

# Are the Effects of COVID-19 on Inequality in Tertiary Education in Ghana Gendered?

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**Abstract:** Educational institutions around the world were hit hard by the COVID-19 pandemic as there were nationwide closures of educational institutions around the world to contain the spread of the virus, resulting in the migration of teaching and learning to online platforms. This study examines the effects of the COVID-19 pandemic on inequality in tertiary education in Ghana, focusing on the gendered effects. Primary data were collected from 371 students from six selected public universities in Ghana mainly online using KoboCollect. Binary logistic regression was employed in the data analysis. The results show that the COVID-19 induced universities' closure and migration of teaching and learning to online platforms accentuated inequalities in learning opportunities by university students in Ghana, just that its effects are not gendered. Location significantly explained the observed inequalities experienced during the period of the universities' closure and online teaching and learning. It is recommended that universities should embrace online systems as part of their teaching and learning practices.

**Keywords:** COVID-19, Inequality, Tertiary Education, Ghana

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## 1. Introduction

The coronavirus disease 2019 (COVID-19) outbreak has been the greatest global pandemic since the beginning of the 21<sup>st</sup> century. The COVID-19 pandemic contracted the demand for goods and services both spontaneously and forcibly by official orders and lockdowns (Kikuchi, Kitao & Mikoshiba, 2020). The education, economic, social, health, and other sectors have all been thwarted by the novel virus. The education systems of both developing and developed countries could not withstand the uncertainties of this virus. All schools, no matter the level, around the world faced closures to limit the spread of the virus. As of May 14, 2020, UNESCO statistics showed that there were 160 country-wide closures of educational institutions around the world. In Ghana, all educational institutions were closed on March 16, 2020. School closure is a non-pharmaceutical measure during pandemics (Doyle, 2020). The closure of the educational institutions disrupted learning, examinations schedules, academic calendars, and other planned educational events.

Essentially, the closure of schools shifted education from the classroom to the home and parents were required to play a great role, at least at the lower education level (Doyle, 2020). At the tertiary level, the universities resorted to online teaching and learning platforms to minimise the disruption to academic work and calendars. Both lecturers and students were expected to use these online platforms for teaching and learning, examinations, and assessments. However, the shift in education platforms was challenging for both lecturers and students, especially in universities/ colleges that introduced online platforms for the first time due to COVID-19 and school closures. These online platforms were untested and both students and lecturers had challenges with access and use. Also, to use the online platforms, students needed devices such as computers, laptops/smartphones, reliable internet connection, large amount of internet data, and physical space at home. Gyampoh et al. (2020) found in Ghana that, tutors were challenged with their inability to confidently use the digital teaching and learning platforms. The online platforms posed serious challenges to the universities and have disproportionately affected students. Hence, it was not surprising that, in all Ghanaian public universities, the Student Representative Councils (SRCs) called for the abrogation of the online platforms for teaching, examinations, and assessments due to unequal access to the platforms as well as the malfunctioning of some of the platforms. Even in advanced nations, concerns were raised about the fairness of online teaching and assessment since students require technology and suitable space for work (Montacute, 2020). Also, some students will be engaged in family responsibilities during the crisis, thus reducing the time available for online studies and assessments (Montacute, 2020).

The shift to online platforms in universities, the associated challenges, and the general hold-up of academic work caused by the COVID-19 pandemic can accentuate inequality in education. There is some level of existing inequality in tertiary education, more especially in the developing world. According to Doyle (2020), widening inequalities and skills in education are a potential outcome of school closures due to COVID-19. Thus, the interruptions in academic work and schedules can worsen inequality in the short- and long-term (Burgess & Sievertsen, 2020). The critical empirical research question is, did COVID-19 promote inequality in tertiary education and are the effects gendered? This study was designed to answer this question by examining the

effect of the COVID-19 pandemic on inequality in tertiary education in Ghana. Related studies have largely concentrated on basic education and, to some extent, secondary education. Ghana provides a good scenario for understanding the effects of the COVID-19 pandemic on tertiary education and tertiary education inequality due to the serious challenges it posed to the universities, lecturers, and students. The study can inform policy and practice post the COVID-19 crisis for governments and universities as well as the work and policies of international education and development organisations on reducing education inequality and enhancing inclusive education. Understanding the distributional impact of COVID-19 on education can enable targeted education and investment.

