Factors Responsible for the Existence of Digital Divide in Higher Education and Its Impact on Academic Performance during COVID-19

Pinke Rani Dey[1]

[1]Department of Economics, Faculty of Social Science, Rabindra University, Bangladesh, Sirajganj 6770, Bangladesh

Abstract: The drastic outbreak of COVID-19 pandemic in March 2020 forced to close all kinds of educational institutions which instantly compelled countries to move from traditional to an online based learning system. However, due to the existence of inequality in access to ICT among the students, online learning has become one of the biggest challenges for many countries, especially for Bangladesh. Conducting an online survey among 390 students from different public and private universities, this study aims to identify the factors responsible for the existence of digital divide among the university students of Bangladesh and also examine how the resulting inequalities affect their academic performance during the period of COVID-19. In investigating the drivers of digital divide, the logistic regression model predicted university type, residence, monthly income and digital skills as significant factors of digital divide among the students. Moreover, the results of bivariate analysis revealed that the academic performance of the students was severely hampered due to the inability to purchase internet packages (55.13%), low speed during online classes (77.44%), and lack of internet access (62.05%). The suggestions of this study are therefore to provide special treatment to the susceptible student groups who terribly faced the severity of digital inequality, and asserted for synergetic initiatives by government and higher education authorities for necessary infrastructural development and skill development training programs.

Keywords: *Digital Divide, Online Learning, Higher Education, COVID-19, Academic Performance.*

Introduction: The world has seen a remarkable growth in the strength and reach of information and communication technologies (ICTs) over the last thirty years [1]. The advancement of internet, especially, has enabled a new way of confronting development challenges for the countries. Proper access to internet can also ensure the fourth goal of sustainable development, which is quality education for all [2]. A number of factors are responsible for not fulfilling the goal of ensuring quality education during the period of Corona Virus Disease of 2019 (COVID- 19). With the drastic outbreak of COVID-19 pandemic in March 2020, all kinds of educational institutions were moved for forced closure [3]. Because of the restriction on all kinds of physical meetings and conferences, the education system of the COVID affected countries instantly moved from a traditional learning to an online based learning system [4]. Very quickly, online learning has become one of the biggest challenges for many countries, especially for the developing countries including Bangladesh [5].

Although Bangladesh got the internet connectivity in 1996, the penetration rate has reached at a milestone with the advent of third generation wireless service (3G) in 2013 and fourth generation wireless service (4G) in 2018. According to the Bangladesh Telecommunication Regulatory Commission (BTRC), the number of internet users in Bangladesh has reached to 116 million in March 2021 [6]. Although more of the country's population is joining in the age of digitalization, the inequality of access to technology among the people, also known as the digital divide, within the country are preventing the speed of growth and development [7]. The term 'digital divide' refers to the differences that exist between the persons who can and cannot access to the modern information and communication technologies (ICTs) [8]. People without having the benefit of available technologies are put at a behindhand situation since they are less able to interact both socially and economically. This kind of technical and financial inabilities can exist between countries, regions, and persons as well [9]. A cross country analysis of Siddiquee and Islam mentioned the term digital divide as a multidimensional issue which has major linkage with various socio-demographic, economic, and geographic characteristics [10].

Developing countries are more likely to face the problem of digital divide than the developed countries. Populations from rural areas often fail to utilize the available technologies due to the lack of proper access and skills, age gap and educational gap between persons, differences in financial classes, and the differences that exist between genders [1,11]. The rural-urban divide is more acute in Bangladesh. Reducing this gap has become a major challenge and growing concern for the government of Bangladesh [10]. In terms of internet access, internet usage, and technological know-how, the rural-urban gap is remarkable, with rural people lagging behind (38%) than the urbane [12]. The digital gap between rural and urban people, created by the lack of access to online services, also exist among the people from different literacy group [13,14]. The study of Blazic and Blazic also documented aged based digital divide in education [15]. Rubin mentioned gender as a significant variable in determining the

Corresponding author details: Pinke Rani Dey
E-mail address: pinke.dey.eco.du@gmail.com
Tel: +8801521470531

presence of digital divide among males and females [16]. Considering several confounding factors like education, employment, and income the study found that females have more internet access and skills than males in the United States. In contrast, the analysis of Siddiquee and Islam asserted the worst gender gap in Bangladesh in terms of access to modern technology, that is, Bangladeshi women are less likely to own a mobile phone and to use the internet compared to men [10].

