res.* 2, 397–410.
- Basilaia, G., 2020. Replacing the classic learning form at universities as an immediate response to the COVID-19 virus infection in Georgia. *Int. J. Res. Appl. Sci. Eng. Technol.* 8 (3), 101–108.
- Billings, D.M., 2008. Developing your career as a nurse educator: the professional Portfolio. *J. Cont. Educ. Nurs.* 39 (12), 532–533.
- Bussmann, S., Johnson, S.R., Oliver, R., Forsythe, K., Grandjean, M., Lebsack, M., Luster, T., 2017. On the recognition of quality online course design in promotion and tenure: a survey of higher ed institutions in the western United States. *Online J. Dist. Learn. Adm.* 20 (1).
- Cameron, A.C., Trivedi, P.K., 2009. In: LP, S. (Ed.), *Microeconometrics Using Stata*. A Stata Press Publication, Texas.
- Conrad, R.M., Donaldson, J.A., 2011. *Engaging the Online Learner: Activities and Resources for Creative Instruction* - Rita-Marie Conrad. J. Ana Donaldson - Google Books. John Wiley & Sons. [https://books.google.com.bd/books?hl=en&lr=&id=do9bsdMhtUC&oi=fnd&pg=PR7&dq=Conrad,+R.+and+Donaldson,+J.++\(2004\),+Engaging+the+Online+Learner,+Wiley+and+Sons,+San+Francisco&ot=szQ8KinDF5l&sig=jlvF0tKIGD1eXOAEHR3u326XbSk&redir_esc=y#v=onepage&q=Conrad%2C%20R.%20and%20Donaldson%2C%20J.%20\(2004\)%2C%20Engaging%20the%20Online%20Learner%2C%20Wiley%20and%20Sons%2C%20San%20Francisco&f=false](https://books.google.com.bd/books?hl=en&lr=&id=do9bsdMhtUC&oi=fnd&pg=PR7&dq=Conrad,+R.+and+Donaldson,+J.++(2004),+Engaging+the+Online+Learner,+Wiley+and+Sons,+San+Francisco&ot=szQ8KinDF5l&sig=jlvF0tKIGD1eXOAEHR3u326XbSk&redir_esc=y#v=onepage&q=Conrad%2C%20R.%20and%20Donaldson%2C%20J.%20(2004)%2C%20Engaging%20the%20Online%20Learner%2C%20Wiley%20and%20Sons%2C%20San%20Francisco&f=false).
- Deressa, T.T., Hassan, R.M., Ringler, C., Alemu, T., Yesuf, M., 2009. Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environ. Change* 19 (2), 248–255.
- Fauzi, I., Sastra Khusuma, I.H., 2020. Teachers' elementary school in online learning of COVID-19 pandemic conditions. *Jurnal Iqra' : Kajian Ilmu Pendidikan* 5 (1), 58–70.
- Fritz, M., Berger, P.D., 2015. Chapter 11 - will anybody buy? Logistic regression. In: Fritz, Mike, Berger, Paul D. (Eds.), *Improving the User Experience through Practical Data Analytics*. Morgan Kaufmann, pp. 271–304.
- Hoque, M.N., Hannan, A., Imran, S., Alam, M.A., Matubber, B., Saha, S.M., 2021. Anxiety and its determinants among undergraduate students during E-learning in Bangladesh amid covid-19. *J. Affect. Disord. Rep.* 6, 100241.
- Hossain, M.E., Rana, M.J., Islam, M.S., Khan, M.A., Chakroborty, S., Ema, N.S., Bekun, F.V., 2021a. COVID-19 Vaccine-Taking Hesitancy Among Bangladeshi People: Knowledge, Perceptions and Attitude Perspective. *Human Vaccines & Immunotherapeutics*.
- Hossain, M.E., Islam, M.S., Ghose, T.K., Jahan, H., Chakroborty, S., Hossen, M.S., Ema, N.S., 2021b. COVID-19 Vaccine Acceptability Among Public university Students in Bangladesh: Highlighting Knowledge, Perceptions, and Attitude. *Human Vaccines & Immunotherapeutics*, pp. 1–10.
- Husain, B., Idi, Y.N., Basri, M., 2021. Teachers' perceptions on adopting e-learning during Covid-19 outbreaks; advantages, disadvantages, suggestions. *Jurnal Tarbiyah* 27 (2).
- Jelińska, M., Paradowski, M.B., 2021. Teachers' perception of student coping with emergency remote instruction during the COVID-19 pandemic: the relative impact of educator demographics and professional adaptation and adjustment. *Front. Psychol.* 12.
- Kabir, M.R., 2020. Impact of faculty and student readiness on virtual learning adoption amid Covid-19. *Revista Internacional de Educacion Para La Justicia Social* 9 (3), 387–414.
- Khanom, M., Hoque, A., Sharif, P.I., Uddin, A.T.M.M., Hossain, M.A., Sabuj, M.U., 2021. Teachers' perception on virtual teaching learning activities and assessment: web-based study on a non-government medical college in Bangladesh. *Bangladesh J. Med. Educ.* 12 (1), 3–9.
- Kulal, A., Nayak, A., 2020. A study on perception of teachers and students toward online classes in Dakshina Kannada and Udupi District. *Asian Assoc. Open Univer. J.*
- Louwrens, N., Hartnett, M., 2015. Student and teacher perceptions of online student engagement in an online middle school. *J. Open Flex. Distance Learn.* 19 (1), 27–44.
- Martin, F., Wang, C., Jokiah, A., May, B., Grübmeier, S., 2019. Examining faculty readiness to teach online: a comparison of US and German educators. *Eur. J. Open Dist. E Learn.* 22 (1), 53–69.