## 2. Literature Review

Existing inequalities can drive the spread and effects of COVID-19 and COVID-19 can also aggravate existing inequalities. The *UNDP (2020) states that the economic consequences of the COVID-19 pandemic will be far-reaching and will deepen existing inequalities, including gender inequalities. Some studies have examined the effects of COVID-19 on economic and social outcomes and have concluded a worsening effect of COVID-19 on inequality [e.g., widening food insecurity (Van Lancker & Parolin, 2020; Kikuchi, Kitao & Mikoshiba, 2020), inequality in employment and earning for low-educated, low-skilled, and low-income groups (Doyle, 2020; Kikuchi, Kitao & Mikoshiba, 2020; Adams-Prassl et al., 2020), and inequality in employment and earnings for women (Alon et al., 2020; Kikuchi, Kitao & Mikoshiba, 2020; Adams-Prassl et al., 2020)]. Gender inequality may increase during and post COVID-19 as sectors with high female employment share are hit harder and working mothers may be more burdened with childcare with the closure of schools (Alon et al., 2020; Bick & Blandin, 2020). Adams-Prassl et al.'s (2020) study in the United Kingdom, United States, and Germany has shown that the impacts of the COVID-19 crisis are large and unequal within and across countries.*

On the education front, though the literature on the effects of the COVID-19 pandemic on education inequality is limited, the few existing theoretical and empirical studies have concluded that education inequality will increase (e.g., Doyle, 2020; Van Lancker & Parolin, 2020; Burgess & Sievertsen, 2020; Bick & Blandin, 2020). The COVID-19 related school closures and migration of learning to homes and online platforms will likely widen the learning gap between students from high and low socioeconomic backgrounds and hence worsen educational outcome inequality (Van Lancker & Parolin, 2020). Students from low socioeconomic backgrounds are more likely to be adversely affected by the COVID-19 pandemic (Doyle, 2020) and several reasons may account for this: lack of a conducive environment at home that supports learning (Van Lancker & Parolin, 2020; Bol, 2020; Montacute, 2020); lack of access to resources such as computers and internet connectivity for remote learning (Van Lancker & Parolin, 2020; Bol, 2020; Montacute, 2020); inability of poorer households to invest in education due to the COVID-19 induced economic recession (Van Lancker & Parolin, 2020; Bol, 2020); and the inability of uneducated or lowly-educated parents to supervise and support their children's studies at home (Lee & Bowen, 2006; Bol, 2020).

Bania and Banerjee (2020) noted that the socioeconomic aspects of unequal access to the new online learning have their bearing from age, race, education, and most importantly gender. In Brazil, Marinoni and van't Land (2020) identified unequal access to information and communication technology in the Amazon area with a greater percentage of students with limited or no access to online teaching and learning. In Nepal, Tulza (2020) indicated that all attempts at online teaching and learning were crushed due to the inaccessibility on the part of poor students residing in remote parts of the country. Bania and Banerjee's (2020) study in India revealed that only 8.5% of females in rural areas are internet literate, pointing out that the digital divide with its embedded gender divide is widening the inequality gap in India. In Ghana, Demuyakor (2021) revealed that some students were challenged with unstable electricity, unreliable internet service, expensive learning technologies, and high cost of internet access. The geographical location of students renders such students more susceptible to the challenges identified (Demuyakor, 2021). Furthermore, an assessment of COVID-19's effects on Ghanaian households and living standards proved that females and rural communities are disadvantaged (Bukari et al., 2021). Conversely, a few studies have recorded no negative impact of the COVID-19 pandemic on education. For instance, a comparative study in South Africa, Wales, and Hungary by Cranfield et al. (2021) highlighted that most students had better experiences with their online teaching and learning sessions.

## 3. Conceptual Framework

The conceptual framework developed for the study is presented in Figure 1. In the framework, there are several channels through which the COVID-19 pandemic causes education inequality. COVID-19 has led to public policy

changes including social distancing and lockdowns, which have also led to (i) university closures, and (ii) contributing to economic repression. The university closures have denied students the space, on-campus internet access, and use of computer labs for learning. The migration of teaching and learning to online platforms requires resources such as computers, internet, time, and learning space at home. That is, additional investment is required on learning resources and space as well as time. However, the economic repression leading to job losses and reduced incomes directly affects the ability to invest in additional resources for learning at home. Public policy changes are also affecting access to learning resources. In general, students from higher socio-economic backgrounds will have access to the resources, time, and space for learning at home. The COVID-19 will worsen education inequality among university students.

