

Challenges of online education /distance learning for university students during the COVID-19 pandemic: An observation from Bangladesh

Md. Tanvir Hossain (✉ tanvirku05@soc.ku.ac.bd)

Khulna University School of Social Science <https://orcid.org/0000-0003-0315-6900>

Nishana Afrin Nishu

Khulna University School of Social Science

Afsana Sultana

Khulna University School of Social Science

Nusrat Jahan

Khulna University School of Social Science

Shayla Sharmin Snigdha

Khulna University School of Arts and Humanities

Raed Bashitialshaaer

Lund University: Lunds Universitet

Research Article

Keywords: COVID-19, online education/distant learning, financial obstacles, technical obstacles, pedagogical obstacles, Bangladesh

Posted Date: June 3rd, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-453518/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Following the spread of COVID-19, online education/distance learning (OE/DL) was opted by the governments across the world. However, many challenges remained unexplored as OE/DL was quite an unfamiliar teaching approach, particularly in Bangladesh. This study was aimed at identifying the major challenges of OE/DL in Bangladesh from the perspectives of students. Data for this web-based cross-sectional study were collected using an e-questionnaire based on Google Form. Out of 451 initial responses, 419 were retained based on some specifications. The univariate analyses identified the financial, technical, and pedagogical issues as major problems. Exploratory factor analysis and confirmatory factor analysis suggest a two-factor solution – ‘financial-technical obstacles’ and ‘pedagogical obstacles’ – with overall good reliability (Cronbach’s $\alpha = 0.881$; McDonald’s $\omega = 0.880$). The two-factors, with strong intercorrelation ($r = 0.552$), meet the criteria of discriminant validity. To overcome the shortfalls of OE/DL in Bangladesh, inclusiveness with sustainable educational and infrastructural approaches was recommended.

Introduction

Following the confirmed coronavirus cases in the second week of March, the government of Bangladesh declared a nationwide ‘general holidays’ on March 26, 2020 to enforce the non-therapeutic measures, advocated by the World Health Organization, to minimize the spread of COVID-19 (Jahid, 2020; Opu, 2020; Shammi et al., 2020; World Health Organization, 2020a). However, the educational institutions, including the primary, secondary, and tertiary of both public and private, were closed on March 18, 2020 initially for two weeks (Shawon, 2020). As the number of both infections and deaths increased in the following months (World Health Organization, 2020b, 2020c, 2020d), the closure of educational institutions and ‘general holidays’ extended on a regular interval (Dhaka Tribune, 2020a, 2020b). Although the government lifted the ‘general holidays’ in early September (The Daily Star, 2020b), the schools and colleges will remain closed till the 29 March 2021 (The Daily Star, 2021a), while universities will re-open on 24 May 2021 (The Daily Star, 2021b).

The prolonged closure of educational institutions has adversely affected not only the academic activities of students, but also their mental well-being during the ongoing COVID-19 pandemic. Studies suggest that restricted social interaction, insufficient mental refreshment, uncertainties over academic and professional career together with prolonged home confinement have amplified the mental problems (Cao et al., 2020; Islam et al., 2020; Lu et al., 2020; Shovo et al., 2021), intensified the screen time (Gao et al., 2020; Hossain et al., 2020) and increased the substance use among students (Gritsenko et al., 2020). Moreover, the exposure to ‘infodemic’ through social and mass media (Gao et al., 2020; Hossain et al., 2020; Xie et al., 2020) along with the concern over the social and physical well-being of relatives (Cao et al., 2020; Odriozola-González et al., 2020) led to an overall degradation of mental health. The world has witnessed heightened mental health problems, including anxiety, depression, stress, fear, poor sleep, and suicidal behavior, particularly among students (Ahmed et al., 2020; Cao et al., 2020; Islam et al., 2020; Kaparounaki et al., 2020; Odriozola-González et al., 2020; Shovo et al., 2021; Zou et al., 2020).

Despite the ongoing awful, yet unavoidable, circumstances of social and physical distancing and restriction on mobility (Shammi et al., 2020; World Health Organization, 2020a), the government of Bangladesh through the University Grants Commission (UGC) of Bangladesh provided the basics to re-start the teaching and learning activities based on the online platform (Rahman et al., 2020) using appropriate and affordable means (Oyedotun, 2020; Schneider & Council, 2020). The purpose is not only to continue the education to avoid academic loss (Hasan & Bao, 2020; Rajhans et al., 2020) but also to reduce the intensity of psychological problems (Besser et al., 2020). Like other countries that explored different video-conferencing applications and platforms to facilitate online education/distance learning (OE/DL) (Oyedotun, 2020; Rajhans et al., 2020), the educational institutions in Bangladesh, with the help of the Bangladesh Research and Education Network (BdREN), integrated the Zoom enterprise version into the institutional learning platform to facilitate online academic activities (Rahman et al., 2020).

The unexpected switch from traditional 'lecture theatre-based' education to OE/DL during the ongoing health emergency led to a 'shock and tension' (Lassoued et al., 2020) among teachers, students, and parents, largely due to individual, institutional, organizational, pedagogical, financial as well as technical difficulties (Abuhammad, 2020; Al-Balas et al., 2020; Almaiah et al., 2020; Béché, 2020; Lassoued et al., 2020). Studies suggesting that both teachers and students, particularly in developing countries, could not adjust to the transition from traditional 'face-to-face' teaching-learning to OE/DL (Ela et al., 2021; Rannastu-Avalos & Siiman, 2020), largely because of the existing educational inequalities between sexes, between rural and urban areas, between poor and rich people (Béché, 2020). Moreover, the absence of 'shock resilient' pedagogical resources in schools, colleges, and universities, as well as the presence of multiple online platforms together with a sheer lack of technical know-how for both ends made it more difficult for the educators and educands to ensure the continuity of equal, quality, and all-inclusive education for all (Bashithalshaaer et al., 2021; Béché, 2020; Lassoued et al., 2020; Rannastu-Avalos & Siiman, 2020). Moreover, parents with limited income, especially in developing countries, could not meet the growing demands for expensive personal computers and other smart devices with high-speed internet connections to assure the participation of their children in OE/DL. A suicide by a school going female student in India (Lathabhavan & Griffiths, 2020) and a 'suicide pact' of a mother and her university going son in Bangladesh (Mamun et al., 2020) reflect the association of OE/DL with some unresolved issues.

A wide range of factors is contributing as major impediments to the success of OE/DL as an alternative to traditional teaching and learning to continue education during the pandemic. However, there are only a handful of studies aimed at identifying the underlying challenges of OE/DL for university students in Bangladesh (Al-Amin et al., 2021; Ela et al., 2021). Thus, an intensive study focusing mainly on unearthing the underlying obstacles for university students to participate in OE/DL is needed.

Objectives

This study is aimed at exploring the major challenges of OE/DL at universities of Bangladesh from the perspective of students, and to help the educationists, the policymakers as well as educational institutions

to plan and implement policies and strategies to ensure an effective and quality OE/DL and to allow the students to complete their higher education successfully. The complementary sub-objectives are:

1. Specifying the challenges faced by university students in Bangladesh to participate in OE/DL.
2. Constructing and confirming a classification of the challenges and validate their replicability.
3. Making some suggestions or possible way out to overcome those challenges to ensure all-inclusive and quality OE/DL for all in Bangladesh.

