

## UNDERSTANDING DIGITAL DIVIDE IN ONLINE CLASS EXPERIENCES DURING COVID-19 LOCKDOWN IN BANGLADESH

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### ABSTRACT

This paper explores students' online class experiences during Covid-19 pandemic in Bangladesh. This has been an unprecedented situation and many educational institutions find it very difficult to balance the need to continue the courses with the uncertainties and mental stress faced by the students using digital platforms, mostly untested for in different contexts. To understand the online class experiences in a novel situation, we conduct an online survey of 204 top-tier private university students in Bangladesh. We find that students make logical choice between two types of online classes – live/ real-time and recorded video lectures. We observe income and gender based digital divide in how students engage with these online classes during a crisis. We find that recorded video lectures have the potential to reduce many of the problems students face during online classes by addressing digital divide to a large extent. We recommend instructors provide video recordings and other materials regularly even if they conduct live/ real-time online classes and consider novel yet empathetic approach towards learning.

**Keywords:** Online class, Covid-19 pandemic, digital divide, recorded lecture

### 1. INTRODUCTION

The Covid-19 pandemic and the unprecedented lockdown introduced by the governments in many countries have forced educational institutions to utilize digital technologies such as online classes, television, texting etc. to ensure remote learning (World Bank, 2020). Even though online technology is being utilized in the education sector from 1990s (Kumar, Kumar, Palvia, & Verma, 2017; Palvia et al., 2018), till now, the use has been limited only to a supplementary role to in-person class. Even after the emergence of Massive Open Online Courses (MOOC) and e-learning platforms such as the Khan Academy, in-person classes have always been esteemed as superior because of the highest channel richness of face-to-face communication. Numerous predictions about how all the universities would go extinct due to the disruptive online education could not make any dent in the reputation of most of the universities. In their study on MOOC, MIT researchers Reich and Ruipérez-Valiente (2019) find that in 2017-18 only 3.13% of people enrolling in MOOCs have finished the courses. They also point out that the participants are almost entirely from the developed countries and thus the claim of bridging the digital divide in the worldwide education through MOOC remains unrealized (Lederman, 2019). In reality, MOOCs simply provide an extension of the existing business models enabling the reputed universities to offer online masters degrees to professionals (Pollack Ichou, 2018; Reich & Ruipérez-Valiente, 2019).

This backdrop altered abruptly with the Covid-19 lockdown (Wakefield, 2020). Not only the big universities have to be online now, but the whole education sector has to join in with those in this turbulent journey. When the lockdown began, nobody could predict how and when educational institutions would reopen, and as a result, digital platforms became the only feasible and safe method that the teachers and the students could use for academic activities at all levels – from primary to higher education. Many schools and universities in the developed world opted for full-fledged online classes and enquired digital platforms like Coursera regarding

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online course delivery options (Batty & Hall, 2020; World Economic Forum, 2020). However, the question remains – is the world of education, especially in the developing countries, ready for this bumpy ride?

While some work has been done to shed light on the effect of this sudden transition to online teaching on digital divide in the context of developed countries (Oster, 2020), research in the context of least developed countries or developing countries is virtually non-existent. Bangladesh is a least developed country which met the UN eligibility criteria in March 2018 and is all set to become a developing country in 2024 (World Bank, 2019). In Bangladesh, all educational institutions were shut down on March 16, 2020 (The Daily Star, 2020). After about two weeks of confusion, according to the University Grants Commission (UGC), 63 out of 151 public and private universities started online classes (Alamgir, 2020). The general idea was to conduct live online classes during the same time slots as the in-person classes. However, this decision needs to be weighed against the digital readiness of Bangladesh to evaluate the applicability of live/ real-time online classes for long-term use in case some form of the lockdown persists. In the 2019 Network Readiness Index, Bangladesh ranks 101 out of 121 countries (Portulans Institute, 2019). In terms of household with Internet access, Bangladesh ranks 120, in fixed broadband subscription it ranks 90, and in active mobile broadband subscription, it ranks 116 (Portulans Institute, 2019). According to the Bangladesh Bureau of Statistics (2019), only about 5.6% households in Bangladesh have a home computer while 95.9% households have some type of mobile devices and about 37.6% households have access to Internet at home. These data are indicative of the existence of a deep digital divide making Bangladesh a very interesting case in point for exploring how the sudden initiation of online classes influences the existing or latent digital divide.

According to the ‘Speedtest’ by Ookla LLC (2020), from the week of first Covid-19 case detection in Bangladesh over the course of the next one month when the online classes were ongoing in full flow in many private universities and schools, the mobile data download speed (in mbps) in the country dropped by about 12% while fixed broadband download speed dropped by about 9%. The increased use of social media and online services during the lockdown in all likelihood must have had an impact on this drop in speed. Given that the country’s Internet speed was relatively slower in comparison with the developed countries to begin with, this further drop in speed undoubtedly has the potential to negatively affect students’ experiences of live/real-time online classes.

