

Minding the Digital Gap: Investigating the Digital Divides Amplified by COVID-19 Among Undergraduate Students in Ghana

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Abstract

The digital divide, a manifestation of technological inequality, continues to place students in developing economies at a socioeconomic and educational disadvantage. This study examined the forms of digital divide experienced by undergraduate students in Ghana during the peak of the COVID-19 pandemic and explored the coping strategies adopted to mitigate these challenges. Anchored in the qualitative research paradigm, this study employed a case study design involving undergraduate students from selected universities in Ghana. Using purposive sampling techniques, 25 students were selected to participate in this study. Data were collected through focus group discussions and thematically analysed to identify recurring patterns and experiences. The findings revealed that the access, financial, and motivational divides were among the dominant forms of digital inequality confronting students during online learning. These challenges affected students' participation in virtual learning activities and deepened existing educational inequities. To cope with these constraints, some students adopted information-seeking behaviours and developed resource-saving strategies, including the selective use of internet data and the sharing of digital resources. This study recommends the formulation and implementation of inclusive digital policies by higher-education institutions and governments to improve equitable access to digital learning resources. It also calls on telecommunications companies and institutional managers to develop affordable and sustainable digital support systems to help bridge the digital divide in higher education, particularly in developing economies such as Ghana.

Keywords: *digital divide, COVID-19, Higher Education Institutions, social inequality, technology acceptance, e-learning in Ghana.*

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1. Introduction

The advent of the Coronavirus Disease of 2019 (COVID-19) has plunged the world into a public health crisis, affecting all sectors of society worldwide (Chaturvedi et al., 2021). COVID-19 has significantly disrupted day-to-day life and business operations, global trade, travel, and educational, political, social, religious, sporting, and entertainment activities (Chaturvedi et al., 2021). According to Abrams and Szeffler (2020), COVID-19 poses a substantial developmental challenge for many countries because it exposed the strengths and weaknesses of their health sectors and, by extension, their educational systems.

The COVID-19 pandemic has had far-reaching implications for educational systems worldwide, disrupting traditional modes of teaching and learning and exposing longstanding structural inequalities within the sector. Following the closure of schools in many countries, educational institutions were compelled to adopt remote and online teaching and learning approaches to ensure the continuity of academic activities (Sing Yun, 2023). This abrupt shift altered pedagogical practices and accelerated the integration of digital technologies into education systems. However, the extent to which institutions and students adapted varied considerably, particularly between developed and developing economies. In many developing countries, the pandemic exposed deficiencies in digital infrastructure, institutional preparedness, internet access, and students' and educators' technological competencies (Sing Yun, 2023). Consequently, educational systems have become increasingly dependent on Information and Communication Technologies (ICTs) as essential tools for teaching, learning, communication, assessment, and academic administration. Therefore, the pandemic reinforced the centrality of ICTs in contemporary education and intensified discussions on digital inclusion, technological inequalities, and the readiness of educational institutions to function effectively in digitally mediated learning environments.

As argued by previous scholars such as Sein and Furuholt (2012) and Stephenson (2020), ICTs are essential to the functioning of economies and societies worldwide, although some citizens have been disadvantaged, especially in developing countries (DCs). This is an essential conversation because ICTs have a profound impact on the development of individuals and countries by boosting education and knowledge acquisition, healthcare delivery, entrepreneurship, and agricultural technologies, among other economic indicators (Heeks 2022; Reddick et al., 2012). Today, ICTs are used more intensively for productive education and social, health, and entertainment-related activities because of pandemic-imposed restrictions. For instance, in the educational sector, ICTs are used for online learning to connect students with their teachers. This has accelerated digitisation, which was expected to take years to materialise but has developed rapidly in a short time because of the pandemic. To buttress this, Stephenson (2020) indicated that between the first and second quarters of 2020, the use of networking solutions increased by 324% and distance education grew by 60%, especially in Latin America.