- Meski, B., Ponomareva, S., Ugnich, E., 2019. E-learning in higher inclusive education: needs, opportunities and limitations. *Int. J. Educ. Manag.* 33 (3), 424–437.
- Mishra, L., Gupta, T., Shree, A., 2020. Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *Int. J. Educ. Res. Open* 1, 100012.
- Mozid, N.E., Amin, M.A., Jhumur, S.S., Monju, I.H., Ahmed, S.B., Sharmin, S., Hawlader, M.D.H., 2021. COVID-19 risk of infection and vaccination during Ramadan fasting: knowledge and attitudes of Bangladeshi general population. *Heliyon* 7 (10), e08174.
- Mulat, A., Tadesse, S., Asfaw, A., 2021. The Effects of COVID-19 on Livelihoods of Rural Households: South Wollo and Oromia Zones, Ethiopia. *Heliyon*, e08550.
- Munoz, A., Mackay, J., 2019. An online testing design choice typology towards cheating threat minimisation. *J. Univ. Teach. Learn. Prac.* 16 (3), 5.
- Murday, K., Ushida, E., Chenoweth, N.A., 2008. Learners' and teachers' perspectives on language online. *Comput. Assist. Lang. Learn.* 21 (2), 125–142.

- Muthuprasad, T., Aiswarya, S., Aditya, K.S., Jha, G.K., 2021. Students' perception and preference for online education in India during COVID-19 pandemic. *Social Sci. Human. Open* 3 (1), 100101.
- Nambiar, D., 2020. The impact of online learning during COVID-19: students' and teachers' perspective. *Int. J. Indian Psychol.* 8 (2), 783–793.
- Nazu, S.B., Khan, M.A., Saha, S.M., Hossain, M.E., Rashid, M.H.A., 2021. Adoption of improved wheat management practices: an empirical investigation on conservation and traditional technology in Bangladesh. *J. Agric. Food Res.* 4, 100143.
- Nevo, C.M., Egenti, S., 2019. A disaggregated analysis of wealth status and educational attainment in Nigeria using the multinomial logit approach. *Economies* 7 (2), 39.
- Prado, S.M.M., Sánchez, M.I.A., Anastacio, J.A.R., 2019. Academic literacy program implementation in an Ecuadorian University: a multinomial logit approach. *Int. J. Adolesc. Youth* 24 (3), 351–361.
- Raffo, D.M., Brinthaup, T.M., Gardner, J.G., Fisher, L.S., 2015. *Balancing Online Teaching Activities: Strategies for Optimizing Efficiency and Effectiveness*. Free Press.
- Remuzzi, A., Remuzzi, G., 2020. COVID-19 and Italy: what next? *Lancet* 395 (10231), 1225–1228.
- Sadeghi, M., 2019. A shift from classroom to distance learning: advantages and limitations. *Int. J. Res. English Educ.* 4 (1), 80–88.
- Sahu, P., 2020. Closure of universities due to coronavirus disease 2019 (COVID-19): impact on education and mental health of students and academic staff. *Cureus* 12 (4), e7541.
- Salik, S.A., Chowdhury, M.R., 2020. Impact of COVID on online teaching platform: study on IB curriculum in Bangladesh. *Am. Int. J. Bus. Manag. Stud.*
- Serin, H., 2020. *Virtual reality in education from the perspective of teachers*. Amazon. Invest. 9, 291. www.amazoniainvestiga.info.
- Souleles, N., Laghos, A., Savva, S., 2020. From face-to-face to online: assessing the effectiveness OF the rapid transition OF higher education due to the coronavirus outbreak. *Proc. ICERI2020 Conf.* 9, 927–934.
- Stern, B.S., 2004. A comparison of online and face-to-face instruction in an undergraduate foundations of American education course. *Contemp. Issues Technol. Teach. Educ.* 4 (2), 196–213.
- Stratton, L.S., O'Toole, D.M., Wetzel, J.N., 2008. A multinomial logit model of college stopout and dropout behavior. *Econ. Educ. Rev.* 27 (3), 319–331.
- Sultana, S., Khan, M.A., Hossain, M.E., Prodhan, M.M.H., Saha, S.M., 2022. Yield gap, risk attitude, and poverty status of aman rice producers in climate-vulnerable coastal areas of Bangladesh. *J. Agric. Sci. Technol.* 24 (1), 83–95.
- Tandon, U., 2020. Factors influencing adoption of online teaching by school teachers: a study during COVID-19 pandemic. *J. Publ. Aff.*, e2503
- UGC, 2019. *UGC Annual Report 2019*. University Grants Commission of Bangladesh, Sher-e-Bangla Nagar, Dhaka-1207.
- Valentina, A., Nelly, A., 2015. The role of E-learning, advantages and disadvantages of its adoption in higher education. *Int. J. Inst. Technol. Dist. Learn.* 12 (1), 29–42. https://itdl.org/Journal/Jan_15/Jan15.pdf#page=7.
- Vuong, Q.H., Vu, T.H., Doan, Q.H., Ho, M.T., 2019. Determinants of Vietnamese footwear exporting firms' market selection: A multinomial logistic analysis of panel data. *Heliyon* 5 (10), e02582.
- Wooldridge, J.M., 2002. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge, MA.
- Wu, S.Y., 2021. How teachers conduct online teaching during the COVID-19 pandemic: a case study of Taiwan. *Front. Educ.* 6.
- Zakaria, A., Piper, M., Doua, L., Jackson, N.M., Flynn, J.C., Misra, D., Sankari, A., 2021. Determinants of All-Cause In-Hospital Mortality Among Patients Who Presented with COVID-19 to a Community Teaching Hospital in Michigan. *Heliyon*, e08566.