This research is important because it is imperative to pin down the problems of this method so that educational institutions can support students with alternative solutions along with live/real-time classes. To the best of our knowledge, academic work to understand the digital divide in university students in Bangladesh is non-existent and this research aims to target that knowledge gap. The objective of this research is to uncover the mechanisms through which online live/ real-time classes bring to the fore the already existing yet opaque digital divide among the private university students in Bangladesh and how to reduce this divide.

The rest of the paper is organized as follows. Section 2 provides a review of the scholarly work on digital divide in developing countries and also the use of information technologies in classroom. Section 3 discusses the data collection and analysis methods and presents a summary of respondent characteristics. Section 4 presents the findings and discusses the results in light of the research objective while section 5 presents the implications of the research. Section 6 concludes by pointing out the limitations and directions for further research.

## **2. LITERATURE REVIEW**

Digital divide, in the early Information and Communication Technologies (ICT) literature, is conceptualized as the differences in terms of ICT adoption existing between the developed and the developing countries (Ayanso, Cho, & Lertwachara, 2014; James, 2004). During those early days, researchers (Corrocher & Ordanini, 2002;

Cuervo & Mene'ndez, 2006) primarily focus on developing frameworks with a view to explaining cross-country digital divide. Researchers then start to highlight the importance of using different measures of digital divide for developing countries compared with the developed countries. James (2004), e.g., argues, based on his work in India, that the traditional measures of digital divide focusing on personal Internet usage cannot capture the true number of Internet beneficiaries in developing countries since a large portion of the population gets services through intermediaries. In a later study, Sein and Furuholt (2012) analyze the characteristics, types and roles of intermediaries for bridging the digital divide in developing countries. Citing Grameen Phone's early initiative in Bangladesh with mobile phones, James (2007) argues that to reduce the digital gap developing countries must build up new institutional mechanisms rather than just rely on existing models constructed in the context of the developed world. To understand the extent of digital divide that exists across countries, United Nations commissioned the development of global ICT Development Index (IDI) in 2009 (International Telecommunication Union, 2020).

At the next stage, researchers start arguing about the importance of analyzing international and within country digital divide using the lens of socioeconomic, technological, and linguistic contexts (Armenta, Serrano, Cabrera, & Conte, 2012; Barzilai-Nahon, 2006; Chen & Wellman, 2004; Thomas & Parayil, 2008; Tirado-Morueta, Aguaded-Gómez, & Hernando-Gómez, 2018). For example, Cartier, Castells, and Qui (2005) analyze digital divide in Chinese cities and find that 'information have-less' population make use of translocal networks to counter the stratified nature of information access. Korupp and Szydlík (2005) find that new technologies diffuse not randomly but systematically along the socioeconomic line and in consequence reveal social inequalities. Guo and Chen (2011) in their work on Chinese peasants find that adoption of different ICT tools varies among different social statuses and it reproduces the existing social cleavages among four different types of villages. Tewathia, Kamath, and Ilavarasan (2020), in their research in India, follow Marxian conflict perspective and Weberian cultural perspective and find that digital divide is exacerbated through social inequalities such as lower education, income and caste strata. In a recent study covering 191 countries, Mubarak, Suomi, and Kantola (2020) reconfirm the link between ICT diffusion and lack of income and education. Garcia (2011) finds that mobile phone alone, in the absence of supportive social structures, cannot automatically bring women empowerment and in certain situations such as undocumented migration, actually increases the digital divide and power relations among men and women. In their study in Uttar Pradesh, India, Bala and Singhal (2018) find gender based digital divide due to lack of technical skills, unhelpful social norms and economic constraints. Pearce and Rice (2013) compare mobile and personal computer internet users and report that sociodemographic factors have significant effects on access, device, usage and activities and that mobile internet users engage in a much narrower range of activities compared with personal computer users. Following the arguments by van Deursen and van Dijk (2010) about internet skills and digital divide, Liu and Wang (2020), in a recent study of Chinese mobile users, also call for a novel conceptualization of digital divide and argue that the new divide centers around the quality of network connection and service, not the difference between having and not having a mobile phone.

The aforementioned situation also rings true in the education sector. Researchers and policy makers alike agree that use of ICT in education has the potential to engender significant human development (Assar, Amrani, & Watson, 2010). However, material access to ICT alone without considering the socio-demographic factors cannot bring about any meaningful change. In her research at four schools in Cape Town, South Africa, Gudmundsdottir (2010) finds that existing social inequalities, language barriers and inadequate training of teachers can exacerbate the digital divide among students even if the schools have relatively equal access to ICT tools. She recommends incorporating culturally sensitive local contexts into teachers' training programs for effective ICT integration in schools. By applying John Rawls' principles of justice, Anthony and

Padmanabhan (2010) identify the existence of inequitable situations when it comes to web based education in India. Sims, Vidgen, and Powell (2008) argue that digital divide receives scant attention in higher education and find that students differ in their affordability of technology, broadband access, and digital skills.