Li and Lalani (2020) argue that the pandemic has caused over 1.2 billion children to drop out of school worldwide. For university and college students, the pandemic led to approximately 1.723 billion learners, representing about 80% of students across the globe, being out of school due to the closure of educational institutions (Crawford et al., 2020; UNESCO, 2020; UNICEF, 2021). According to Dhawan (2020), this led to intensified online activity and the use of ICTs in all aspects of life worldwide. However, Dhawan (2020) is concerned about the quality of education provided by online teaching methods, as most educational institutions focus more on the mass adoption of platforms. Again, the widespread use of these ICTs has exposed socioeconomically vulnerable individuals to digital inequality (Aissaoui, 2022; Beaunoyer et al., 2020).

Moreover, scholars such as Thongsri et al. (2018) and Osabwa (2022) argued that many Higher Education Institutions (HEIs) in the DC context made minimal efforts to integrate ICTs into their pedagogical practices before the pandemic, exposing the unpreparedness of managers, teachers, and students alike. This would not only trigger knee-jerk reactions but also widen the digital divide. This stands in direct contravention of what is observed in some advanced jurisdictions, such as Japan, where students encountered minimal difficulties using ICTs for learning because the phenomenon was not entirely alien to them (Hirata, 2021).

As argued by Chetty et al. (2018), ICTs are crucial to the socioeconomic development of people worldwide. Despite their importance, there remain very visible challenges stemming from the impact of COVID-19 and from how people are using ICTs for education in places like Australia (Seymour et al., 2020), Kenya (Osabwa, 2022) and many other places (Borda et al., 2022), with no clear end in sight. The case is even worse for DCs, which view ICTs as ostentatious given the poor economic strides emerging post-lockdown. As corroborated by UNICEF (2021), there are currently minimal efforts by countries to understand and measure the learning deficits that students incurred because of COVID-19.

Although several studies have examined the digital divide (Adhikari et al., 2016; Ayanso et al., 2010; Francis & Weller, 2021; Radovanović et al., 2015; van Deursen & van Dijk, 2019), few have focused on how HEIs responded to the influx of ICTs brought about by COVID-19 and the various forms of digital divide that emerged as a result. Again, many of the studies were conducted in the Western context, leaving the DC context highly marginalised within the literature. Moreover, some of the few studies that examined the digital divide in education focused on learners at lower levels, such as primary and secondary schools (Adhikari et al., 2016), even though learners in HEIs are more likely to use ICTs. Furthermore, some of the few studies that focused on DC contexts explored only the perspectives of HEI managers and teachers, leaving out those of key stakeholders such as students.

Given the apparent gaps in the literature, this study was undertaken to answer the following research questions:

1. What forms of the digital divide did undergraduate students in Ghana experience during the peak of COVID-19?
2. Which strategies did the undergraduate students in Ghana deploy to mitigate the digital divides they faced?

Currently, Ghana's HEIs have no known rigorous digital policy implementations. This is partly due to a lack of practical, research-driven recommendations. Therefore, this study is timely, as it contributes to the literature on remote learning in HEIs and addresses a crucial socioeconomic inequality issue, such as the digital divide. It also offers practical recommendations for HEI managers, governments, and telecommunications companies to help shape human-centred policies that will drive ICT use, especially in education.

2. Literature Review and Theoretical Framework

2.1 Review of Related Studies

The concept of the digital divide has attracted significant scholarly attention over the years, particularly in discussions of technological access, social inequality, and educational development. Earlier conceptualisations of the digital divide primarily focused on disparities in access to technological devices and Internet connectivity among individuals, regions, and countries. However, contemporary scholarship has broadened the discussion to include differences in digital skills, motivation, patterns of use, and the benefits individuals derive from ICTs (van Deursen & van Dijk, 2019). The COVID-19 pandemic further intensified scholarly interest in the digital divide, as educational systems worldwide became heavily dependent on digital technologies to maintain continuity in teaching and learning.