Materials And Methods

Study sites and samples

This web-based cross-sectional study was conducted a straight three weeks, starting from the third week of November to that the first of December 2020. This study was carried out to identify the predicaments of OE/DL in Bangladesh from university students' perspective. The inclusion criteria for university students were (i) any on-seat university students – both private and public, (ii) participating in the online classes during the COVID-19 pandemic in Bangladesh. A self-reported e-questionnaire, using the online Google Form, was forwarded by the researchers to the university students through professional networks as well as different social media platforms, such as Facebook, Messenger, and WhatsApp. Thus, the participants were selected conveniently through snowballing from the primary contacts Four hundred and nineteen responses (419), out of the initial 451 responses, were deemed suitable to retain in the study after careful and rigorous scrutiny. It is important to note that using a population proportion equation with a margin of error of 5% (Yamane, 1967), the recommended sample size was 384 for a population of 5,94,493 (University Grants Commission of Bangladesh, 2020).

Ethical issues

This study was ethically approved by the institutional ethical clearance committee. The participants responded voluntarily by filling up a written informed consent letter in the first section of the e-questionnaire, confirming their anonymity and right to withdraw. Thus, the participants were free to decline from the web-based survey at any moment without prior justification.

Measures

Following the consent of the participants, the survey commenced. The e-questionnaire was divided into three separate but interrelated sub-sections, each focused on a different issue. For example, the section one extracted relevant demographic information, including age, sex, location, level of education, discipline/department, and type of university; the section two highlighted questions regarding access to and use of internet connection and digital devices to participate in OE/DL; and the last section contained 18 closed-ended Likert-scale questions divided into five sub-categories (see Table 1 for details), to identify the experience and perception of the participants regarding the OE/DL.

Socio-demographics

The socio-demographic information of the participants includes age, sex, levels of education, residence, stream of education and type of university. The participants, with an average age around 22 years ($SD = 2.00$), were almost equally distributed between male (56.6%) and female (43.4%), and about 61% of participants were students of First Year (26.3%) and Second Year (33.9%). Around 45% of the participants resided in urban areas, and 46.3% were studying courses of humanities and social sciences. Around three out of five participants were from general universities, followed by 28.9% from engineering universities, while 7.6% of participants enrolled in other forms of university in Bangladesh, including private universities.

Challenges of online education/distance learning

The questions, regarding the experience and perception of the participants regarding the OE/DL, were developed with some minor modifications primarily from Lassoued et al. (2020), which originally contained 14 questions divided into four major sub-divisions, as well as other relevant literature (Abuhammad, 2020; Adarkwah, 2020; Al-Balas et al., 2020; Almaiah et al., 2020). The responses of the five-point Likert-scale items were 'not sure' (score = 0), 'strongly disagree' (score = 1), 'disagree' (score = 2), 'agree' (score = 3) and 'strongly agree' (score 4).

Analysis

Data were analyzed in three consecutive stages: firstly, the descriptive analysis, including the percentage, mean (M) and standard deviation (SD), was estimated; secondly, the exploratory factor analysis (EFA) was executed; and finally, confirmatory factor analysis (CFA) was performed. The analyses were executed by SPSS 25.0 and AMOS 23.0 for a windows software package, respectively.

The goodness-of-fit of the CFA models were assessed by the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root-mean-square error of approximation (RMSEA) and the standardized-root-mean-square residual (SRMR) (DiLalla, 2000; Hu & Bentler, 1999). These indices suggest an excellent fit by $CFI = \geq 0.95$, $TLI = \geq 0.90$, $RMSEA = \leq 0.06$ and $SRMR \leq 0.08$ (Hu & Bentler, 1999; Tabachnik & Fidell, 2013), minimize the errors of deciding the good fit of a model. The reliability was assessed by the Cronbach's alpha (α) and McDonald's omega (ω) to measure the internal consistency of the constructs; however, the latter was used for a construct with error covariance (Hayes & Coutts, 2020). Finally, the model was validated by the average variance extracted (AVE) and construct validity (CR), with an excellent indicator of $AVE = 0.50$ and $CR = 0.70$ (Hair Jr. et al., 2014).

Results

Description of the challenges of online education/distance learning

Table 2 presents the descriptive information, including percentage, mean and standard deviation, as well as order for each item, about the challenges of OE/DL during the COVID-19 pandemic in Bangladesh. The challenges were categorized into five different groups, including personal, pedagogical, technical, financial, and organizational. The university students of Bangladesh financial challenges, including cost

of data packages ($N = 178$ [$M = 2.97$, $SD = 1.25$]) and communication devices ($N = 148$ [$M = 2.82$, $SD = 1.29$]), as the major obstacles to quality OE/DL during the ongoing pandemic, followed by internet connectivity ($N = 137$ [$M = 2.81$, $SD = 1.23$]) and the absence of classroom interaction ($N = 121$ [$M = 2.81$, $SD = 1.23$]), respectively. Among other issues, the difficulties in learning applied course through OE/DL ($N = 129$ [$M = 2.78$, $SD = 1.30$], the unstable or absence of electricity ($N = 123$ [$M = 2.79$, $SD = 1.29$], the familiarity of face-to-face learning ($N = 87$ [$M = 2.58$, $SD = 1.25$]) were the important ones.

Exploratory factor analysis

Maximum likelihood extraction with varimax rotation was executed on 18 items from a sample of 419 university students. Initially principal components extraction was performed before maximum likelihood extraction, to estimate the number of factors, presence of multicollinearity and factorability of the correlation matrices (Field, 2013; Tabachnik & Fidell, 2013), to determine the number of factors with three principles: the Kaiser's criterion (Kaiser, 1960), the Cattell's scree plot test (Cattell, 1966) and the Horn's parallel analysis (Horn, 1965). The Kaiser's criterion based on eigenvalues was inconclusive as it suggests 5 factors with an eigenvalue of 1 and above. The scree plot test endorses a three-factor solution by accepting the 'higher scree' and ignoring the 'lower scree' (Horn, 1965). The suitability of a three-factor solution was further assessed by comparing the eigenvalues from the extracted eigenvalues generated from the same size of random data set, and it also suggested a three-factor solution as the first three factors with the eigenvalues exceed the values from randomized data (Horn, 1965; Watkins, 2000). However, the pattern coefficient of ≥ 0.40 , and an internal consistency of ≥ 0.70 (DeVellis, 2003) were considered for a meaningful and consistent factor structure. The items were sorted and grouped by size of loading, and three items were deleted as their loadings were under 0.40, while two others were deleted for high cross-loading (Hair Jr. et al., 2014). Later, five more items were deleted from the extraction as three of them had low commonalities (≤ 0.50), while the other two were eliminated because of cross-loading and loading under 0.40, respectively (Hair Jr. et al., 2014).

Based on the criteria, a two-factor solution was retained from the exploratory factor analysis by using maximum likelihood extraction with varimax rotation – the first factor contained six items, while the second factor consisted of two items (see Table 3). The two-item factor was retained because the items were highly correlated ($r = 0.70$) (Bollen, 1989; Worthington & Whittaker, 2006). The Kaiser-Meyer-Olkin (KMO) for the two-factor solution was 0.86 ('meritorious' according to Kaiser and Rice (1974)) with Bartlett's test of sphericity of $\chi^2 [36] = 1962.225$, $p < 0.001$ signifying the sampling adequacy. Factor 1 – labeled as 'Financial-Technical obstacles' – explaining 50% of the total variance entailed the items associated predominantly with financial and technical aspects. Factor 2 – labeled as 'Pedagogical obstacles' – explaining 10% variance – referred to pedagogical issues associated with OE/DL. Cumulatively the two-factor measurement of challenges of OE/DL, explaining 60% of the total variance (Hair Jr. et al., 2014) indicates that the measurement could be applicable for similar studies.