The idea of using technology in the education sector has taken up different forms. One form like MOOCs aim to completely substitute in-person classes. Another form focuses on supplementing in-person classes either by using live streaming or by using 'lecture capture' technologies, i.e., recorded lectures, for future access by the students. Covid-19 pandemic has blurred the boundary between these two forms in the sense that teachers are expected to go 'fully online' to support their in-person classes which were stopped abruptly. Different teaching methods such as online practice questions, flipped classrooms and videos have been suggested acknowledging the fact that those are not perfect substitutes for in-person classes (Chick et al., 2020). In pre-Covid-19 world, recorded lectures were mainly being used as a supplementary resource to the live in-person lecture. The predominant model was to capture video of the live classes and at a later time make those available to students for future access. Researchers find that students are more likely to access the videos of difficult contents compared to the easier ones (McCunn & Newton, 2015). Students are more satisfied and show better learning performance when they get recordings which is interactive with rewinding capabilities (D. Zhang, Zhou, Briggs, & Nunamaker, 2006). Students report higher perceived flexibility when recordings are provided (Chapin, 2018; Elliott & Neal, 2016), though researchers (Lokuge Dona, Gregory, & Pechenkina, 2017) warn that recorded lectures may be less suitable for certain fields. Even with more time and space flexibility, students may still find recorded lectures as less authentic compared to face-to-face interaction (Tsang, 2011) and they may also crave for interaction with their peers for in-and-after lecture discussion and the associated learning (Hafford-Letchfield, 2010). A concern about whether the students lose the ability of 'deep learning' when recorded lectures are used is palpable in the literature. Even though this is a big debate to be addressed in one single work, Cartney (2013) attempts to shed some light on this issue. Based on the evidence collected from social work students, she argues that the assumption of 'deep learning' occurring 'here and now' is probably misplaced; in contrast, recorded lectures have the potential to provide students with a chance to engage and reengage with the materials and thus facilitate deep learning at their own pace.

Covid-19 situation has forced many universities to consider and adopt digital platforms for conducting classes. This unexpected circumstance has also forced students to adjust their learning styles in the middle of a semester. In this paper, we aim to show that Covid-19 situation and the subsequent abrupt adoption of digital platforms can unearth a digital divide – hidden until now, among university students.

### **3. RESEARCH METHODS**

#### ***3.1 Data Collection***

We conduct an online survey of 204 private university students of Bangladesh during April 26 - May 2, 2020. We use Google form to create the survey and obtain responses. We use convenience sampling to obtain data given the movement restrictions due to the Covid-19 induced lockdown during the data collection period. The survey was conducted on students from ten different online classes taught by us and our colleagues. The respondents are students of top-tier private universities in Bangladesh and therefore, represent a relatively higher income cluster compared to other similar groups in Bangladesh such as public university students. For the purpose of our analysis we divide the respondents into five income groups – low, lower middle, middle, upper middle and high. Respondent characteristics are summarized in Table 1.

**Table 1:** Respondent characteristics

<b>Information Criterion</b>	<b>Value</b>
Agea (number)	
Min	18
Max	49
Average	24
Median	24
Gender (%)	
Male	61
Female	39
Monthly household income (%)	
Low income: Below Tk. 50,000 (USD 589) <sup>b</sup>	27
Lower middle income: Tk. 50,000-100,000 (USD 589-1,177)	42
Middle income: Tk. 100,000-150,000 (USD 1,177-1,766)	16
Upper middle income: Tk. 150,000-200,000 (USD 1,766-2,354)	8
High income: Above Tk. 200,000 (USD 2,354)	7
Type of student (%)	
Undergraduate	64
Graduate	36
Field of study: Undergraduate (%)	
Business	65
Pharmacy	12
Computer Science/ Engineering	9
Engineering	5
Economics	5
Law	2
Biochemistry and Microbiology	1
English	1
Field of study: Graduate (%)	
Business	80
Economics	20
District during lockdown (%)	
Dhaka	70
Outside Dhaka	30
Residing in urban/ rural area during lockdown (%)	
Urban	88
Rural	12

**Note:** Number of respondents, N = 204, a 90% of the respondents are between 21 and 30 years old.<sup>b</sup> According to the interbank exchange rate reported by the Bangladesh Bank as on May 31, 2020

### 3.2 Data Analysis

In this exploratory study, we analyze the survey responses to illicit information on digital divide among students as they cope with the sudden unanticipated transition from on-campus classes to online classes. As pointed out in the literature review section of the paper, mere use of technology without considering socio-demographic factors cannot bring about meaningful positive changes; rather it often results in increased inequity through exacerbation of digital divide. In the US context, e.g., Oster (2020) identifies a race based digital divide in addition to an income based one. She reports that the performance of low-income

students fall significantly further than their high-income counterparts at the onset of online classes due to Covid-19 school closures in the US, and the difference persists throughout the next couple of months. The same pattern is observed when performance of black students is compared with that of the white students, with the performance of the black students deteriorating much more.