Several empirical studies have shown that the pandemic exacerbated existing technological inequality, particularly in developing economies. In the United States, Beaunoyer et al. (2020) found that the pandemic exposed multiple layers of digital inequality, including disparities in Internet access, digital literacy, and the ability to use online platforms effectively. Their study revealed that socioeconomically disadvantaged groups were more vulnerable to exclusion during the transition to online learning and remote work. Similarly, Aissaoui (2022), in a conceptual review of digital inequality during COVID-19, argued that the crisis transformed digital exclusion from a technological issue into a broader social justice concern, particularly in education.

In higher education, the rapid shift from face-to-face to online learning has posed significant challenges for both students and institutions. Crawford et al. (2020), in a comparative study of 20 countries, observed that many universities adopted emergency remote teaching without adequate preparation. The study found that, while institutions in advanced economies were better able to adapt to online teaching due to existing digital infrastructure, those in developing contexts struggled with infrastructural deficits, poor internet access, and limited digital competencies among lecturers and

students. These findings suggest that institutional readiness played a critical role in shaping students' online learning experiences during the pandemic.

In the African context, studies on the digital divide during COVID-19 have revealed more severe challenges related to infrastructure, affordability, and technological preparedness. Malenya and Ohba (2023) examined the Kenyan higher education context and found that many students experienced unstable internet connectivity, a lack of digital devices, and high internet costs during online learning. The study further reported that students from rural areas and low-income households were disproportionately affected, thereby deepening educational inequalities. Similarly, Maphosa and Maphosa (2023) argued that the shift to online learning in many African higher-education institutions exposed institutional weaknesses in digital policy implementation and technological preparedness. Their findings showed that although universities attempted to deploy digital learning systems, many students lacked the necessary resources and digital competencies to participate effectively.

Studies conducted in Asia have also shown varied experiences of the digital divide during the pandemic. For instance, Kita et al. (2022) found that university students in Japan experienced relatively little disruption during the transition to online learning because ICT integration had already been embedded in the educational system before the pandemic. This contrasts sharply with many developing countries, where the pandemic forced educational institutions to make sudden, unplanned digital transitions. Therefore, the Japanese experience illustrates the importance of prior investment in digital infrastructure and technological preparedness in mitigating educational disruptions during crises.

The literature further suggests that the digital divide is multidimensional, rather than merely a problem of physical access to technology. Van Deursen and van Dijk (2019) identified four critical dimensions of digital inequality: motivational, material, skills, and usage access. Motivational access refers to individuals' willingness or interest in using digital technologies; material access concerns device ownership and internet connectivity; skills access relates to digital competencies; and usage access concerns how effectively people use technologies to derive benefits. During the COVID-19 pandemic, these dimensions became more pronounced within educational systems, especially in developing economies, where socioeconomic inequalities already existed.

Financial constraints have emerged as a dominant factor in the digital divide in developing countries. In a study of remote learning during COVID-19, Maphosa and Maphosa (2023) found that many students struggled to afford internet data, digital devices, and reliable electricity for online learning. These financial barriers significantly affect participation in online classes and widen inequalities between students from affluent and disadvantaged backgrounds. Seymour et al. (2020) reported similar findings in Australia, where economically vulnerable students struggled to fully participate in remote learning despite the country's relatively advanced digital infrastructure. This suggests that the digital divide is not confined to developing economies but manifests differently, depending on socioeconomic conditions.

Another significant issue in the literature concerns the relationship between digital literacy and online learning effectiveness. Adhikari et al. (2016), studying digital learning among younger learners, found that students with limited digital competencies struggled to navigate online learning platforms effectively. Although their study focused on lower-level learners, the findings remain relevant to higher education because digital literacy influences students' ability to engage meaningfully with online educational systems. During the pandemic, many university students were compelled to adapt quickly to unfamiliar digital platforms, often without adequate institutional support or training.