The education sector of the countries that have responded to the COVID-19 pandemic faced some common challenges. In Bangladesh, the first and foremost problem for online learning is the lack of internet access with sufficient bandwidth. Besides other sectors, internet has also created a new culture of accessing information in the field of education. The continuation of online based education during the pandemic period requires for having well internet connectivity among all students throughout the country. The study of Kabir *et. al*. also explained poor internet connectivity and access inability as the substantial barriers to online education [17]. The unavailability of necessary devices like a computer, tablet or mobile phone has added another dimension to this problem [18]. Various pandemic control measures adopted by the government has risen the existing economic crisis, and thereby forcing the families of the students to fall below the poverty line [19]. On top of that, limited and low-quality broadband connectivity, high cost of internet packages, expensive and insufficient devices also expand the existing gap in education by excluding most of the students from availing of internet, compounding inequalities [20,21]. Again, there is substantial difference between using internet and having potential online skills in Bangladesh. When the sudden outbreak of COVID pandemic exacerbate the technological dependency in education, the acquisition of technological advantages is obstructed due to access challenge imposed by lower family income of the students [22, 23]. The study Van Dijk and Hacker mentioned limited access to internet services and lack of corresponding social support that helps to develop technological skills as the potential barriers to reduce digital inequality [24]. Even with available technological facilities within households, high cost of data packages, and access to internet connectivity, internet speed, and even the access to electricity may influence the use of technologies [25]. Students face worst academic experience by struggling to complete their online coursework and exams implies that the inadequacy of technological facilities severely affect their overall academic success [9]. Researchers have analyzed the essence of digital divide in the education sector of Bangladesh from time to time. The proliferation of COVID-19 pandemic has added another dimension to this analysis. Although various studies on distance learning were conducted in the context of COVID affected countries; such as, in the USA [26,9,4], India [3,8] Malaysia [27], and so on, studies examining the factors causing digital divide among students and thereby affecting their academic performance during the COVID-19 time are very rare in context of Bangladesh. Saha *et al*. conducted research on the mental impact of digital inequality among the undergraduate students of Dhaka city considering the context of COVID-19 pandemic [5]. Again, some of the researches were on various methods and techniques for the improvement of online learning [18,17,28].

This research, therefore, aims to investigate the factors responsible for digital divide among the university students of Bangladesh by discussing the role of various socio-demographic factors in affecting the access to digital services, and also examines the impact of such digital divide on their academic performance during the period of COVID-19 outbreak. In this regard, students from different public and private universities of Bangladesh were queried some questions related to their socio-demographic characteristics, internet access, internet usage, online skills, and academic activities. The findings of the study will possess better information to the policymakers and practitioners in making policies and adopting necessary pursuits in reducing the existence of digital divide in Bangladesh. This study will also guide the education stakeholders in taking requisite steps during any unfavorable situation like COVID-19 pandemic and thereby enhancing the education management system of Bangladesh for ensuring a mellifluous progress in higher education afterward.

Research Questions

This study addresses the following research questions-
1. What are the factors responsible for digital divide in education sector of Bangladesh?
2. How does the presence of digital divide affect the academic performance of university students during the COVID-19 pandemic?

Hence, among five sections of this study, section 1 describes the background of the study including research objectives and research questions. And the rest sections of the paper are organized as follows: data and methodological procedures in section 2. Section 3 showcases the results and corresponding discussions, recommendations and limitations including future study scopes are explained in section 4, and finally a concluding remark in section 5.

Data and Methodology

Research method: Both the descriptive and econometric methods were used to explore the objectives of this study. A binary logistic model was used to identify the factors responsible for digital divide among the university students during COVID-19 since the model uses a dependent variable with dichotomous responses- attending online classes regularly or not. Besides, the bivariate analysis was used to inspect the impact of such divide on the academic performance of the students during the period of COVID-19.

Study area and sampling methods: The whole country was used as the study area for this research. Because of the closure of educational institutions, an online survey was conducted for data collection. Students from various public and private universities were the target population and selected randomly for the online survey.

Data collection and data analysis: Data were collected through a structured questionnaire designed with the help of previous literature survey to search for the possible answers to the research questions. A pilot survey was done with 20 students and the final questionnaire was designed by considering their feedback. 390 students from different public and private universities response through filling google forms. The survey was conducted by a complete voluntary participation of the respondents. The purpose of the study was explained in brief in the beginning of the google form and students were asked to provide their consent before participating in the survey. Data were analyzed using the STATA software.