In the context of Bangladesh, in addition to investigating income based digital divide, we compare online class experiences of students located in Dhaka with students located outside of the capital; and compare experiences of male with female students. The difference in location may be of importance in terms of online class experience as many students moved to their hometown/ village during the lockdown and the average Internet speed outside of Dhaka is deemed to be much lower than that of Dhaka. We focus on gender based digital divide given the traditional patriarchal societal structure of Bangladesh. Females usually perform a much greater proportion of household work and given the layoffs of many household helpers (especially the part-time ones) during the lockdown, the type of online class (live/ real-time vs. recorded) may have a different effect on females compared to their male counterparts. Based on the student responses to our survey questions, although we do not find much evidence for the existence of a location based digital divide, we do identify income-based and gender-based digital divides.

#### **4. FINDINGS**

This section presents the income and gender based digital divide that we find among our respondents and a comparative picture of the online class experiences of the students focusing on the differences between online live/ real-time and recorded video lectures.

##### ***4.1 Income and digital divide in online class experiences***

Our respondents belong to top-tier private universities in Bangladesh and under normal circumstances they get access to fully equipped computer labs and Internet facilities on campus. In cases where students are sharing an apartment together, they usually pool their resources and subscribe to a good Internet service. However, Covid-19 pandemic and the associated lock-down completely shuffled these previous arrangements as many of the respondents have returned to their homes in different cities/ villages and therefore cannot access on-campus computer resources or their shared Internet facilities. This unprecedented situation reveals an income based digital divide which was not visible before among our respondents.

Our analysis suggests that the respondents belonging to the low and lower middle-income groups are hit harder during this lockdown. 10% of our respondents do not own their own personal computer or laptop and they perceive it to be a problem for effectively attending online classes. Among these respondents, 45% belong to the low-income group and 50% belong to the lower middle-income group, whereas only 5% belong to the three higher income groups combined. It is commonly understood in Bangladesh that young people buy cheap mobile data packages for their personal Internet use and we expect the same for our respondents because of their age. It is quite common for university students to get pocket money from their parents/ guardians and 64% of our respondents report to have received it before the lock-down began. 99% of them report a decrease in the amount received. It is also a common practice among the university students in Bangladesh to take up some part-time jobs such as giving tuition to younger students to finance their personal Internet usage. However, the Covid-19 situation creates a problem in this respect as well since 34% of our respondents who had a job/ multiple jobs before the pandemic report that they have lost at least one job after the lock-down began. Among those respondents losing a job, again we see that the low-income group bears a greater burden. As Figure 1 shows, 77% of respondents belonging to the low-income group have lost at least one job after lock-down whereas nobody in the high-income group lost a job. Loss in monthly household income depicts a similar picture. Overall, 57% of respondents who had an income before the Covid-19 pandemic report an income loss

after the lockdown started. This proportion is 73% for respondents belonging to the low-income group, and only 30% for the high-income group. These differences in job and income loss can pose a greater burden on the relatively low income students in how they engage in online classes and give rise to a nascent digital divide since at the time of Covid-19, the low-income group is more likely to spend a higher proportion of their income to buy health related products such as masks, gloves, sanitizers, medicines etc.

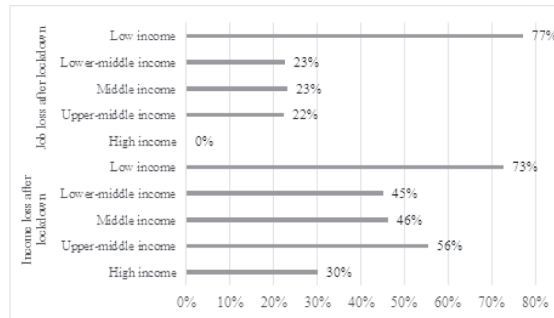


Figure 1: Job loss and income loss among different income groups

Not surprisingly, we observe a positive correlation between monthly income and Internet spending both before and after the lock-down. In normal circumstances, the high-income group is able to spend more on Internet and get better service. The low-income group in the past was able to reduce this divide by utilizing either on-campus computer resources or their shared arrangements with their peers. However, during Covid-19 lockdown when every student is required to attend online classes, the lower income groups are again hit harder since they now have to spend a higher proportion of their income to level the playing field with their counterparts. As Figure 2 clearly shows, the lower the income, the higher is the increase in Internet spending due to lockdown. The low-income group has to increase median Internet spending by about 60% after lockdown whereas the high-income group actually is able to decrease it by 3.3%. This divide is also evident in the fact that 38% of the respondents in the low-income group complain about lack of money to buy data or Internet package whereas only 11% in the high-income group do so.