Scholars have also examined the coping strategies students adopted in response to digital inequalities during the pandemic. Thongsri et al. (2018) found that students developed several adaptive strategies, including sharing devices, rationing internet data, relying on peer support, and selectively participating in online activities to reduce costs. These strategies highlight students' agency in navigating digital constraints, even though they may not always guarantee effective learning outcomes. Similarly, some students reportedly adopted resource-saving behaviours, such as downloading learning materials during off-peak internet periods and limiting non-essential internet use.

In Ghana, empirical studies specifically examining the digital divide experiences of university students during COVID-19 remain relatively limited. However, the available evidence suggests that many Ghanaian students faced significant barriers during the transition to online learning. A 2021 report by the United Nations Children's Fund (UNICEF) indicates that the pandemic affected pupils in basic and secondary schools in Ghana, leading to school closures. According to the report, the pandemic affected over 9 million learners across pre-primary and secondary education levels. The report showed that monitoring and evaluation data gathered under the Research for Effective COVID-19 Responses (RECOVER) in May 2020 found that 60% of children in Ghana made time for education-related activities after schools closed, averaging 5.9 hours per week on their studies. This was due to a lack of supervision by parents and guardians. The report also indicated that 60% of school-going children in households preferred learning from their textbooks rather than other educational materials, including Internet content and Ghana Learning Television. According to UNICEF (2021), among children attending primary and high school in Ghana, 39.4% of their households lacked access to essential tools such as computers or mobile phones, 32% lacked learning materials, including textbooks, and 28% of households reported that children's lack of interest in taking lessons was a leading learning difficulty. For students in Senior High Schools (SHS), almost half of their households (45.3%) lacked access to essential tools like computers and phones. This was also the main difficulty for the students. Of the respondents, 27.6% lacked learning materials, including textbooks, while 25.6% lacked internet access to learning materials.

In the educational sector, the pandemic has highlighted the need for multi-directional learning and transformation worldwide to enable all countries to achieve sustainability and equity (Abrams & Szeffler, 2020). The pandemic has adversely affected pre-university and university education in Ghana.

Most teachers, pupils, and students in Ghana's educational institutions lack access to the internet or ICTs. Many who do have access do not know how to use them effectively. In Ghana, some areas lack easy access to ICTs due to low income and poor network connectivity. This aligns with broader arguments by scholars such as Sein and Furuholt (2012), who contend that developing countries often struggle to fully maximise the developmental potential of ICTs because of infrastructural, economic, and policy-related challenges.

Although existing empirical studies have made important contributions to understanding digital inequality during COVID-19, significant gaps remain. First, many studies have concentrated on developed countries, leaving developing economies underrepresented. Second, some studies focus primarily on institutional responses and the perspectives of administrators or lecturers, while paying limited attention to students' lived experiences. Third, several studies have examined digital divide issues generally, without specifically exploring the coping strategies students adopted to navigate digital exclusion during the pandemic.

Therefore, this study contributes to the literature by focusing specifically on undergraduate students in Ghana and examining both the forms of the digital divide experienced and the coping strategies employed during the peak of COVID-19. By foregrounding students' perspectives in a developing-country context, this study provides contextually grounded insights into the complex relationship among technological inequality, higher education, and crisis-induced digital transformation.

2.2 Theoretical Framework

This study is underpinned by the Resources and Appropriation Theory of the Diffusion, Acceptance and Adoption of New Technologies, developed by van Dijk (2012). The theory explains how inequalities in access to and use of ICTs contribute to the digital divide within society. According to van Dijk (2012), access to technology occurs in successive stages: motivational, physical and material, digital skills, and usage access. The theory posits that individuals must first be motivated to use technology before they can acquire physical access to it. Beyond physical access, individuals require material resources, such as Internet subscriptions, software, and devices, to utilise technology continuously. However, physical and material access alone does not guarantee effective appropriation of ICTs unless users develop the requisite digital skills, including operational, communication, informational, and strategic skills. The final stage of appropriation is meaningful usage, where individuals use technology frequently and effectively to meet their personal, educational, and social needs.