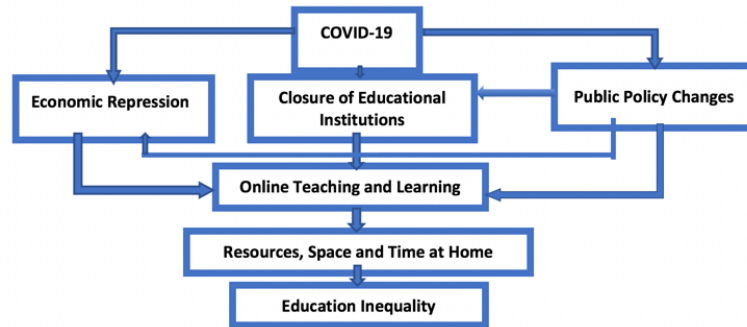


Figure 1: Conceptual framework

Source: Authors’ Construct (2022)

## 4. Materials and Methods

### 4.1 Data

The study adopted a mixed research approach, employing both quantitative and qualitative methods. The study population comprised students from six selected public universities in Ghana, namely, the University of Ghana (UG), Kwame Nkrumah University of Science and Technology (KNUST), University for Development Studies (UDS), University of Cape Coast (UCC), University of Environment and Natural Resources (UENR), and the University of Education, Winneba (UEW). Data collection was mainly online due to the social and physical distancing policy in Ghana, with limited personal interviews conducted by enumerators on the university campuses due the low responses to the online survey. The data collection thus spanned May to September 2022. The questionnaire was designed and transferred to KoboCollect and made available online. The link to the survey was also sent via students’ university emails and WhatsApp platforms. Due to the online survey methodology, sampling was not practicable. As a result, the complete response cases from students stood at 372 after data cleaning. Also, data were collected from 10 university teachers via Key Informant Interviews.

### 4.2 Variables

Education inequality was measured in terms of access to education during the COVID-19 school closures. Access to education was measured in terms of: (i) physical space for learning at home, (ii) internet access for learning at home, (iii) data access, (iv) ease of use of online platforms while at home, and (v) access to computers for learning at home. The independent variables relate to the socio-economic characteristics of students and university characteristics. The socio-economic characteristics of students include age, gender, level of education, household size, employment status, parents’ level of education, urban/rural home location, region of residence, type of home (home quality), and programme of study. Data were collected on teaching and learning innovations and platforms, and challenges to access and use for both students and lecturers. The specific variables used in our models are defined in Table 1.

Table 1: Variables and measurement

Variable	Definition	Measurement
<i>Dependent variables</i>		
Study_space	Access to a convenient place to study at home during the COVID-19-induced universities’ closure	1 if access to a convenient place to study and 0 otherwise
InternetAccess	Student’s access to internet at home	1 if yes and 0 otherwise

Variable	Definition	Measurement
DataAccess	Ease of student's acquisition of internet data for online learning	1 if easily accessible/acquired and 0 otherwise
EasyOnlineP	Easy access to online platform	1 if yes and 0 otherwise
COMP_LAPTOP	Access to a computer or laptop	1 if student has access to a computer or laptop and 0 otherwise
<i>Explanatory variables</i>		
Gender	Gender of the student	1 if female and 0 if male
LnHHSIZE	Natural log of household size	Number
LnAge	Natural log of age of the student	Completed years
Marital_status	Marital status of student	1 if married and 0 otherwise
FatherEdu	Father's education status	1 if formal education and 0 otherwise
MotherEdu	Mother's education status	1 if formal education and 0 otherwise
Workingstudent	If a student is working (private or public)	1 if a student worker and 0 otherwise
ComputerLiterate	Self-reported indicator for computer literacy	1 if student is computer literate and 0 otherwise
PMScience	Major field of study of student	1 if the field of study is physical, biological, engineering, and medical sciences and 0 otherwise
UrbanLoc	Locality lived by student during the COVID-19-induced schools' closure	1 if urban or peri-urban location and 0 otherwise
Universities	University attended by student	Dummies created for six universities with UCC and UEW, from the same region, as the base
Regions	Regions stayed during the COVID-19-induced schools' closure	Dummies created for the 16 regions of Ghana, with NE region serving as the base