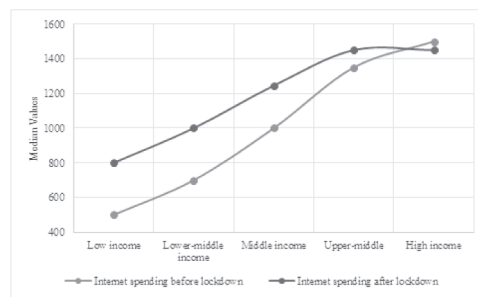


Figure 2: Monthly income and Internet spending

#### 4.2 Gender and digital divide in online class experiences

The covid-19 pandemic has also unearthed a gender based digital divide in how students experience online classes. In Bangladesh, females generally perform a disproportionate share of household work. Families that can afford household helps hire either full-time or part-time people. These helpers generally do all types of household chores from cleaning, cooking, washing to babysitting. Again, it is in the main the duty of the females in the house to manage these full-time and/ or part-time hires. Covid-19 pandemic and the associated

lock-down forced families to layoff the helpers, mostly the part-time ones. What naturally transpired is that females had to take up the majority of the workload in addition to their prior duties. We observe a pattern of gender based digital divide in the online class experiences of our respondents that is consistent with the above scenario. In our sample, females are likelier to mention about time flexibility problem of online live/ real-time classes; 60% of the females see it as a problem whereas only 40% of the male respondents do so. Among undergraduate students, 36% of males see time flexibility as a problem in contrast to 60% of females. Among graduate students, this male-female proportion is 48% versus 59%. These findings reveal that if someone is a female in Bangladesh, regardless of her age, she has to bear a greater proportion of workload at home and more so during the lock-down and therefore, it is more difficult for females to attend online live/ real-time classes. This divide is also reflected in how our respondents' grade expectations change after online classes began. More females expect a lower grade though at the undergraduate level the male-female difference is small (60% versus 62%). In contrast, in case of graduate students, a much larger proportion (59%) of females who are likelier to be married and have children expect a lower grade compared to their male counterparts (46%).

### ***4.3 Recorded video lectures versus online live/ real-time classes***

In this study, we focus on two types of online classes – live/ real-time classes and recorded video lectures. In our sample, all respondents had experience of attending both online live/real-time classes and recorded video lectures during the lockdown. On average, 68% of the courses that a student took offered live/ real-time online lectures while the remaining courses offered recorded video lectures. 42% of the respondents prefer live/real-time online classes while 58% prefer recorded video lectures.

Of the students who prefer recorded lectures, 74% like the flexibility of being able to watch the lectures in their own time, 71% report that they can go over the recordings as many times as they need, 50% like the fact that they can download the lecture once and watch it offline, 46% report that they can ask relevant questions to the teacher at their preferred time, and 45% report that they get an equal chance of asking questions even with a relatively slower Internet connection. 74% of the respondents who do not like recorded lectures complain that those are less interactive while 71% suggest that they cannot ask instant questions. (See appendix A)

73% of the students who prefer live/real-time online classes do so because they find those to be more interactive and 68% find those to be easier for instant queries. Of the students who do not like live/real-time classes, 84% complain about connectivity problems, 51% report that some materials presented during the live/real-time classes become inaccessible later, 47% complain about the lack of time flexibility, 43% complain about people with high speed connections getting undue advantage, while 40% suggest that ensuring attendance during the live sessions is stressful (See appendix B).

In the past, online classes have been perceived as a tool to enhance access to education. The main comparison was being done between in-person and online classes. Although different forms of online classes that can supplement or arguably replace in-person classes have emerged over time, the Covid-19 situation exposes the fact that all forms of online classes are not equally desirable during a crisis. This greater preference for recorded lecture, in fact, points to the digital divide that emerged during the lockdown situation and was not present during normal times. We observe that income level has an influence on the type of lecture preferred by the respondents in our sample. Majority of the respondents (76%) report experiencing Internet speed slowdown and this experience does not vary much by income level (see appendix C for the reasons of Internet speed slowdown). However, among respondents who prefer recorded lectures, 46% in the low and lower middle-income groups perceive that students with higher Internet speed is getting an advantage in online live/ real-time classes in contrast to 34% respondents in the three higher income groups. Overall, preference for recorded video lectures is also the highest (71%) among respondents belonging to the low-income group.