Based on the results of the EFA, the scores of the two-factors were measured by unit-weighted items together. The Cronbach's α coefficients of the 'financial-technical obstacles' and 'pedagogical obstacles'

were 0.882 and 0.819, respectively, and the overall coefficient was 0.881 ('good' according to DeVellis (2003)) (see Table 3). Table 4 presents the correlation among the factors, and the results suggest that the factors are intercorrelated ($r = 0.522$). These findings indicate that the challenges assessed in the two-factor solutions form a coherent structure.

Confirmatory factor analysis

The Model 1 of CFA, presented in Table 5, shows that the fit indices were not with the acceptable limit ($\chi^2_{[df = 19, N = 419]} = 10.232, p < 0.001$; CFI = 0.898 [≥ 0.95]; TLI = 0.850 [≥ 0.90]; RMSEA = 0.149 [≤ 0.06]), except for SRMR (0.059 [≤ 0.08]) (Hu & Bentler, 1999). The SRMR suggest an excellent fit, however, the CFI, TLI and RMSEA all were greater than their respective cut-off points. The covariance in the modification indices suggests a covariance between FINO 1 and FINO 2, between TECHO 1 and TECHO4, between FINO 1 and TECHO4, and between PO2 and PEDO1. A study, during the swine flu pandemic, suggests a strong relationship between financial resources with access to and use of technology (Van et al., 2010), and studies during the COVID-9 pandemic are not the exceptions. A study in Nigeria identified electricity and access to digital devices and internet connectivity as important determinants for OE/DL (Azubuike et al., 2020). Likewise, the high costs of digital devices, lack of accessibility to the internet and electricity connection are also being identified in a study in Ghana as well as in Bangladesh (Adarkwah, 2020; Al-Amin et al., 2021). A qualitative investigation on both teachers and students in Bangladesh revealed that the financial constraints limited the access to and use of both digital devices and internet connectivity for university students, particularly in remote rural areas. The study further added that university students often struggle during OE/DL, especially in the practical classes where a face-to-face interaction with both teachers and classmates would be a fitting solution (Ela et al., 2021). Based on these empirical underpinnings, the error covariances were correlated. After correlating the error variances, the Model 2 of CFA, presented in Table 5, suggest an excellent fit in all the indices ($\chi^2_{[5, N = 1317]} = 18.260, p = 0.003$; CFI = 0.990 [≥ 0.95]; TLI = 0.982 [≥ 0.90]; RMSEA = 0.052 [≤ 0.06] and SRMR = 0.029 [≤ 0.08]). The factor solutions for Model 1 and Model 2 were presented in Figure 1 and Figure 2, respectively. Although the standardized estimates of factors in Model 1 (ranging from 0.71 to 0.86) were relatively better than those of Model 2 (ranging from 0.64 to 0.86), the later model suggest better psychiatric properties than the former one. Considering the error covariance, the McDonald's omega (ω) was measured, and it was 0.882 for the first component – financial-technical obstacles. Overall McDonald's omega (ω) for the two-factor solution was 0.880.

The two-factor solution with eight items was subsequently validated by calculating the AVE and CR (Table 6). The values of AVE and CR for both 'Financial-technical obstacles' (0.530 [≥ 0.50] and 0.871 [≥ 0.70]) and 'Pedagogical obstacles' (0.696 [≥ 0.50] and 0.821 [≥ 0.70]) ensure adequate construct validity (Hu & Bentler, 1999).

Discussion

The year 2020 is marked by the COVID-19 pandemic that ceased all forms of educational activities following the implementation of countrywide lockdown throughout the world. Governments of both developed and developing countries were compelled to suspend academic and administrative activities in schools, colleges, and universities out of a sheer fear after witnessing an unprecedented growth of infections as well as deaths from the COVID-19 (Cao et al., 2020; Gritsenko et al., 2020; Odriozola-González et al., 2020). After breaking the initial spell of fear and panic, the OE/DL was promoted extensively by the government of Bangladesh using the online platforms as an alternative means to on-campus academic activities to avoid session jams, as well as to minimize uncertainties over academic and professional careers of young educands (Rahman et al., 2020). The sudden move from traditional teaching and learning to OE/DL in Bangladesh has drawn mixed opinions from students, teachers as well as administrators, however, mostly negative (Jameel & Real, 2020). An online poll on both public and private universities in Bangladesh indicate a negative attitude of both educators and educands towards OE/DL (The Daily Star, 2020a), while in a developed country like Germany, the perception is another way around (Schlenz et al., 2020). The implication is that the students and teachers in developing countries could not adjust with the 'neo-normality,' i.e., the introduction of OE/DL, with ease compared to their equivalents from developed countries, and there are some valid reasons.

One of the major issues prompting the potential pessimist attitude towards OE/DL among students in Bangladesh is the financial constraints (Ela et al., 2021; Mamun et al., 2020). The COVID-19 pandemic has been affecting not only the mental well-being of people, but also threatening the means of livelihood, especially in the developing and less developed countries, by reducing income, increasing unemployment and by bankrupting the small and medium-sized businesses (El Keshky et al., 2020; Pak et al., 2020). In Bangladesh, a lower-middle income country (Bhattacharya & Khan, 2019), the lower and lower-middle income families are also struggling financially and could not afford the basic necessities (Ela et al., 2021). The first factor of the two-factor solution of our study, based on EFA and CFA, is comprised of six items, and it indicated that financial and technical obstacles, interlinked with each other, were the major challenges for university students in Bangladesh to participate in the OE/DL.

Because financial constraints are substantially influencing the access to and use of technical or technological issues. Because the technologies and gadgets required for starting-up the OE/DL are not inexpensive (Ela et al., 2021; Singh & Thurman, 2019), thus, limited budgets may not allow people to get connected to the online platforms. In such case, frustration may lead to self-harm, like suicide. In India, for example, a female teenager committed suicide for being unable to participate in online classes as she did not have either a smartphone or television to connect with OE/DL (Lathabhavan & Griffiths, 2020). In Bangladesh, only 5.7% of households had a computer, while the internet was used by a mere 4.8% (Bangladesh Bureau of Statistics, 2015). Bangladesh stands 113 in the global networked readiness index (NRI) and 150 in the e-government development index (EGDI) (Access to Information Programme et al., 2013). Apart from the unavailability or inaccessibility to digital devices, the unstable and inconsistent internet connection and electricity could also be a major problem for students to participate in OE/DL. A survey on university students in Bangladesh suggests that the frequent load shedding and unstable internet connection were the two leading problems for OE/DL during the COVID-19 pandemic (Al-Amin et

al., 2021). A study on university students in UAE, one of the richest countries with almost cent percent households having internet accessibility, also identified internet connectivity as a concerning issue to participate in OE/DL (Hussein et al., 2020). The simultaneous and overuse of internet connections by people during the lockdown (Alheneidi et al., 2021) may have led to the problems of internet connectivity.