### 4.3 Data Analysis

The analytical methods ranged from descriptive statistics such as frequencies, means, t-tests, and Chi-square tests, to regression analysis. For determinants of education inequality, the study employed a generalised model of the form:

$$(1) \quad Y_i = \beta'X_i + \varepsilon$$

where  $Y$  is education inequality, measured in terms of access to physical space, internet, data, online platforms, and computers/laptops for learning at home. Each of these dimensions is modelled and estimated using a binary logit model (Hill, Griffiths & Lim, 2018; Greene, 2018). Also,  $X$  is a vector of independent variables affecting education inequality, including gender,  $\beta$  is a vector of parameters corresponding to  $X$  to be estimated, and  $\varepsilon$  is the error term.

## 5. Results and Discussion

### 5.1 Online Learning Platforms, Effectiveness and Challenges

Various online teaching and learning platforms were used by lecturers and students during the COVID-19-induced schools' closures (Marinoni, van't Land & Jensen, 2020; Toquero, 2020). The Zoom platform was the most used platform during the period, with about 45% of the respondents indicating its use (Table 2). The availability of free Zoom versions and the ease of use of the platform may have accounted for its high use during the period. However, the free versions have shorter time limits for lectures/meetings. Often, the system closes when the time limit is reached with more than two participants. Some universities have acquired Zoom platforms with unlimited time for the delivery of lectures. WhatsApp and Microsoft Teams were also important platforms used during the period. The WhatsApp platform is convenient for sharing documents, video, and audio recordings, as well as giving information and receiving information in real-time via a smart phone. The 'others' category includes the use of YouTube, Google Classroom, Sakai, and Google Meet.

**Table 2: Online Learning Platforms Employed**

Platform	Frequency	Percent Frequency
Moodle	51	10.08
Zoom	228	45.06
Microsoft Teams	62	12.25
WhatsApp	70	13.83
Others	95	18.77
Total	506	100.00

The results on students' assessment of online learning effectiveness are presented in Table 3 by gender and location. In terms of differences in responses, the Chi-square test results show that there is no significant difference between male and female students in their assessment of online teaching and learning effectiveness. However, there is a significant difference between students who stayed in rural and urban locations during the schools' closure in their assessment of online teaching and learning effectiveness. This finding is synchronous with that of Bukari et al. (2021) and Demuyakor (2021), who observed that even though COVID-19 affected virtually everyone, its damaging effects on those living in rural areas will be far greater than those in urban areas. Of course, such inequalities are driven by the absence of or ineffective online platforms in rural areas, among others.

**Table 3: Assessment of Online Learning Effectiveness by Gender and Location**

Category	Gender		Location	
	Male (n=224)	Female (n=146)	Rural (n=85)	Urban (n=285)
Ineffective	44	31	24	51
Fairly effective	66	39	28	77
Effective	75	55	26	104
Very effective	34	18	7	45
Excellent	5	3	0	8
Pearson $\chi^2$	1.3112		9.9571**	

Note: \*\* represents  $p < 0.05$ .

From Table 4, the most common problem experienced by students with the online learning system was unreliable internet access, whether viewed based on gender or location. This reflects the experience in Afghanistan as told by Noori (2021), but it is symptomatic of developing countries' circumstances during the pandemic. Indeed, Henaku (2020) and Owusu-Fordjour, Koomson and Hanson (2020) reported similar results for Ghana. The other challenges students faced in order of importance were family distractions, inaccessibility to lecturers, internet data problems, inaccessibility to laptops/smartphones, psychological stress, and power outages. The challenges faced by both male and female students are similar as shown in Table 4. This is especially so because a test of the difference between the challenges faced by males and females returned no significant result even at the 0.10 level, as revealed by the reported Chi-square statistic. In terms of locality, those living in rural and urban areas face significantly different challenges as shown in the table.