Similarly, 54% of the low-income group respondents who prefer recorded video lectures appreciate the fact that with recordings, the files can be downloaded once and then viewed later offline, whereas only 22% of the respondents from high-income group perceive it as an advantage of recorded video lectures. Along the same line, among the respondents who prefer recorded video lectures, 31% belonging to the low-income group find recorded lectures as a cheaper option while only 11% respondents of the high-income group mention it as a reason for their preference.

## **5. IMPLICATIONS OF THE RESEARCH**

This study has important implications for the education sector, especially in the developing countries. First, this research reinforces the fact that there is an income based divide in how low- and high-income groups access and utilize new educational technologies. A crisis can exacerbate the situation and sometimes uncover previously hidden divide. Therefore, the policy makers must invest more in long-run initiatives to improve the network access of a larger section of population with a focus on providing usage training and support. Digital unpreparedness has forced many educational institutions in the developing countries to completely shut down their activities during the lock-down. This should be a wake-up call for the policymakers as well as the education sector leaders for larger and meaningful long-term investments in digitalization. The Government may think about helping educational institutions by providing them necessary financial assistance such as grants or subsidized loans to initiate their digital journey.

Second, according to our findings, during a crisis like the Covid-19 pandemic, it is important for educational institutions to formulate novel strategies to help students who are facing problems with online classes. Arguing from the perspective of Tavani (2003), failure to ensure e-inclusion of the full student body in the online digital platform can raise an ethical concern that needs to be addressed by the institutions. Hence, as a step to mitigate digital divide during a crisis, monthly Internet plans can be arranged for students who complain about financial burden. Longer time frames should be allowed for completing assignments for people with time flexibility issues during lock-down. Teachers should be careful and empathetic towards the need of the students without compromising the quality of education by using plagiarism checking tools.

Third, this study uncovers a preference for recorded video lectures over online live/ real-time classes. Recorded lecture is Janus-faced in nature – it facilitates flexibility but hinders interaction and spontaneity (Joseph-Richard, Jessop, Okafor, Almpanis, & Price, 2018). Edwards and Clinton (2019) argue that recorded lecture has a negative impact on class attendance while Larkin (2010) and Saunders and Hutt (2015) show that students mostly use lecture recordings either for supplementing learning or for making up for a lecture they were unable to attend. Nordmann, Calder, Bishop, Irwin, and Comber (2019) on the other hand do not find any evidence of negative relationship between lecture recordings and attendance. During Covid-19 lockdown, educators in fact, do not want students to physically attend the classes. The challenge now is to keep students engaged into the learning loop with minimum exposure to other people and with less psychological stress (W. Zhang, Wang, Yang, & Wang, 2020). Our study points out that recorded video lectures can provide an effective solution to this problem. Although online live/ real-time lectures can be more interactive theoretically, in a developing country like Bangladesh, it is more prone to disruption due to connectivity issues as reported by almost all our respondents. Recorded video lectures can provide a cheaper option for the students and can ensure time flexibility. Therefore, we recommend that whatever form of online classes an educational institution opts for, teachers should be required to make the recordings available for the students. If someone cannot join the live lecture, s/he must have an option to catch up. Recorded lectures, which in the past, occupied a supplementary role to in-person live lectures, in a time of crisis can be an equalizer that reduces the digital divide and create a level playing field.

## 6. CONCLUSION

This study illuminates that during a crisis like Covid-19 pandemic, students make logical choice between online live/ real-time classes and recorded video lectures depending on their personal situations. A deeper look reveals an income and gender based digital divide that can impact students' online class experiences. This study has important implications for the education sector, mainly in the developing countries. Still, there are some limitations that we need to point out. First, our data have been collected from top-tier private university students in Bangladesh and they are more privileged relative to other groups of students. We want to emphasize that this fact, though important, hardly undermines our findings and suggestions. It actually highlights the pervasiveness of digital divide in every segment of the population – including the relatively privileged class – in the developing countries. Given that we observe income and gender based digital divide in our sample of top-tier private university students, we should expect a deeper divide in other student groups such as public university students. Second, we do not measure the impact of the type of online classes on student performance since the timing of data collection was the middle of a semester. Future research can look at – how and to what extent student performance is related to the type of online classes they attend during a crisis. Also, the next step in research could be an extension of analysis to encompass other universities as well as educational institutions from other educational levels such as schools and colleges. We expect future research to uncover many other culture and context specific dimensions of digital divide, especially in the education sectors of developing countries which remains largely unexplored.