In addition to financial and technical issues, in the first construct the difficulties of students to understand the OE/DL, particularly the applied courses, in absence of classroom interaction, with both teachers and classmates, were also identified. Students across the globe reiterated the significance of interactions and communications with peers and teachers to improve their self-efficacy and learning motivation (Ela et al., 2021; Hussein et al., 2020). An experiment in Canada suggest that student performance decreased in online teaching environment compared to traditional face-to-face teaching environment (Lu & Lemonde, 2013).

The last factor of the two-factor solution – pedagogical obstacles – contained two items, and it was identified by the students as a major challenge for OE/DL in Bangladesh. Despite the initiatives of the government of Bangladesh to implement the OE/DL at the universities with the help of BdREN, the unfamiliarity with the online platforms and ineptitude to use it properly make it difficult for both students and teachers to interact and participate in the OE/DL (Ela et al., 2021). In Cameroon, the OE/DL was effectively used only by computer science teachers because of the familiarity with new technologies (Béch , 2020). In Estonia, only the privileged teachers with access to digital tools experienced ‘a smoother transition’ for OE/DL (Rannastu-Avalos & Siiman, 2020). Furthermore, the absence of effective pedagogical approaches and insufficient time to prepare the learning contents by teachers were several other challenges to materialize the benefits of OE/DL for both students and teachers (Huang et al., 2020). The findings of our study complemented the previous studies.

Strengths And Limitations

There are several issues that are determining the strengths and limitations of this study. This study was conducted through web-based survey – a tool proved effective and widely used during health emergencies – to reach out and cover university students at regional and national levels by maintaining the ‘social/physical distance’ for rapid assessment of the emerging situation. The samples cover heterogenous population, ranging from rural, sub-urban and urban residents, from freshers to seniors, from different streams of education including science, humanities, and commerce, from public and private universities of different types, such as general as well as specialized universities. Moreover, the data were collected using globally standardized and validated research tools and methods to assess the opinions of the university students regarding OE/DL. Hence, the experiences and opinions of diversified samples could lead to the generability of the findings. Yet, there are some limitations that should be kept in mind when generalizing the results. First, the data were collected from university students participating in OE/DL during the pandemic and could not reach to the students who did not participate in OE/DL due to poor or no internet connectivity. The study did not cover other educational institutions, including schools, colleges, *Madrasahs* in Bangladesh, and could lead to the limited representation of a specific age group. Moreover,

the cross-sectional nature of the samples together with a tendency to provide socially desirable response could also produce biasness, and such could limit the interpretation of the findings.

Future Research

The future research, in the context of Bangladesh, is expected to address the limitations of the current study. The future studies should be able to collect the information from both the participants and non-participants of OE/DL, on a nationally representative samples and should not rely on online- platforms only for data collection. Moreover, the researchers are expected to reach out students at schools, colleges, and *Madrasahs* to get an all-inclusive view regarding the OE/DL to formulate the national education policy and strategy of Bangladesh to cope with the unprecedented condition such as the COVID-19 pandemic.

Conclusion

Despite the shortcomings, there is no denial that OE/DL is the only options for the government of Bangladesh to maintain the teaching and learning process without pushing the student and teacher to participate in the class physically during the COVID-19 pandemic. Thus, with its other development stakeholders, the government should plan and implement an appropriate guideline to adopt OE/DL for active teaching and learning and for better educational outcomes in future. However, the initiation of OE/DL under the emergent health crisis could not meet the requirements for an all-inclusive and quality education for all – a goal set forth by the sustainable development goals (SDGs). The university students in Bangladesh, as reported in this study, were struggling to participate in OE/DL largely due to financial, technical as well as pedagogical limitations. The integration of OE/DL in the educational systems in Bangladesh will highly be appreciated and embraced only if it ensures the necessary provisions. For inclusive, secured, and improved educational outcomes, which the current government is thriving for, the policymakers must make some adjustment in the current educational systems, including (i) development and implementation of online platform-based curriculum; (ii) provide extensive training and other necessary facilities for both educators and educands to familiarize with OE/DL; (iii) enhance the capacity of universities and other educational institutions to provide OE/DL by increasing the educational budget; (iv) modernize the existing technological infrastructure to strengthen the internet connectivity and universalize the use of modern means of education at urban, sub-urban and rural educational institutions, (v) introduce online platform-based network among teachers and students at all levels to increase mutual trust and to make learning enjoyable and efficient, (vi) provide educational loans for teachers and grants for students financially struggling to afford the digital devices and internet connections, and finally (vii) reduce the existing income inequality between different social strata.

Abbreviations

AVE: Average variance extracted; BdREN: Bangladesh research and education network; CFA: Confirmatory factor analysis; CFI: Comparative fit index; COVID-19: Coronavirus disease of 2019; CR: Construct validity; EFA: Exploratory factor analysis; EGDl: E-government development index; FINO: Financial obstacles; M:

Mean; OE/DL: Online education/distance learning; ORGO: Organizational obstacles; PEDO: Pedagogical obstacles; PO: Personal obstacles; RMSEA: Root-mean-square error of approximation; SD: Standard deviation; SRMR: Standardized-root-mean-square residual; TECHO: Technical obstacles; TLI: Tucker-Lewis index; UGC: University grants commission

References

- Abuhammad, S. (2020). Barriers to distance learning during the COVID-19 outbreak: A qualitative review from parents' perspective. *Heliyon*, 6(11), e05482.
<https://doi.org/https://doi.org/10.1016/j.heliyon.2020.e05482>
- Access to Information Programme, Bangladesh Bureau of Statistics, & Statistics and Informatics Division. (2013). *Global e-Indices' Rankings and Bangladesh: Indicators for Measuring Digital Bangladesh*.
- Adarkwah, M. A. (2020). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-020-10331-z>
- Ahmed, M. Z., Ahmed, O., Aibao, Z., Hanbin, S., Siyu, L., & Ahmad, A. (2020). Epidemic of COVID-19 in China and associated psychological problems. *Asian Journal of Psychiatry*, 51, 102092.
<https://doi.org/10.1016/j.ajp.2020.102092>
- Al-Amin, M., Zubayer, A. A., Deb, B., & Hasan, M. (2021). Status of tertiary level online class in Bangladesh: students' response on preparedness, participation and classroom activities. *Heliyon*, 7(1), e05943.
<https://doi.org/https://doi.org/10.1016/j.heliyon.2021.e05943>
- Al-Balas, M., Al-Balas, H. I., Jaber, H. M., Obeidat, K., Al-Balas, H., Aborajoo, E. A., Al-Taher, R., & Al-Balas, B. (2020). Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: Current situation, challenges, and perspectives. *BMC Medical Education*, 20(1), 341.
<https://doi.org/10.1186/s12909-020-02257-4>
- Alheneidi, H., AlSumait, L., AlSumait, D., & Smith, A. P. (2021). Loneliness and problematic internet use during COVID-19 lock-down. *Behavioral Sciences*, 11(1), 5. <https://doi.org/10.3390/bs11010005>
- Almaiah, M. A., Al-Khasawneh, A., & Althunibat, A. (2020). Exploring the critical challenges and factors influencing the e-learning system usage during COVID-19 pandemic. *Education and Information Technologies*, 25(6), 5261-5280. <https://doi.org/10.1007/s10639-020-10219-y>
- Azubuikwe, O. B., Adegboye, O., & Quadri, H. (2020). Who gets to learn in a pandemic? Exploring the digital divide in remote learning during the COVID-19 pandemic in Nigeria. *International Journal of Educational Research Open*, 100022. <https://doi.org/https://doi.org/10.1016/j.ijedro.2020.100022>
- Bangladesh Bureau of Statistics. (2015). *ICT Use and Access by Individuals and Households: Bangladesh 2013*.