The theory further argues that access to ICTs is shaped by broader social inequalities and the unequal distribution of resources. Van Dijk (2012) explains that personal and positional categorical inequalities, such as age, gender, education, income, employment status, and national development levels, significantly influence individuals' access to digital technologies and their ability to benefit

from them. Consequently, unequal access to ICTs leads to unequal participation in society, reinforcing existing socioeconomic inequalities. Therefore, the theory conceptualises the digital divide not merely as a technological problem but as a multidimensional social inequality issue influenced by structural, economic, and demographic factors.

The theory is relevant to this study because it explains the various forms of the digital divide Ghanaian undergraduate students experienced during the COVID-19 pandemic. As higher education institutions transitioned to online learning, students' ability to participate effectively in digital learning environments depended largely on their motivation, access to devices and internet connectivity, digital competencies, and ICT usage patterns. Therefore, the theory provides a useful framework for understanding how socioeconomic and technological inequalities affected students' online learning experiences during the pandemic, as well as the coping strategies they adopted to mitigate these challenges.

3. Methodology

This study explored the meanings undergraduate students in Ghana ascribed to the digital difficulties they experienced during the peak of the COVID-19 pandemic (Creswell & Creswell, 2018); accordingly, it adopted a qualitative approach. Specifically, the study adopted a case study design. This design enables researchers to explore a contemporary phenomenon in its real-life context, particularly when the boundaries between the phenomenon and context are unclear (Yin, 2018). This design was appropriate because it allowed a detailed examination of participants' lived experiences, perceptions, and coping strategies regarding the digital divide in the context of the COVID-19 pandemic in Ghanaian higher-education institutions.

Data were collected through focus group discussions (FGDs) with undergraduate students from selected public universities in Accra, namely the University of Ghana (UG), University of Professional Studies, Accra (UPSA), Ghana Communication Technology University (GCTU), and the University of Media, Arts and Communication (UniMAC). Three FGDs were held, each with seven to nine participants, for a total of 25 participants. The groups were formed to ensure gender diversity while maintaining the depth of discussion. Each FGD followed a semi-structured guide covering access to digital devices, Internet affordability, learning experiences during online education, and coping strategies adopted during the pandemic. Discussions were moderated to encourage interaction among participants, allowing them to respond to the facilitator and to each other's contributions, thereby generating rich data.

Data collection continued iteratively until saturation was reached. Saturation was reached in the third focus group, when no new themes, patterns, or conceptual insights emerged from participants' responses. At this point, the repetition of ideas across participants indicated that sufficient depth and breadth of information had been obtained to adequately address the research questions.



All focus group discussions were audio-recorded with participants' consent, transcribed verbatim, and analysed using thematic analysis guided by a three-stage coding process. In the first stage (open coding), transcripts were read repeatedly, and initial codes were generated to capture meaningful segments of data on students' experiences of the digital divide. In the second stage (axial coding), related codes were grouped into broader categories by identifying relationships and patterns, such as access-related barriers, financial constraints, and motivational challenges. In the third stage (selective coding), core themes were developed by integrating and refining categories into coherent analytical constructs that directly addressed the research question. This systematic approach ensured a rigorous and transparent analysis of qualitative data.

Ethical considerations were observed throughout the study, beyond anonymisation. Informed consent was obtained from all participants before data collection, and they were assured of their voluntary participation and their right to withdraw at any stage without penalty. We maintained confidentiality by assigning pseudonyms to participants, and we securely stored all audio recordings and transcripts and used them solely for academic purposes. Ethical clearance was obtained from our university's Ethics Review Committee before data collection, ensuring compliance with established ethical standards for research involving human participants.

4. Results

4.1 Demographics

The demographic characteristics of the participants included sex, age, educational level, and employment status. Of the 25 participants in the focus group discussions, 15 identified as female and 10 as male. Most participants were between 17 and 22 years of age, with only two aged 26. All participants were undergraduate students from selected public universities in Accra, with 13 pursuing degree programmes and 12 pursuing diploma programmes. Regarding employment status, 23 participants were unemployed and reported relying primarily on their parents or guardians for financial support, whereas only two were employed.