**Table 4: Descriptive Statistics of the Challenges of Students**

Challenges	Gender			Location		
	Male	Female	Test of diff. ( $\chi^2$ )	Rural	Urban	Test of diff. ( $\chi^2$ )
Family distractions	45(20.09)	43(29.25)		23(27.06)	65(22.73)	
Intermittent internet access	71(31.70)	38(25.85)		31(36.47)	78(27.27)	
Access to lecturers	36(16.07)	28(19.05)	8.97	13(15.29)	51(17.83)	24.29***
Psychological	17(7.59)	8(5.44)		6(7.06)	19(6.64)	
Data purchase	15(6.70)	7(4.76)		2(2.35)	20(6.99)	
Laptop/phone	5(2.23)	6(4.08)		7(0.24)	4(1.40)	
Power outage	3(1.34)	3(2.04)		-	6(2.10)	
No challenge	28(12.50)	13(8.84)		3(3.53)	38(13.29)	
Don't Know	4(1.79)	1(0.68)		-	5(1.75)	
Total	224(100)	147(100)		85(100)	286(100)	

Note: \*\*\* represents  $p < 0.01$ ; figures in parentheses are percentages.

Lecturers also faced challenges in delivering their lectures during the migration of teaching and learning to online platforms. The lecturers, as key informants, enumerated challenges they faced as unstable internet connectivity

leading to frequent breakdowns during lectures, expensive internet data, and generally unfriendly nature of the online platforms. Indeed, a lecturer key informant had this to say:

Unfortunately, everyone was caught unawares so no well-planned training took place before lectures were migrated onto the online platforms. Even though some of us were lucky to have received a bit of training before the commencement of the online lectures, some lecturers have indicated they did not undergo any training. Fact is that even those who went through some form of training needed some more time to imbibe the process and procedure well (Lecturer/Key Informant, June 2022).

The sentiments expressed in the above quote reflect those highlighted by Adom (2020) and Gyampo et al. (2020), who noted that among other problems associated with online teaching and learning in Ghana, lecturers were not properly trained and so lacked critical technical knowledge for smooth virtual teaching and learning. Given the challenges the lecturers indicated they faced, they were asked if they appreciated the fact students might also face similar or even more challenging situations. All lecturer key informants indicated they were aware students would face challenges and so they had adopted very flexible regimes to be able to assist the students. They mentioned some of the assistance they offered to students as accepting late submissions of answers to assignments and/or examinations, rescheduling lectures where it is not possible to have a given lecture, arranging to deliver hard copies of materials to students located in hard-to-reach areas, and discussing with students to settle on what works best for them.

## 5.2 Effects of COVID-19 Pandemic on Inequality in Tertiary Education

The majority of the sampled students (ranging from 61.54 to 84.71%) have indicated from their experience that the COVID-19-induced universities' closure and online learning created inequality in access to teaching and learning among students in their classes. In their opinion, such inequalities come in access to study space, online platforms, internet access, data bundle, and access to equipment such as computer/laptop and phone/tablet as reported in Table 5. Except in phone/tablet access, they indicated inequality in accessing all other items meant to facilitate their learning as shown in Table 5. This finding reflects that revealed by Bick and Blandin (2020), Burgess and Sievertsen (2020), Doyle (2020), and Van Lancker and Parolin (2020) to the effect that education inequality will increase with COVID-19. However, while the responses of male and female students did not show any statistically significant differences, locality does on all fronts except in computer/laptop and phone/tablet (Table 5). For example, while 84.7 percent of students located in rural areas during the COVID-19-induced online learning perceived inequality in learning opportunities, those in urban/peri-urban areas with this perception is 61.5 percent. This implies that even though all sampled students perceive inequality because of the migration of learning online, those located in rural areas might suffer this more than those in urban areas. Lecturer key informants held a similar view. They revealed that the COVID-19-induced school closures and the subsequent migration to online learning had brought about serious inequality in learning opportunities. They maintained that such inequalities emanated from unstable internet access, especially for those located in rural areas, and the inability of students to buy data, especially those with 'humble' socio-economic backgrounds. The opinions of the lecturer key informants thus corroborated those of the students.