- Bashitialshaaer, R., Alhendawi, M., & Lassoued, Z. (2021). Obstacle comparisons to achieving distance learning and applying electronic exams during COVID-19 pandemic. *Symmetry*, 13(1), 99. <https://www.mdpi.com/2073-8994/13/1/99>
- Béché, E. (2020). Cameroonian responses to COVID-19 in the education sector: Exposing an inadequate education system. *International Review of Education*. <https://doi.org/10.1007/s11159-020-09870-x>
- Besser, A., Lotem, S., & Zeigler-Hill, V. (2020). Psychological stress and vocal symptoms among university professors in Israel: Implications of the shift to online synchronous teaching during the COVID-19 pandemic. *Journal of Voice*. <https://doi.org/10.1016/j.jvoice.2020.05.028>
- Bhattacharya, D., & Khan, S. S. (2019). The LDC paradigm, graduation and Bangladesh: Concepts, comparison and policy. In D. Bhattacharya (Ed.), *Bangladesh's Graduation from the Least Developed Countries Group: Pitfalls and Promises* (1st ed., pp. 16-60). Routledge.
- Bollen, K. A. (1989). *Structural Equations with Latent Variables*. John Wiley & Sons, Inc.
- Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Research*, 287, 112934. <https://doi.org/10.1016/j.psychres.2020.112934>
- Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, 1(2), 245-276. https://doi.org/10.1207/s15327906mbr0102_10
- DeVellis, R. F. (2003). *Scale development: Theory and application* (2nd ed.). Sage Publications Inc.
- Dhaka Tribune. (2020a, 5 May, 2020). Education institutions to remain closed till May 30. *Dhaka Tribune*. Retrieved 25 May, 2020, from <https://www.dhakatribune.com/bangladesh/education/2020/05/05/education-institutions-to-remain-closed-till-may-30>
- Dhaka Tribune. (2020b, 29 July, 2020). School, college shutdown extended till August 31. *Dhaka Tribune*. Retrieved 26 August, 2020, from <https://www.dhakatribune.com/bangladesh/education/2020/07/29/school-college-shutdown-extended-till-august-31>
- DiLalla, L. F. (2000). Structural equation modeling: uses and issues. In H. E. A. Tinsley & S. D. Brown (Eds.), *Handbook of Applied Multivariate Statistics and Mathematical Modeling*. Academic Press.
- El Keshky, M. E. S., Basyouni, S. S., & Al Sabban, A. M. (2020). Getting through COVID-19: The pandemic's impact on the psychology of sustainability, quality of life, and the global economy – a systematic review. *Frontiers in Psychology*, 11(3188). <https://doi.org/10.3389/fpsyg.2020.585897>

Ela, M. Z., Shohel, T. A., Shovo, T.-E. A., Khan, L., Jahan, N., Hossain, M. T., & Islam, M. N. (2021). Prolonged lockdown and academic uncertainties in Bangladesh: A qualitative investigation during the COVID-19 pandemic. *Heliyon*, 7(2), e06263. <https://doi.org/https://doi.org/10.1016/j.heliyon.2021.e06263>

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). Sage.

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., Wang, Y., Fu, H., & Dai, J. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *PLOS ONE*, 15(4), e0231924. <https://doi.org/10.1371/journal.pone.0231924>

Gritsenko, V., Skugarevsky, O., Konstantinov, V., Khamenka, N., Marinova, T., Reznik, A., & Isralowitz, R. (2020). COVID 19 fear, stress, anxiety, and substance use among Russian and Belarusian university students. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-020-00330-z>

Hair Jr., J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.). Pearson.

Hasan, N., & Bao, Y. (2020). Impact of “e-learning crack-up” perception on psychological distress among college students during COVID-19 pandemic: A mediating role of “fear of academic year loss”. *Children and Youth Services Review*, 118, 105355. <https://doi.org/https://doi.org/10.1016/j.childyouth.2020.105355>

Hayes, A. F., & Coutts, J. J. (2020). Use omega rather than cronbach’s alpha for estimating reliability. But.... *Communication Methods and Measures*, 14(1), 1-24. <https://doi.org/10.1080/19312458.2020.1718629>

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2), 179-185. <https://doi.org/10.1007/BF02289447>

Hossain, M. T., Ahammed, B., Chanda, S. K., Jahan, N., Ela, M. Z., & Islam, M. N. (2020). Social and electronic media exposure and generalized anxiety disorder among people during COVID-19 outbreak in Bangladesh: A preliminary observation. *PLOS ONE*, 15(9), e0238974. <https://doi.org/10.1371/journal.pone.0238974>

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>

Huang, R., Tlili, A., Chang, T.-W., Zhang, X., Nascimbeni, F., & Burgos, D. (2020). Disrupted classes, undisrupted learning during COVID-19 outbreak in China: Application of open educational practices and resources. *Smart Learning Environments*, 7(1), 19. <https://doi.org/10.1186/s40561-020-00125-8>

Hussein, E., Daoud, S., Alrabaiah, H., & Badawi, R. (2020). Exploring undergraduate students’ attitudes towards emergency online learning during COVID-19: A case from the UAE. *Children and Youth Services*

Review, 119, 105699. <https://doi.org/https://doi.org/10.1016/j.chilyouth.2020.105699>

Islam, M. A., Barna, S. D., Raihan, H., Khan, M. N. A., & Hossain, M. T. (2020). Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey. *PLOS ONE*, 15(8), e0238162. <https://doi.org/10.1371/journal.pone.0238162>

Jahid, A. M. (2020, 26 April, 2020). Coronavirus pandemic: 45 districts now under complete lockdown. *The Daily Star*. Retrieved 25 May, 2020, from <https://www.thedailystar.net/online/news/coronavirus-pandemic-45-districts-now-under-compete-lockdown-1896967>

Jameel, R., & Real, H. R. K. (2020, 10 September, 2020). The lessons of online learning. *The Daily Star*. Retrieved 10 October, 2020, from <https://www.thedailystar.net/shout/news/the-lessons-online-learning-1958629>

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20(1), 141-151. <https://doi.org/10.1177/001316446002000116>

Kaiser, H. F., & Rice, J. (1974). Little jiffy, mark iv. *Educational and Psychological Measurement*, 34(1), 111-117. <https://doi.org/10.1177/001316447403400115>

Kaparounaki, C. K., Patsali, M. E., Mousa, D.-P. V., Papadopoulou, E. V. K., Papadopoulou, K. K. K., & Fountoulakis, K. N. (2020). University students' mental health amidst the COVID-19 quarantine in Greece. *Psychiatry Research*, 290, 113111. <https://doi.org/https://doi.org/10.1016/j.psychres.2020.113111>

Lassoued, Z., Alhendawi, M., & Bashitialshaaer, R. (2020). An exploratory study of the obstacles for achieving quality in distance learning during the COVID-19 pandemic. *Education Science*, 10(9), 232. <https://doi.org/10.3390/educsci10090232>

Lathabhavan, R., & Griffiths, M. (2020). First case of student suicide in India due to the COVID-19 education crisis: A brief report and preventive measures. *Asian journal of psychiatry*, 53, 102202-102202. <https://doi.org/10.1016/j.ajp.2020.102202>