The demographic composition suggests that the participants generally reflect the dominant profile of undergraduate students at Ghanaian public universities. Similarly, the high unemployment rate among participants may be linked to both their age and educational level, as many undergraduate students in Ghana have not yet acquired the qualifications and experience required for entry-level employment.

4.2 What forms of digital divide did undergraduate students suffer in Ghana during the peak of COVID-19?



This research question explored the forms of the digital divide experienced by undergraduate students during the peak of the COVID-19 pandemic in Ghana. The forms of the digital divide discussed here are rooted in the scholarly works of van Dijk (2013) and other scholars, such as Taylor and Taylor (2021). van Dijk (2013) argues that the digital divide evolves through access divides, usage divides, and inequalities of outcomes, while Taylor and Taylor (2021) identify access divide, use divide, and quality-of-use divide as major dimensions of the phenomenon. The findings of the present study both confirmed existing forms of the digital divide identified in the literature and revealed additional context-specific dimensions emerging from participants' experiences during the pandemic.

Following the thematic analysis of the focus group discussions, five major themes emerged: access, finance, usage, connectivity, and motivation divides. Across the three focus groups, participants acknowledged experiencing at least one of these divides during their transition to online learning.

4.2.1 Access divide

Scholars such as Attewell (2001) and van Dijk (2017) argue that a complete lack of access to ICTs deepens digital inequality, particularly among economically disadvantaged groups. In the focus group discussions, participants described situations in which some students lacked smartphones, laptops, or computers needed for online learning. The discussions revealed that poverty and economic hardship within families were the main causes of this divide.

Participants in the first focus group explained that some students were entirely excluded from online lectures and examinations because they had only basic mobile phones or no digital devices at all. The group members recounted colleagues who had relocated to rural communities during the lockdown and therefore had no access to peers or institutional support systems to help them participate in online learning activities. One participant, assigned the pseudonym Amina, remarked the following:

I could not take part in the online lectures and exams because I did not have a smartphone or laptop. I use a 'yam phone', and at the time of the online lectures and exams, I was in Walewale. I did not have any of my classmates close to me to help me out. I pray that the university pardons those of us who could not write the online exams, especially to be able to do so physically on campus.

The collective discussions across the groups indicated that the access divide was not simply an issue of technology ownership but also reflected broader socioeconomic inequalities affecting the students and their families. These findings corroborate the observations of Pick et al. (2021), who observed significant spatial inequalities in ICT adoption and use across Latin America and the Caribbean, with countries differing in socioeconomic development, infrastructure, urbanisation, and societal openness.

4.2.2 Financial divide

Matthews (2019) describes the financial divide as a major dimension of digital inequality, as financial capacity determines individuals' ability to access and sustain ICT use. This divide was strongly evident in all three focus group discussions. Participants consistently explained that the transition to online learning significantly increased their expenditure on Internet data, device maintenance, and technological resources.

The discussions revealed that even students with laptops or smartphones struggled financially to maintain online participation because of the high cost of internet data. Participants explained that online learning consumed far more data than they had previously budgeted for. In addition, some students used faulty devices because they lacked the financial resources to buy new ones or repair existing ones.

One participant, assigned the pseudonym *Kwesi*, explained:

I had to buy more data with the money I barely had. Initially, 20 cedis worth of Vodafone data was enough for my personal use for a week. But when online learning started, I started buying 40 cedis worth of the same Vodafone data for the same week. I also wanted to buy a MacBook for the online lectures because my HP laptop was giving me problems, but I didn't have money, and this prevented me. I had to use my faulty HP laptop, which prevented me from joining some lectures, and I also submitted some of my exam scripts late.

Similarly, participants in another focus group reported that malfunctioning phones and laptops disrupted their participation in online lectures and assessments. Across the discussions, the prevailing sentiment was that online learning increased students' financial burdens, particularly for those from low-income households.