**Table 5: Descriptive Statistics of Inequalities Faced by Students**

Inequality	Gender			Location		
	Male (n=224)	Female (n=147)	Test of diff. ( $\chi^2$ )	Rural (n=85)	Urban (n=286)	Test of diff. ( $\chi^2$ )
<i>Perception of inequality</i>						
No	80(35.71)	43(29.25)	1.67	13(15.29)	110(38.46)	1.86***
Yes	144(64.29)	104(70.75)		72(84.71)	176(61.54)	
<i>Study space</i>						
Otherwise (No)	126(56.25)	85(57.82)	0.09	57(67.06)	155(54.20)	4.66***
Convenient (Yes)	98(43.75)	62(42.18)		28(32.94)	131(45.80)	
<i>Ease of use of online platforms</i>						
Not easy at all	32(14.29)	21(14.38)	2.02	24(28.24)	29(10.18)	30.60***

Inequality	Gender		Test of diff. ( $\chi^2$ )	Location		Test of diff. ( $\chi^2$ )
	Male (n=224)	Female (n=147)		Rural (n=85)	Urban (n=286)	
Fairly easy	66(29.46)	49(33.56)		35(41.18)	80(28.07)	
Easy	78(34.82)	53(36.30)		15(17.65)	116(40.70)	
Very easy	48(21.43)	23(15.75)		11(12.94)	60(21.05)	
<i>Internet problem</i>						
Otherwise	83(37.05)	60(40.82)		9(10.59)	134(46.85)	
Internet problem	141(62.95)	87(59.18)	0.53	76(89.41)	152(53.15)	36.38***
<i>Internet data</i>						
Otherwise	83(37.05)	50(34.01)		16(18.82)	117(40.91)	
Internet data	141(62.95)	97(65.99)	0.36	69(81.18)	169(59.09)	13.90***
<i>Computer/laptop</i>						
No	105(46.88)	75(51.02)		38(44.71)	142(49.65)	
Yes	119(53.12)	72(48.98)	0.61	47(55.29)	144(50.35)	0.64
<i>Phone/tablet</i>						
No	2(0.89)	2(1.36)		-	4(1.40)	
Yes	222(99.11)	145(98.64)	0.18	85(100.00)	282(98.60)	1.20

Note: \*\* and \*\*\* represent  $p < 0.05$  and  $p < 0.01$ , respectively; figures in parentheses are percentages.

Things were taken further to examine what factors might be contributing to the inequalities students faced in their studies during the COVID-induced schools' closure. We measured inequalities in education during the closure using five items, viz. access to study space, access to internet, access to internet data, ease of access to online platforms, and access to a computer or laptop at home. These are cast in a positive light, as defined in Table 1, so that factors that negatively affect each of these will be considered as contributing to inequality in access to education during the period of schools' closure. For each of these, individual binary logit models were estimated, and the results are shown in Table 6. Two basic models were estimated for each where the control variables include regional fixed effects in the first model and then the same model re-estimated without controlling for regional fixed effects. It should be noted that we controlled for university-specific fixed effects in all the models.

From the results, age has mixed effects on inequality. While increasing age increases access to study space at home thereby reducing inequality to study space, it reduces access to data for online purposes implying that it increases inequality in access to data. It is very likely that while older students might have relatively well-established and spacious homes, their spending might be directed to other things rather than financing data for lectures. Household size is consistent in reducing access in all the models in which it appears. Increasing household membership reduces study space at home and reduces data access. It is also negative in the computer/laptop access model even though it is not significant in this model. The implication of this result on household size is that the variable increases inequality in terms of study space and internet data. Mother's education reduces inequality in educational opportunity at least during the period of schools' closure. For example, relative to not having formal education, a mother's formal education status increases the probability of having study space at home by 21.7 to 24.1 percent depending on whether regional fixed effects have been controlled for or not. The results so far are in consonance with those of Aristovnik et al. (2020), and Bania and Banerjee (2020) who observed that household socioeconomics (including age, race, and household size among others) drive inequality in learning opportunities during the COVID-induced schools' closure.