Result and Discussion

Background of the respondents: Table 1 showcases the various socio-demographic and other imperative characteristics of the respondents. The potential respondents are the university students whose mean age is 21.87 years with a standard deviation of 1.67 years. The survey result shows that among 390 students 52.05% are male and 47.95% are female where 73.33% are from public universities and only 26.67% are from different private universities of Bangladesh. 90% of the students participated in the survey are from under graduation level and it is only 10% who have completed their graduation. The sudden closure of the educational institutions during COVID-19 forced the students to leave their institutional area and to lock up themselves in their homes. As the education system moved to online based learning soon, students had to join online classes from their existing residence. According to this survey, 40.26% of the students were in rural area, 23.08% were in sub-urban area, and another 36.67% students resided in urban area during their online class period. Exploring their family status, this survey finds that almost 65.13% students' monthly family income is more than 20000 and the rest 34.87% students' family income is below 20000 per month implies that majority of the students participated in the survey are from a moderate economic background.

Table 1. Basic information on the respondents (n=390).

Variable	Frequency (%)
Age (Mean ± SD) in years	21.87 ± 1.67
Gender	
Male	203 (52.05%)
Female	187 (47.95%)
Type of University	
Public	286 (73.33%)
Private	104 (26.67%)
Level of Education	
Under graduation	351 (90%)
Graduation	39 (10%)
Location during online class	
Rural area	157 (40.26%)
Sub-Urban area	90 (23.08%)
Urban area	143 (36.67%)
Monthly household income (BDT) (In Bangladeshi Taka, 1 USD=107 BDT approx..)	
Below 6000	28 (7.18%)
6000 to 10,000	21 (5.38%)
10,000 to 20,000	87 (22.31%)
20,000 to 50,000	165 (42.31%)
Above 50,000	89 (22.82%)

Source: Author's field survey.

Access to ICTs and technical skills of the students: The effectiveness of the online learning system among university students highly depends on their access to different technological facilities and their individual technical skills. According to this survey, about 68.21% of the students are dependent on smartphone or tablet for internet use with 43.59% of them who have personal

computer. As suggested by the previous literature, students with proper access to smartphone, tablet or personal computer are academically more successful than the others [29,30].

Moreover, for internet connectivity, broadband facility is available in the area of 60.77% students while more than half of the students (52.31%) do not have broadband connection in their home. In case of individual internet skills, students are largely acquainted with Facebook/Messenger (97.18%), Email operation (89.49%), and Internet browsing (81.28%). Besides, some of them are also acquainted with Microsoft Word (59.49%), Excel (42.82%), and Power point (46.15%). Hence, inequalities in access to digital devices, internet facilities and technical abilities indicate the existence of substantial digital divide among the university students in Bangladesh. (Table 2)

Table 2. Access to ICTs and technical skills (n=390).

Access to Personal Computer (n=390)	Frequency (%)
Yes	170 (43.59%)
No	220 (56.41%)
Device for internet use (n=390)	
Personal Computer	9 (2.31%)
Smartphone/Tablet	266 (68.21%)
Both	115 (29.49%)
Availability of broadband connection in the area (n=390)	
Yes	237 (60.77%)
No	153 (39.23%)
Broadband connection in the home (n=390)	
Yes	186 (47.69%)
No	204 (52.31%)
Technical Ability (n=390)	
Email sending/receiving	349 (89.49%)
Facebook/Messenger	379 (97.18%)
Internet browsing	317 (81.28%)
Online shopping	266 (68.21%)
Mobile Banking	286 (73.33%)
YouTube browsing	308 (78.97%)
Basic computer operation	212 (54.36%)
Microsoft word	232 (59.49%)
Microsoft excel	167 (42.82 %)
Microsoft power point	180 (46.15%)

Source: Author's field survey.

Factors responsible for digital divide in education: The logistic model predicted university type, residence during online classes, monthly family income and digital skills as significant factors of digital divide among the university students. There is high presence of digital divide among the students of public and private universities. At 1% level of significance, type of university is negatively related to attend online classes on a regular basis. That is, public university students were less likely to attend online classes regularly than the private university. Another significant (at 1% level of significance) predictor of the model is the residence of students during online classes. Students stayed in suburban and urban area could attend online classes more frequently than their fellows lived in rural places. Again, monthly family income has also significant and positive effect on attending online classes. Students who have family income 20000 to 50000 (at 5% level of significance) and above (at 1% level of significance) per month were more present in online classes than the students who have monthly family income of below 20000. Unavailability of broadband connection, slow internet speed in the remote areas, high price of internet data packages, are some of the reasons mentioned by the students for not attending the classes regularly. These findings are aligned with the previous researches [31,18]. Moreover, digital skills also significantly and positively related to determine the presence of digital divide among students. Students with medium skills to digital technology, at 10% level of significance, could attend online classes regularly than the low skilled. (Table 4)

Table 3. Digital divide and online classes.