4.2.3 Usage divide

According to Wagner (2000), educational and literacy levels significantly influence individuals' ability to use digital technologies effectively. The study's findings revealed that many participants had difficulty navigating digital platforms and university learning management systems, despite having physical access to devices.

Across the focus groups, participants admitted they lacked the digital competencies required for online learning. Many indicated they were unfamiliar with laptops, typing, and learning management systems

before the pandemic. Consequently, they struggled to attend lectures, upload assignments, and submit examination scripts by the stipulated deadlines.

Participants in the second and third focus groups almost unanimously reported that they often became confused when navigating the university portals, leading to delays in joining lectures and completing academic activities. One participant, assigned the pseudonym Esi, noted:

...as for me, I have a laptop, but I just started learning how to use it when lectures had to migrate online, so I struggled to join lectures and even submit exam scripts on time...

Another participant, *Mawuli*, similarly stated:

...the portal was just too difficult for me to use. Whenever I log in, I get confused, so by the time I join a lecture after all the struggles, I arrive at the end of the lecture. As for the exams, I submitted virtually all my scripts after the deadline.

The focus group interactions revealed that digital illiteracy significantly undermined students' confidence and participation in online learning during the pandemic.

4.2.4 Connectivity divide

Xia (2010) and Paradiso (2010) argue that inadequate network infrastructure and unreliable Internet connectivity continue to disadvantage individuals in developing countries. The connectivity divide was strongly evident across all focus groups, particularly among participants living in areas with unstable mobile network coverage.

Participants collectively described persistent internet disruptions, unstable connectivity, and unreliable network services during online lectures and examinations. Several participants explained that they were compelled to temporarily relocate to other communities with more stable internet connectivity.

One participant, assigned the pseudonym *Akosua*, explained:

I had a big challenge with my network. It was always messing up. I live in Teshie, and the Vodafone network messes up a lot. I switched over to MTN, but it was still unstable. I eventually relocated to Osu to stay with my friends to complete my online lectures and exams.

The MTN network was a bit stable in Osu. Even with that, it still was not the best. I submitted some of my exam scripts late due to poor network.

The focus group discussions indicated that connectivity challenges were widespread and significantly disrupted students' academic participation during the pandemic.

4.2.5 Motivation divide

Chuang (2014) and Wang and Liu (2021) argue that motivation is critical to individuals' willingness to utilise ICTs effectively. The findings revealed that some participants became psychologically exhausted and demotivated during online learning. Across the focus groups, participants explained that constant data expenditure, pandemic-related fear, noisy home environments, and technological frustration reduced their motivation to participate in online lectures and examinations. Others indicated that their inability to navigate digital technologies effectively further diminished their interest in participating in online learning.

One participant, assigned the pseudonym *Linda*, remarked:

At a point, I was seriously demotivated and overwhelmed because of the rise in COVID-19 cases and the fact that people keep talking in the background whenever I join the class online. I was also demotivated because I became fatigued with buying data all the time. My father, for instance, said he did not understand why we paid school fees but were still holding online lectures, which would cost us extra money for data.

Another participant, *Kojo*, similarly stated:

As for me, I had money to buy data, but I just had difficulty using my laptop and instead of learning how to use it, I just imagine the stress and give up. I am a phone person, not a laptop person. I even hate to type, and also I did not know how to use the LMS well, so I was not motivated at all to join the online lectures.

These discussions demonstrate that the digital divide extends beyond access and financial barriers to encompass emotional and motivational dimensions that affect students' participation in online learning.

4.3 Which strategies did undergraduate students in Ghana deploy to mitigate the digital divides faced?

Participants were also asked to discuss the strategies they used to mitigate the digital divide they encountered during the COVID-19 pandemic. Following thematic analysis, four major coping strategies emerged: information-seeking behaviours, a savings culture, relocation and self-motivation.

4.3.1 Information-seeking behaviours

Participants across the focus groups explained that they relied heavily on peers, senior students, Internet café attendants, and university IT staff to acquire the digital skills needed for online learning. Students who lacked proficiency with laptops or learning management systems frequently sought assistance from more technologically experienced colleagues.