Lu, F., & Lemonde, M. (2013). A comparison of online versus face-to-face teaching delivery in statistics instruction for undergraduate health science students. *Advances in Health Sciences Education*, 18(5), 963-973. <https://doi.org/10.1007/s10459-012-9435-3>

Lu, H., Nie, P., & Qian, L. (2020). Do quarantine experiences and attitudes towards COVID-19 affect the distribution of mental health in China? A quantile regression analysis. *Applied Research in Quality of Life*. <https://doi.org/10.1007/s11482-020-09851-0>

Mamun, M. A., Chandrima, R. M., & Griffiths, M. D. (2020). Mother and son suicide pact due to COVID-19-related online learning issues in Bangladesh: An unusual case report. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-020-00362-5>

- Odriozola-González, P., Planchuelo-Gómez, Á., Iruña, M. J., & de Luis-García, R. (2020). Psychological effects of the COVID-19 outbreak and lockdown among students and workers of a Spanish university. *Psychiatry Research*, 290, 113108. <https://doi.org/10.1016/j.psychres.2020.113108>
- Opu, M. H. (2020, 6 June, 2020). *In Pictures: The effects of coronavirus lockdown in Bangladesh*. Retrieved 6 June, 2020, from <https://www.aljazeera.com/indepth/inpictures/pictures-effects-coronavirus-lockdown-bangladesh-200413141320406.html>
- Oyedotun, T. D. (2020). Sudden change of pedagogy in education driven by COVID-19: Perspectives and evaluation from a developing country. *Research in Globalization*, 2, 100029. <https://doi.org/https://doi.org/10.1016/j.resglo.2020.100029>
- Pak, A., Adegboye, O. A., Adekunle, A. I., Rahman, K. M., McBryde, E. S., & Eisen, D. P. (2020). Economic consequences of the COVID-19 outbreak: the need for epidemic preparedness. *Frontiers in Public Health*, 8(241). <https://doi.org/10.3389/fpubh.2020.00241>
- Rahman, M., Mustashin-Ul-Aziz, & Ahmed, S. O. (2020, 5 August, 2020). COVID-19 boosts digitization of higher education in Bangladesh. Retrieved 23 November, 2020, from <https://blogs.worldbank.org/endpovertyinsouthasia/covid-19-boosts-digitization-higher-education-bangladesh>
- Rajhans, V., Memon, U., Patil, V., & Goyal, A. (2020). Impact of COVID-19 on academic activities and way forward in Indian Optometry. *Journal of Optometry*, 13(4), 216-226. <https://doi.org/https://doi.org/10.1016/j.optom.2020.06.002>
- Rannastu-Avalos, M., & Siiman, L. A. (2020). Challenges for distance learning and online collaboration in the time of COVID-19: Interviews with science teachers. In A. Nolte, C. Alvarez, R. Hishiyama, I.-A. Chounta, M. J. Rodríguez-Triana, & T. Inoue (Eds.), *Collaboration Technologies and Social Computing*. Springer. https://doi.org/10.1007/978-3-030-58157-2_9
- Schlenz, M. A., Schmidt, A., Wöstmann, B., Krämer, N., & Schulz-Weidner, N. (2020). Students' and lecturers' perspective on the implementation of online learning in dental education due to SARS-CoV-2 (COVID-19): A cross-sectional study. *BMC Medical Education*, 20(1), 354. <https://doi.org/10.1186/s12909-020-02266-3>
- Schneider, S. L., & Council, M. L. (2020). Distance learning in the era of COVID-19. *Archives of Dermatological Research*. <https://doi.org/10.1007/s00403-020-02088-9>
- Shammi, M., Bodrud-Doza, M., Islam, A. R. M. T., & Rahman, M. M. (2020). Strategic assessment of COVID-19 pandemic in Bangladesh: Comparative lockdown scenario analysis, public perception, and management for sustainability. *Environment, Development and Sustainability*. <https://doi.org/10.1007/s10668-020-00867-y>
- Shawon, A. A. (2020, 16 March 2020). Bangladesh closes all educational institutions till March 31. *Dhaka Tribune*. Retrieved 14 May, 2020, from

<https://www.dhakatribune.com/bangladesh/dhaka/2020/03/16/govt-directs-shutting-all-educational-institutions-mach-17-to-31>

Shovo, T.-E.-A., Ahammed, B., Khan, B., Jahan, N., Shohel, T. A., Hossain, T., & Islam, N. (2021). Determinants of Generalized Anxiety, Depression, and Subjective Sleep Quality among University Students during COVID-19 Pandemic in Bangladesh. *Dr. Sulaiman Al Habib Medical Journal*.
<https://doi.org/https://doi.org/10.2991/dsahmj.k.210108.001>

Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988-2018). *American Journal of Distance Education*, 33(4), 289-306. <https://doi.org/10.1080/08923647.2019.1663082>

Tabachnik, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6th ed.). Pearson Education.

The Daily Star. (2020a, July 17, 2020). Online classes: Increasing the education divide. *The Daily Star*. Retrieved 27 November, 2020, from <https://www.thedailystar.net/opinion/news/online-classes-increasing-the-education-divide-1931409>

The Daily Star. (2020b, 29 May, 2020). PM lifted general holidays considering people's livelihoods. *The Daily Star*. Retrieved 6 June, 2020, from <https://www.thedailystar.net/country/news/pm-lifted-general-holidays-considering-peoples-livelihoods-1906390>

The Daily Star. (2021a, 28 February, 2021). Schools, colleges to reopen on March 30: Govt announces reopening plan; students of classes 5, 10, 12 to have in-person lessons daily. *The Daily Star*. Retrieved 3 March, 2021, from <https://www.thedailystar.net/frontpage/news/schools-colleges-reopen-march-30-2052153>

The Daily Star. (2021b, 22 February, 2021). Universities to reopen on May 24, halls on May 17: No exams before universities open. *The Daily Star*. Retrieved 2 March, 2021, from <https://www.thedailystar.net/country/news/universities-reopen-may-24-halls-may-17-2049173>

University Grants Commission of Bangladesh. (2020). *Strategic plan for higher education in Bangladesh: 2018-2030*.

Van, D., McLaws, M.-L., Crimmins, J., MacIntyre, C. R., & Seale, H. (2010). University life and pandemic influenza: Attitudes and intended behaviour of staff and students towards pandemic (H1N1) 2009. *BMC Public Health*, 10(1), 130. <https://doi.org/10.1186/1471-2458-10-130>

Watkins, M. W. (2000). *Monte Carlo PCA for Parallel Analysis* In Ed & Psych Associates.