Variables	Attending Online class regularly (Yes=1, No=0)
Gender (Male=1, Female=0)	-0.143
	(0.253)
Type of University (Public=1, Private=0)	-1.350***
	(0.322)
Level of class (Undergraduate=0, Graduate=1)	0.599
	(0.396)
Location *(Ref. Rural)*	
Sub-urban	0.858***
	(0.309)
Urban	0.783***
	(0.288)
Monthly family income *(Ref. Below BDT 6,000)*	
6000 to 10,000	0.198
	(0.742)
10,000 to 20,000	0.827
	(0.588)
20,000 to 50,000	1.386**
	(0.587)
Above 50,000	1.907***
	(0.649)
Educational qualification of the Household head *(Ref. No formal education)*	
Primary level	0.698
	(0.635)
SSC/equivalent	0.0939
	(0.618)
HSC/equivalent	0.175
	(0.635)
Honor's/Degree/Equivalent	-0.0671
	(0.578)
Masters/Equivalent/Higher studies	-0.0457
	(0.667)
Skill index *(Ref. Low skill)*	
Medium skill	0.520*
	(0.298)
High skill	0.199
	(0.304)
Constant	-0.751
	(0.778)
Observations	390

Source: Author's analysis.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard errors in parentheses.

Digital divide and academic performance during COVID-19: Table 4 highlighted the presence of digital divide in the education system of Bangladesh during the period of COVID-19. The bivariate analysis indicates the lack of digital equity among the students by their gender, type of university, residence during online classes, level of education, and family income per month. Among 390 students, majority of them strongly agreed or agreed with the statement that their study was hampered due to the inability to purchase internet packages (55.13%), low internet speed during online classes (77.44%) and therefore this lack of internet access severely hampered their academic performance (62.05%). Moreover, the cross tabulation indicates that the problem of digital divide is more acute among the male students than females. The results also show that the students from different public universities, rural residence, under grade level, and lower economic status were the worst sufferer of exiting digital divide in Bangladesh.

Table 4. Digital divide and academic performance.

	N	Study was hampered due to lack of smartphone or tablet		Study was hampered due to inability to purchase internet package		Study was hampered due to lack to internet access		Study was hampered due to low internet speed during online classes	
		Strongly agree or agree (%)	Disagree or neutral (%)	Strongly agree or agree (%)	Disagree or neutral (%)	Strongly agree or agree (%)	Disagree or neutral (%)	Strongly agree or agree (%)	Disagree or neutral (%)
Total Sample	390	36.41	63.59	55.13	44.87	62.05	37.95	77.44	22.56
Gender									
Female	187	29.41	70.59	50.27	49.73	58.82	41.18	78.07	21.93
Male	203	42.86	57.14	59.61	40.39	65.02	34.98	76.85	23.15
Type of University									
Private	104	30.77	69.23	41.35	58.65	56.73	43.27	75	25
Public	286	38.46	61.54	60.14	39.86	63.99	36.01	78.32	21.68
Location during online class									
Rural area	157	52.23	47.77	70.06	29.94	81.53	18.47	87.26	12.74
Sub-Urban area	90	31.11	68.89	54.44	45.56	56.67	43.33	81.11	18.89
Urban area	143	22.38	77.62	39.16	60.84	44.06	55.94	64.34	35.66
Level of education									
Under grade	351	37.32	62.68	56.7	43.3	63.82	36.18	78.63	21.37
Graduate	39	28.21	71.79	41.03	58.97	46.15	53.85	66.67	33.33
Monthly family income (BDT)									
Below 6000	28	82.14	17.86	92.86	7.14	89.29	10.71	85.71	14.29
6000 to 10,000	21	52.38	47.62	66.67	33.33	71.43	28.57	85.71	14.29
10,000 to 20,000	87	50.57	49.43	71.26	28.74	79.31	20.69	85.06	14.94
20,000 to 50,000	165	27.27	72.73	51.52	48.48	56.97	43.03	74.55	25.45
Above 50,000	89	21.35	78.65	31.46	68.54	43.82	56.18	70.79	29.21

Source: Author's field survey.