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## APPENDIX

### A) Preference for recorded video lectures

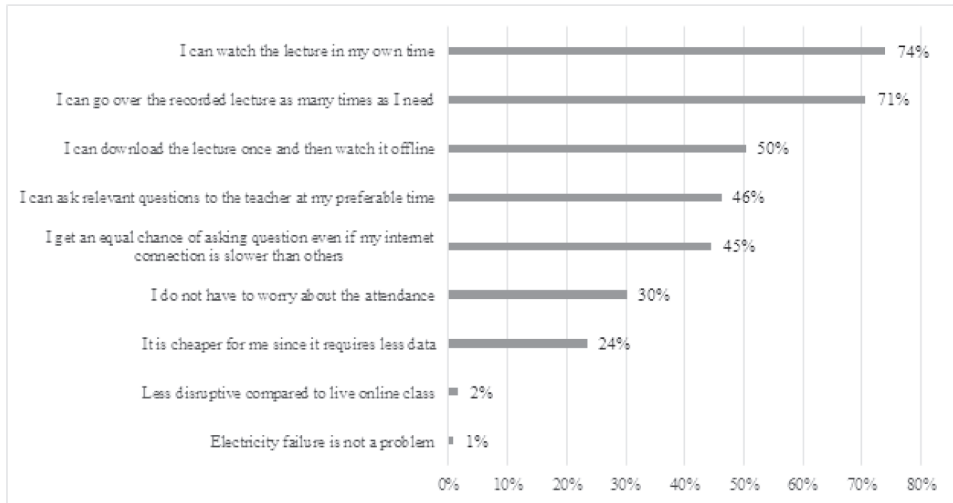


Figure A1: Reasons for preferring recorded video lectures over online live/ real time class (N = 119). Respondents could choose more than one option.

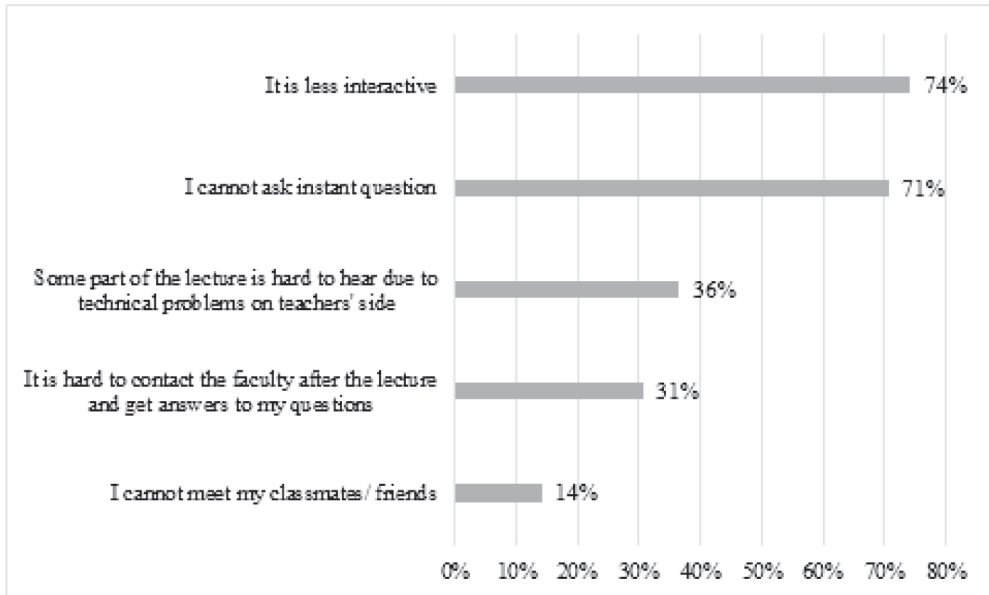


Figure A2: Reasons for not preferring recorded video lectures (N = 85). Respondents could choose more than one option.