World Health Organization. (2020a). *Coronavirus disease (COVID-19) advice for the public*. World Health Organization. Retrieved December 10 from <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>

World Health Organization. (2020b, June 29, 2020). *COVID-19: Morbidity and mortality weekly update (MMWU) # 18* https://www.who.int/docs/default-source/searo/bangladesh/covid-19-who-bangladesh-situation-reports/who-covid-19-update-18-20200629.pdf?sfvrsn=6ef8ba08_2

World Health Organization. (2020c, November 30, 2020). *COVID-19: Morbidity and mortality weekly update (MMWU) No. 40* https://www.who.int/docs/default-source/searo/bangladesh/covid-19-who-bangladesh-situation-reports/who_covid-19-update_40_20201130.pdf?sfvrsn=3bb2e6fb_24

World Health Organization. (2020d, March 31, 2020). *COVID-19: Situation report no. # 5* https://www.who.int/docs/default-source/searo/bangladesh/covid-19-who-bangladesh-situation-reports/who-ban-covid-19-sitrep-05.pdf?sfvrsn=23b90f3c_8

Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practices. *The Counseling Psychologist, 34*(6), 806-838. <https://doi.org/10.1177/0011000006288127>

Xie, X., Zang, Z., & Ponzoa, J. M. (2020). The information impact of network media, the psychological reaction to the COVID-19 pandemic, and online knowledge acquisition: Evidence from Chinese college students. *Journal of Innovation & Knowledge, 5*(4), 297-305. <https://doi.org/https://doi.org/10.1016/j.jik.2020.10.005>

Yamane, T. (1967). *Statistics: An Introductory Analysis* (2nd ed.). Harper and Row.

Zou, P., Wang, X., Sun, L., Liu, K., Hou, G., Yang, W., Liu, C., Yang, H., Zhou, N., Zhang, G., Ling, X., Liu, J., Cao, J., Ao, L., & Chen, Q. (2020). Poorer sleep quality correlated with mental health problems in college students: A longitudinal observational study among 686 males. *Journal of Psychosomatic Research, 136*, 110177. <https://doi.org/https://doi.org/10.1016/j.jpsychores.2020.110177>

Tables

Table 1. Socio-demographic information of the participants

Variables	Response N (%)	Statistics M (SD)
<i>Age (in Year)</i>		
≤ 20	154 (36.8)	21.5 (2.00)
21-23	185 (44.2)	
24 ≥	80 (19.1)	
<i>Sex</i>		
Female	182 (43.4)	
Male	237 (56.6)	
<i>Levels of education</i>		
First year	110 (26.3)	
Second year	142 (33.9)	
Third year	64 (15.3)	
Fourth year	29 (6.9)	
Fifth/backlog	8 (1.9)	
MSS/MA/MSc	66 (15.8)	
<i>Residence</i>		
Rural	158 (37.7)	
Sub-urban	74 (17.7)	
Urban	187 (44.6)	
<i>Stream of education</i>		
Humanities and Social Science	194 (46.3)	
Business and Commerce	70 (16.7)	
Science	155 (37.0)	
<i>Types of universities</i>		
General university	266 (63.5)	
Engineering university	121 (28.9)	
Others	32 (7.6)	

Note: **M.** Mean; **SD.** Standard deviation

Table 2. Challenges of online education/distance learning

Statement		Response					Statistics M (SD)	Rank/ Order
		N (%)						
		Not sure	Strongly disagree	Disagree	Agree	Strongly agree		
Personal obstacles								
PO1	The lack of motivation of students to learn though OE/DL approach	127 (30.3)	10 (2.4)	41 (9.8)	202 (48.2)	39 (9.3)	2.03 (1.45)	13
PO2	The difficulty of students' understanding of some subjects in the absence of classroom interaction	49 (11.7)	16 (3.8)	20 (4.8)	213 (50.8)	121 (28.9)	2.81 (1.23)	3
PO3	Get used to face-to-face learning	54 (12.9)	28 (6.7)	46 (11.0)	204 (48.7)	87 (20.8)	2.58 (1.25)	6
PO4	Doubt among teachers about the usefulness of OE/DL	124 (29.6)	30 (7.2)	52 (12.4)	173 (41.3)	40 (9.5)	1.94 (1.43)	16
PO5	Unwillingness of the university/authority to implement the OE/DL system	118 (28.2)	53 (12.6)	125 (29.8)	96 (22.9)	27 (6.4)	1.67 (1.28)	17
Pedagogical obstacles								
PEDO1	Difficulties in learning some applied courses through OE/DL approach	57 (13.6)	15 (3.6)	21 (5.0)	197 (47.0)	129 (30.8)	2.78 (1.30)	4
PEDO2	Lack of clarity about the evaluation of the OE/DL	74 (17.7)	17 (4.1)	39 (9.3)	216 (51.6)	73 (17.4)	2.47 (1.32)	7
PEDO3	Insufficient preparation by the university to conduct OE/DL	101 (24.1)	21 (5.0)	83 (19.8)	152 (36.3)	62 (14.8)	2.12 (1.40)	12
PEDO4	Absence of proper curriculum and other contents to conduct OE/DL	81 (19.3)	39 (9.3)	82 (19.6)	143 (34.1)	74 (17.7)	2.21 (1.37)	11
Technical obstacles								
TECHO1	Unstable internet connectivity	41 (9.8)	26 (6.2)	40 (9.5)	175 (41.8)	137 (32.7)	2.81 (1.23)	3
TECHO2	Lack of technical know-how to communicate through digital devices	62 (14.8)	34 (8.1)	113 (27.0)	165 (39.4)	45 (10.7)	2.23 (1.20)	10
TECHO3	Security and confidentiality of data and information	106 (25.3)	24 (5.7)	83 (19.8)	173 (41.3)	33 (7.9)	2.01 (1.34)	14
TECHO4	Unstable or absence of electricity	55 (13.1)	20 (4.8)	32 (7.6)	189 (45.1)	123 (29.4)	2.73 (1.29)	5
Financial obstacles								
FINO1	Costly internet data packages	43 (10.3)	18 (4.3)	22 (5.3)	162 (38.7)	174 (41.5)	2.97 (1.25)	1
FINO2	Costly communication devices (mobile/laptop/desktop/headphone)	50 (11.9)	22 (5.3)	28 (6.7)	171 (40.8)	148 (35.3)	2.82 (1.29)	2
Organizational obstacles								
ORGO1	Lack of training to use the necessary technical devices	76 (18.1)	19 (4.5)	65 (15.5)	206 (49.2)	53 (12.6)	2.34 (1.29)	8
ORGO2	Presence of multiple electronic media and the absence of uniform control	122 (29.1)	18 (4.3)	66 (15.8)	180 (43.0)	33 (7.9)	1.96 (1.40)	15
ORGO3	The home/office environment is not suitable for OE/DL	66 (15.8)	41 (9.8)	93 (22.2)	145 (34.6)	74 (17.7)	2.29 (1.30)	9

Note: *M.* Mean; *SD.* Standard deviation.

Table 3. Factor loadings, communalities (h^2), Cronbach's α and percentage of total variance for maximum likelihood extraction with varimax rotation (n = 419)

Items	Factor		h^2
	Financial-technical obstacles	Pedagogical obstacles	
FINO1	0.805		0.679
TECHO1	0.733		0.586
FINO2	0.705		0.538
TECHO4	0.679		0.518
PO2	0.649		0.527
PEDO1	0.630		0.533
PEDO3		0.858	0.783
PEDO4		0.731	0.622
Percentage of variance	49.631	10.200	
Cumulative percentage of variance	49.631	59.831	
Cronbach's α	0.882	0.819	

Table 4. Correlations among the

Variables	1	2
1 Financial-technical obstacles	1.000	0.522**
2 Pedagogical obstacles	0.522**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5. Goodness-of-fit indices

Models	CMIN/DF	CFI	TLI	RMSEA	SRMR
1	10.232 (19); $p < 0.001$	0.898	0.850	0.149 (0.130 – 0.168)	0.059
2	2.110 (15); $p < 0.01$	0.990	0.982	0.052 (0.026– 0.077)	0.029

Notes: CFI = > 0.95 ; TLI = > 0.90 ; RMSEA = < 0.06 ; SRMR = < 0.08

Table 6. Measurement of model analysis and validity

Components	AVE	CR
Financial-technical obstacles	0.530	0.871
Pedagogical obstacles	0.696	0.821

Notes: AVE = > 0.40 ; CR = > 0.70

Declarations

Competing interest

The authors declare no conflicts of interest.