Limitations and Recommendations: This study uses cross-sectional data during COVID-19 period, therefore is unable to describe how the presence of digital divide affect academic activity over time. Again, data were collected through google form which may restrict some students from participating into the survey who are the actual sufferer of existing digital divide in Bangladesh. Hence, there is a scope for further analysis in a longitudinal approach for evaluating the issues related to digital divide. Moreover, the sample size used for this study is small compared to the national level. Future researches should conduct with larger sample for more in-depth analysis regarding this topic.

Besides, this study strongly suggests for synergetic initiatives by the government and higher education authorities. Special attention should be paid to the susceptible student groups who terribly faced the severity of digital inequality during the shutdown of universities. Necessary infrastructural development should be uplifted for ensuring the amalgamation of technology into the teaching and learning system. Several skill development programs and trainings could be incorporated in the regular curriculum to enhance the technological skills of the instructors and learners which also ensure the proper use of innovative digital facilities [17]. Government along with respective stakeholders should take necessary steps for the development of strong internet network in the remote areas in Bangladesh. The availability of broadband internet connectivity should be ensured at a cheaper cost [18]. Immediate actions should be taken to reduce the cost of accessing internet. Besides, online classes could be continued along with onsite classes to enlarge their acquaintance with the technical tools necessary for distance learning.

Conclusion: The education system of Bangladesh has faced a tremendous shift in the mode of education during the period of coronavirus. The presence of substantial digital divide among the students restricts them from enjoying the advantages of digital learning. This study investigates the factors responsible for the existence of significant gap among university students in accessing the modern information and communication technology, and how such divide can affect their academic activities during COVID-19 pandemic. Thoroughly examining the data, findings of this research identify type of university, residence, family income, and digital skills as some significant factors driving digital divide among the university students of Bangladesh. In analyzing its impact on students' academic performance, the survey result postulates that majority of the students are attuned with the fact that their study was hindered due to the unaffordability to purchase internet packages (55.13%) and slow internet speed during online classes (77.44%). Therefore, lack of access to internet problem is more acute than lack of access to device for

the Bangladeshi student community and it severely affected their academic performance (62.05%) during the period of lockdown. Hence, the findings are aligned with the specific objectives of this research. After getting registered for Covid-19 inoculation of the concerned, universities in Bangladesh reopened in September 2021. Teachers and students returned to in-person classes by maintaining safety restrictions. This shift in the mode of teaching and learning has given a serious lesson to the education system of Bangladesh and hence raised the necessity of improving technological facilities in educational institutions. In conclusion, the idea of virtual education has generated new opportunities in the field of education [32]. With the digitalization of education system, Bangladesh can grab this opportunity by adopting fundamental pre-requisites to confront with the prolonged effects of any pandemic, natural disaster, or other public exigency.

References

[1] K.A. Soomro, U. Kale, R. Curtis, M. Akcaoglu, M. Bernstein, Digital divide among higher education faculty, International Journal of Educational Technology in Higher Education 17(21) (2020) 1-16.

[2] United Nations, Sustainable development goals, 2015.

[3] T. Muthuprasad, S. Aiswarya, K.S. Aditya, G.K. Jha, Students' perception and preference for online education in India during COVID-19 pandemic, Social sciences & humanities open 3(1) (2021) 100101.

[4] S. Unger, W.R. Meiran, Student attitudes towards online education during the COVID-19 viral outbreak of 2020: Distance learning in a time of social distance, International Journal of Technology in Education and Science 4(4) (2020) 256-266.

[5] A. Saha, A. Dutta, R.I. Sifat, The mental impact of digital divide due to COVID-19 pandemic induced emergency online learning at undergraduate level: Evidence from undergraduate students from Dhaka City, Journal of Affective Disorders 294 (2021) 170-179.

[6] BTRC, Internet Subscribers in Bangladesh, Bangladesh Telecommunication Regulatory Commission, 2021.

[7] M.C. Tran, A.B. Labrique, S. Mehra, H. Ali, S. Shaikh, M. Mitra, P. Christian, K. West Jr., Analyzing the mobile "digital divide": changing determinants of household phone ownership over time in rural Bangladesh, JMIR mHealth and uHealth 3(1) (2015) e24.

[8] F. van Cappelle, V. Chopra, J. Ackers, P. Gochyyev, An analysis of the reach and effectiveness of distance learning in India during school closures due to COVID-19, International Journal of Educational Development 85 (2021) 102439.