**B) Preference for online live/ real-time classes**

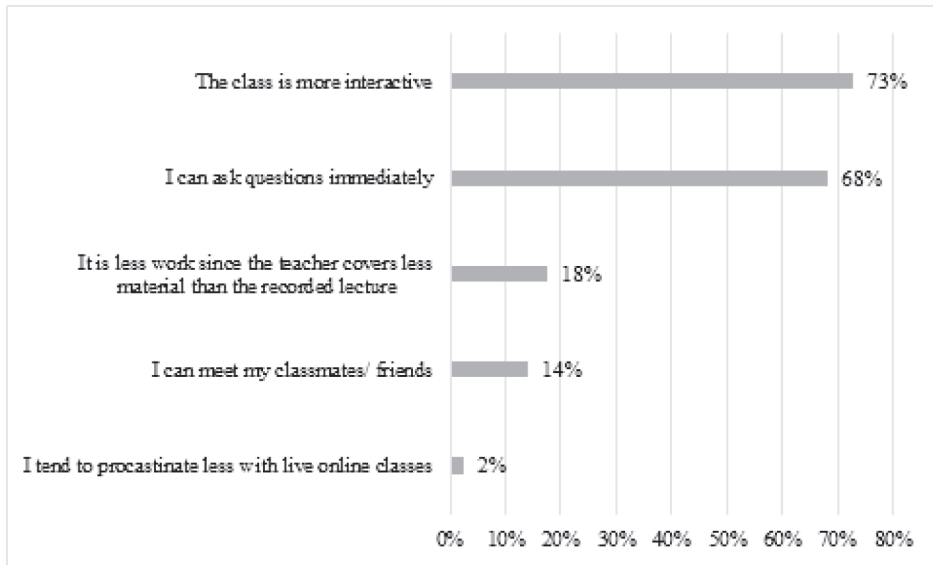


Figure B1: Reasons for preferring online live/ real time class over recorded video lectures (N = 85). Respondents could choose more than one option.

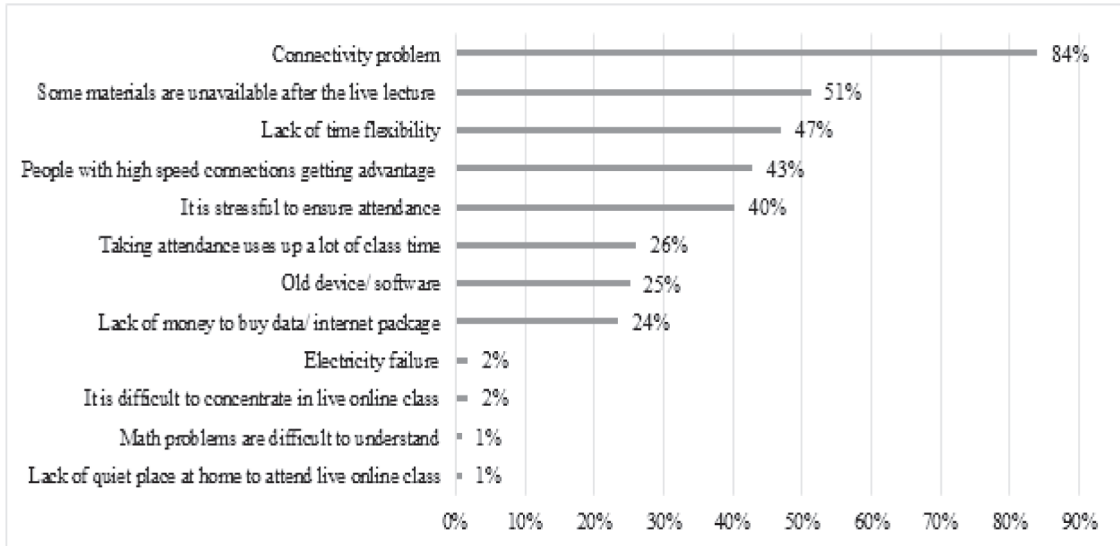


Figure B2: Reasons for not preferring online live/ real time class (N = 119). Respondents could choose more than one option.

### C) Reasons for Internet slowdown during Covid-19 lock-down

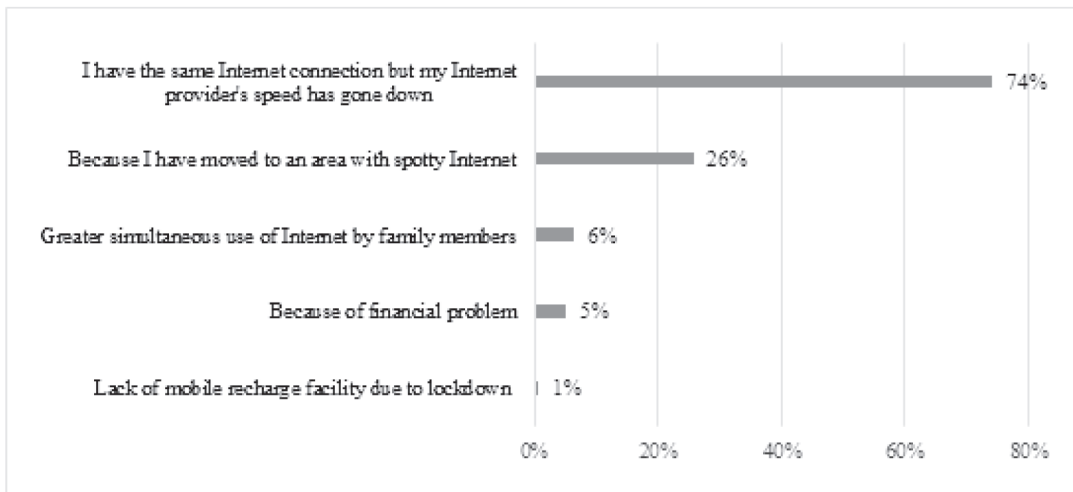


Figure C1: Reasons for Internet speed slowdown (N=155).

Respondents could choose more than one option.

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