Authors Contributions

Md. Tanvir Hossain: Conceptualization, Methodology, Software, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing – Original Draft, Writing – Review & Editing Nishana Afrin Nishu: Investigation, Resources, Writing – Original Draft Afsana Sultana: Resources, Writing – Original Draft Nusrat Jahan: Software, Investigation, Resources, Data Curation, Writing – Original Draft Shayla Sharmin Snigdha: Writing – Review & Editing Raed Bashitialshaaer: Writing – Review & Editing

Availability of Data and materials

The dataset(s) supporting the conclusions of this article is available in the Harvard Dataverse, [<https://doi.org/10.7910/DVN/EFKQBR>].

Funding

This research received no external funding.

Acknowledgments

The authors are grateful to the participants. The authors are thankful to Musammat Mehzabin, Lecturer, Department of Humanities of Khulna University of Engineering and Technology and Abdullah Al Masud, Assistant Professor, Environment Science Discipline, Khulna University for their assistance during the data collection. The authors also appreciate the sacrifices made by the educators, educands and parents to continue the higher education in Bangladesh under the unprecedented circumstance of COVID-19 pandemic.

Ethical Clearance

The study was ethically approved by Ethical Clearance Committee of Khulna University, Bangladesh (Protocol No. KUECC-2020/11/02).

Authors' information

Not applicable.

Figures

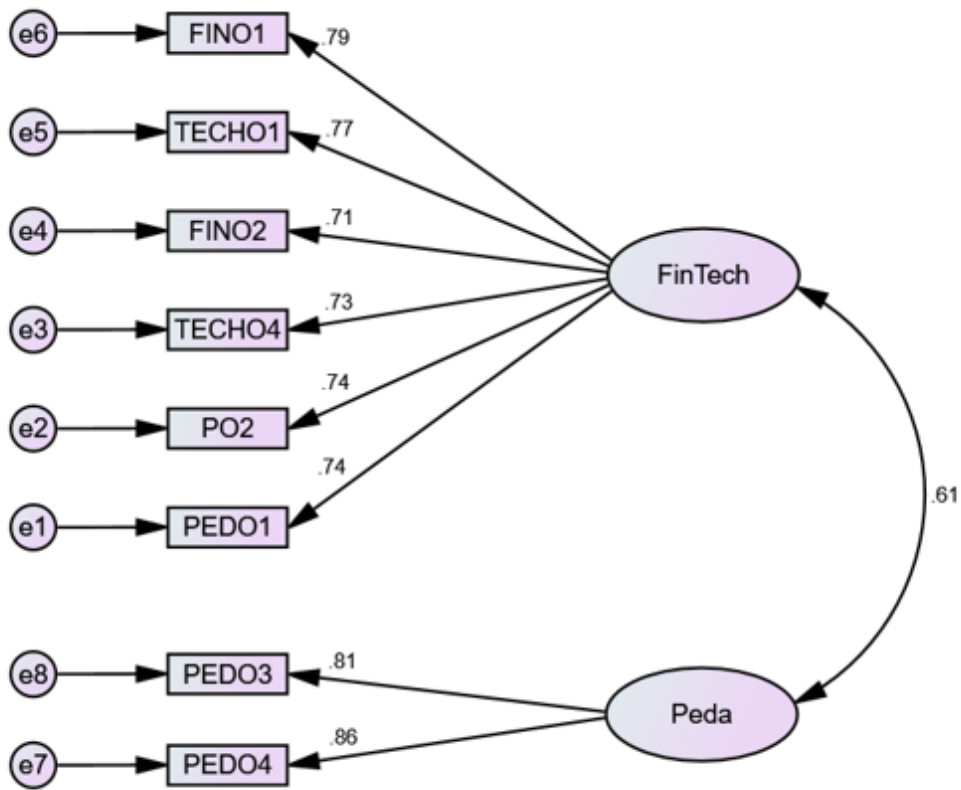


Figure 1

Model 1 is the baseline with no correlation among covariance

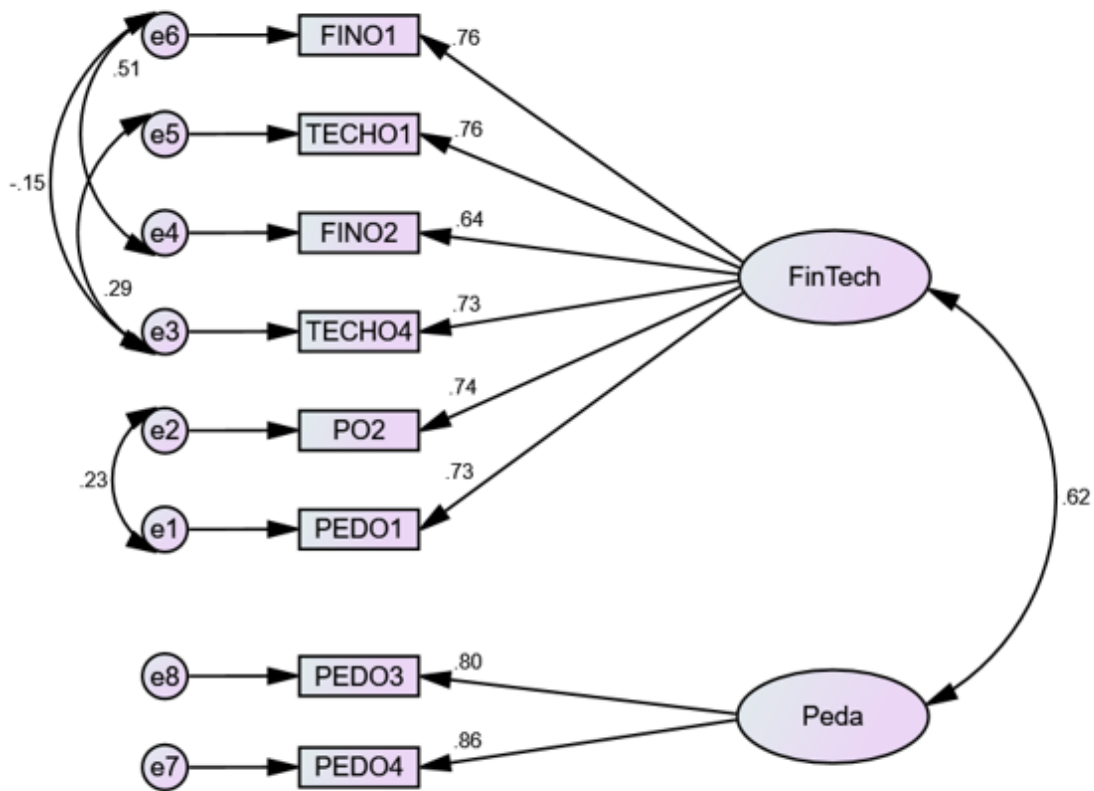


Figure 2

Model 2 with correlations among covariance