Being in urban or peri-urban areas during the time of school closures drives increased access to study space, internet access, data access, and ease of use of online platforms. This implies that those in rural areas have reduced access than their urban and peri-urban counterparts. Location thus plays an important role in inequality to learning opportunities in periods of pandemics. This result resonates with that of Bania and Banerjee (2020) who observed that students located in rural India were especially impacted negatively in their studies during the COVID-induced migration of teaching and learning to online platforms. Demuyakor (2021) made a similar observation for Ghana. Indeed, infrastructural development, especially technological infrastructure, in rural Ghana leaves much to be desired thereby leaving those located in such areas without access to the technology

that will allow them to follow the online lectures. Other studies that found similar results are Marinoni and van't Land (2020) in Brazil and Tulza (2020) in Nepal. A student on a job or in work and computer literacy both reduce inequality through increasing access to educational opportunities during the COVID-induced schools' closure. Specifically, being in work increases the probability of access to study space by between 12.0 and 14.4 percent depending on whether regional fixed effects have been controlled for. Computer literacy increases the probability of use of online platforms by over 23.0 percent, and this increases to about 28.0 percent when regional fixed effects are controlled for.

To answer the question regarding gender dimensions in the effects of COVID-19 on educational inequality, we used Chi-square tests, and the results in Table 5 show no differences in the perception of males and females in inequality in learning opportunities during the period of migration of teaching and learning to online platforms in Ghana. This result is confirmed across all the models in Table 6 where the gender variable does not determine access to any of the facilitating conditions of learning opportunities in the period of the schools' closure. Even though this finding runs counter to our expectation and contradicts that of Aristovnik et al. (2020) and Bukari et al. (2021) who observed gender-accentuated differences in the effects of COVID-19 among their respective samples, our sample simply does not show any gender differences in the outcomes.

**Table 6: Binary Logit Models of Determinants of Inequality in Access to Education**

Variable	Study space		Internet access		Data access		Use of online platforms		Computer/Laptop access	
	Model 1 Marginal effect	Model 2 Marginal effect	Model 1 Marginal effect	Model 2 Marginal effect	Model 1 Marginal effect	Model 2 Marginal effect	Model 1 Marginal effect	Model 2 Marginal effect	Model 1 Marginal effect	Model 2 Marginal effect
<b>Constant</b>										
<b>Gender</b>	0.0205 (0.0497)	0.0319 (0.0495)	0.0574 (0.0515)	0.0461 (0.0482)	-0.0169 (0.0476)	-0.0243 (0.0467)	-0.0351 (0.0524)	-0.0311 (0.0520)	0.0209 (0.0471)	0.0214 (0.0475)
<b>LnAge</b>	0.4186** (.2041)	0.4733** (0.2177)	0.1175 (0.2182)	0.1313 (0.2100)	-0.2993* (0.1808)	-0.3310* (0.1921)	0.1297 (0.2203)	0.1210 (0.2238)	0.1021 (0.2142)	0.1157 (0.2091)
<b>Marital_status</b>	-0.1157 (0.0903)	-0.0957 (0.0926)	-0.1332 (0.1001)	-0.1797 (0.0971)	0.1179 (0.0936)	0.0787 (0.0951)	-0.0012 (0.1009)	-0.0414 (0.1020)	-0.2704*** (0.0911)	-0.2462*** (0.0930)
<b>LnHHSIZE</b>	-0.1442** (0.0516)	-0.1344** (0.0505)			-0.1960*** (0.0455)	-0.2161** (0.0487)			-0.0382 (0.0463)	-0.0342 (0.0457)
<b>FatherEdu</b>	0.0338 (0.0737)	0.0440 (0.0775)	0.0820 (0.0752)	0.1050 (0.0713)	0.0894 (0.0686)	0.1195* (0.0704)			-0.0327 (.0770)	-0.0611 (0.0735)
<b>MotherEdu</b>	0.2409*** (0.0692)	0.2170*** (0.0703)	-0.0496 (0.0637)	-0.0714 (0.0613)	-0.0575 (0.0562)	-0.0399 (0.0581)			-0.0460 (0.0724)	-0.0474 (0.0686)
<b>UrbanLoc</b>	0.0531 (0.0565)	0.0987 (0.0533)	0.4283*** (0.0773)	0.4213*** (0.0645)	0.1661*** (0.0643)	0.2172*** (0.0632)	0.2414*** (0.0654)	0.2683*** (0.0565)	-0.0232 (0.0574)	-0.0250 (0.0569)
<b>Workingstudent</b>	0.1439*** (0.0544)	0.1197** (0.0555)	0.0152 (0.0614)	0.0085 (0.0577)	0.0150 (0.0506)	0.0102 (0.0532)	0.0321 (0.0584)	0.0371 (0.0595)	0.0883 (0.0543)	0.0777 (0.0553)
<b>ComputerLiterate</b>							0.2784*** (0.0886)	0.2356*** (0.0914)		
<b>UDS</b>	-0.3375*** (0.1151)	-0.3007*** (0.1038)	0.0737 (0.1295)	0.0481 (0.1146)	0.1270 (0.1319)	0.0261 (0.1288)	0.1052 (0.1262)	0.1185 (0.1134)	-0.1152 (0.1114)	-0.0829 (0.1020)
<b>UG_Legon</b>	-0.1304 (0.1292)	-0.0981 (0.1195)	-0.2160 (0.1427)	-0.2471* (0.1329)	0.0767 (0.1316)	0.1087 (0.1335)	-0.0256 (0.1337)	0.0996 (0.1255)	0.0207 (0.1191)	0.0340 (0.1127)
<b>KNUST</b>	-0.3005*** (0.1097)	-0.3085*** (0.1056)	0.2163* (.1212)	0.2074* (0.1113)	0.3062*** (0.1222)	0.2897 (0.1235)	0.2703*** (0.1168)	0.2663** (0.1145)	-0.4955*** (0.1051)	-0.4927*** (0.0951)
<b>UENR</b>	0.0840 (0.1565)	0.0680 (0.1479)	0.0872 (0.1612)	0.0733 (0.1540)	0.2131 (0.1566)	0.1930 (0.1562)	0.2067 (0.1565)	0.2337 (0.1458)	-0.0246 (0.1303)	-0.0088 (0.1237)
<b>Regional fixed effects</b>	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>Model diagnostics</b>										
<b>Wald <math>\chi^2</math></b>	283.3***	72.4***	68.0***	54.7***	90.9***	53.1***	51.2***	38.5***	87.9***	77.9***
<b>Pseudo R<sup>2</sup></b>	0.246	0.203	0.223	0.177	0.243	0.167	0.141	0.094	0.233	0.209