[9] S.S. Jaggars, B.A. Motz, M.D. Rivera, A. Heckler, J.D. Quick, E.A. Hance, C. Karwisch, The Digital Divide among College Students: Lessons Learned from the COVID-19 Emergency Transition, Policy Report, Midwestern Higher Education Compact, 2021.

[10] M.S. Siddiquee, M. Islam, Understanding the First and Second Digital Divides in Rural Bangladesh, Working Paper, 2020.

[11] E.E. Centeio, The have and have nots: an ever-present digital divide, Journal of Physical Education, Recreation & Dance 86 (6) (2017) 11-12.

[12] LIRNEasia, After Access: ICT access and use in Asia and the Global South, 2018.

[13] Z.M. Babar, Digital divide: Concepts and reality in Bangladesh, Journal of Business 2(2) (2017) 24-33.

[14] T. Rahman, S.H. Bhuiyan, Multipurpose community telecenters in rural Bangladesh: A study of selected Union Information and Service Centers, Information Development 32(1) (2016) 5-19.

[15] B.J. Blazic, A.J. Blazic, Overcoming the digital divide with a modern approach to learning digital skills for the elderly adults, Education and Information Technologies 25 (2020) 259-279.

[16] R.E. Rubin, Foundations of library and information science, fifth ed., American Library Association, Chicago, 2017.

[17] M.R. Kabir, M.A. Islam, S.A. Deena, Explaining the adoption of technology-based design of higher education during and after COVID 19 period from a developing country perspective, IxD&A 46 (2020) 88-119.

[18] E.K. Emon, A.R. Alif, M.S. Islam, Impact of COVID-19 on the institutional education system and its associated students in Bangladesh, Asian Journal of Education and Social Studies 11(2) (2020) 34-46.

[19] M. Uddin, Effects of the pandemic on the education sector in Bangladesh, The financial Express XXVII (206) (2020) 6.

[20] The Daily Star, Online classes: Increasing the education divide, 17 July 2020.

[21] R.I. Sifat, COVID-19 pandemic: Mental stress, depression, anxiety among the university students in Bangladesh, Soc Psychiatry 67(5) (2020) 609-610.

[22] C.J. Kim, A.M Padilla, Technology for educational purposes among low-income Latino children living in a mobile park in Silicon Valley: A case study before and during COVID-19, Hispanic Journal of Behavioral Sciences 42(4) (2020) 497-514.

[23] N.A. Buzzetto-Hollywood, M. Elobeid, M.E. Elobaid, Addressing information literacy and the digital divide in higher education, Interdisciplinary Journal of e-Skills and Lifelong Learning 14 (2018) 77-93.

[24] J. Van Dijk, K. Hacker, The digital divide as a complex and dynamic phenomenon, The information society 19 (2003) 315-326.

[25] A.J. Ganimian, E. Vegas, F. Hess, Realizing the promise: How can education technology improve learning for all, Brookings Institution, United States of America, 2020.

[26] T. Bell, J.W. Aubele, C. Perruso, Digital divide issues affecting undergraduates at a Hispanic-serving institution during the pandemic: A mixed-methods approach, Education Sciences 12(2) (2022) 115.

[27] A.H. Ngah, N.I. Kamalrulzaman, M.F. Mohamad, R.A. Rashid, N.O. Harun, N.A. Ariffin, N.A. Osman, The sequential mediation model of students' willingness to continue online learning during the COVID-19 pandemic, Research and Practice in Technology Enhanced Learning 17(1) (2022) 13.

[28] A. Aziz, M.M. Islam, M. Zakaria, COVID-19 exposes digital divide, social stigma, and information crisis in Bangladesh, Media Asia 47(3-4) (2020) 144-151.

[29] M.E. Stritto, K. Linder, Student device preferences for online course access and multimedia learning, Reserch report, Oregon State University Ecampus Research Unit, 2018.

[30] J.D. Galanek, D.C. Gierdowski, D.C. Brooks, ECAR Study of Undergraduate Students and Information Technology, Research report, EDUCAUSE, 2018.

[31] M. Badiuzzaman, M. Rafiquzzaman, M.I. Rabby, M.M. Rahman, The latent digital divide and its drivers in e-learning among Bangladeshi students during the COVID-19 pandemic, Information 12(8) (2021) 287.

[32] O.B. Adedoyin, E. Soykan, Covid-19 pandemic and online learning: the challenges and opportunities, Interactive learning environments 31(2) (2023) 863-875.