## 6. Conclusion and Policy Implications

This study was undertaken to examine the effects of the COVID-19 pandemic on inequality in tertiary education in Ghana, focusing on the gendered effects. The study concludes that the COVID-19 pandemic and its induced closure of universities and migration of teaching and learning online have adversely affected lecturers and tertiary students. It worsened inequality in tertiary education, just that its effects are not gendered. In all the estimated binary models for the various dimensions of inequality in access to education, gender was not a significant explanatory variable. Therefore, the effects of COVID-19 on tertiary education inequality during the universities' closure are not gendered. Location rather significantly explained the observed inequalities experienced during the period of the universities' closure and online teaching and learning. The study also concludes that Ghanaian universities, students, and lecturers were not adequately prepared in terms of infrastructure, equipment, training, and other logistics for effective online teaching and learning, and hence several challenges were encountered with the online teaching and learning approach. That notwithstanding, lecturers and students were exposed to online teaching and learning platforms. Both lecturers and students acquired knowledge and developed valuable skills which are essential for future online teaching and learning endeavours. The study further concludes that the COVID-induced universities' closure accentuated inequalities

in learning opportunities for university students in Ghana. The study recommends that universities should embrace online systems as part of their teaching and learning policy. This will require the universities to invest in IT infrastructure, equipment, and online platforms, maintain workable online systems, and enhance the training of students, lecturers, and staff on the use of online learning platforms. It will help the universities to be well prepared in the event of future pandemics that can lead to universities' closure. Investment in infrastructure that will improve internet coverage and strong internet connectivity in rural areas is required. This will enable students who are back home in rural areas to access information and participate in online teaching and learning. The non-gendered effects of the COVID-19 pandemic on tertiary education inequality suggest that efforts aimed at improving learning and hence students' performance should target both males and females.

## Acknowledgement

The authors wish to sincerely thank the Agence Universitaire de la Francophonie/Francophone University Agency (AUF) Africa Region Team based in Senegal and their funding partners for their financial and technical support in a project that has led to the production of this paper.

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