One participant, *Selorm*, explained:

...as for me, during the online exams, I spent most of my time at an internet café close to my house. This is because I didn't know how to use the portal, and I always sought help and information on my way around these technologies. I also don't know how to type well.

The discussions suggest that collaborative learning and peer support emerged as important mechanisms for coping with digital challenges during the pandemic.

4.3.2 Savings culture

Participants also discussed adopting financial discipline and savings strategies to sustain their online learning during the pandemic. Many explained that they cut back on clothing, entertainment, and social outings to prioritise spending on Internet data and device-related expenses.

One participant, *Priscilla*, noted:

As for the online lectures, it helped me to save a lot, and I also started spending my money on more important things like data. I had to put a hold on buying new dresses and shoes just to save, to ensure that I always had data.

4.3.3 Relocation

Some participants explained that they temporarily relocated to areas with better internet connectivity to participate effectively in online lectures and examinations. This strategy was particularly common among participants living in communities with unstable network coverage.

One participant, *Nana Yaw*, stated:

I live in Kasoa, and the network at my side is just terrible. I am always on edge, so I had to go to Osu to perch with one of my friends in her hostel just so that I could enjoy a stable network.

4.3.4 Self-motivation

Participants who experienced emotional fatigue and technological frustration explained that they consciously motivated themselves to remain engaged in online learning despite the difficulties they encountered.

One participant, *Jeffrey*, explained:

In my case, because I struggled to use my laptop and the LMS, I lost interest. There was no motivation at all to continue to use my laptop and the LMS. But you see, I had no choice, so I had to force the interest and also motivate myself to actively partake in all online activities.

The findings suggest that self-motivation emerged as an important psychological coping mechanism for students seeking to overcome the digital difficulties exacerbated by the COVID-19 pandemic.

5. Discussions

The findings of this study reinforce the argument that the digital divide is a multidimensional phenomenon that extends beyond access to digital technologies. Although the COVID-19 pandemic heightened the visibility of the divide within higher education institutions (HEIs), the findings suggest that these inequalities predated the pandemic and were only amplified by the abrupt transition to online teaching and learning. This confirms the arguments of Osabwa (2022) and Martens et al. (2020), who contend that many HEIs in developing countries were inadequately prepared for large-scale digital migration during the pandemic. The findings further demonstrate that undergraduate students in

Ghana experienced not only access-related challenges but also financial, usage, connectivity, and motivational divides, thereby confirming van Dijk's (2012, 2017) assertion that digital inequality occurs in successive and interconnected stages of access, skills, and usage.

The findings on the access divide support earlier studies by Attewell (2001) and van Dijk (2017), which argue that unequal access to ICTs is deeply embedded in broader socio-economic inequalities. Some participants were completely excluded from online learning because they lacked smartphones, laptops, and other digital devices required to participate in lectures and examinations. These findings reveal that, despite the increasing normalisation of digital technologies in education, ownership of digital devices remains a significant challenge for many students in developing countries. They also align with Pick et al. (2021), whose study in Latin America and the Caribbean demonstrated that poverty and unequal access to technology continue to widen educational inequalities. In the context of this study, the inability of some students to access online learning environments meant that they were not only academically disadvantaged but also socially excluded from institutional learning processes during the pandemic.

Similarly, the findings on the financial divide underscore the central role of economic inequality in shaping students' digital experience. Participants consistently highlighted the rising costs of internet data subscriptions, device maintenance, and the acquisition of digital resources required for online learning. This corroborates Steele's (2019) assertion that low-income earners are significantly less likely to maintain access to ICTs than higher-income groups. The findings further suggest that online learning during the pandemic shifted substantial financial burdens onto students and their families, especially in contexts where institutional digital support systems were weak or non-existent. This finding is particularly important because it demonstrates that access to digital technologies alone does not guarantee meaningful participation in online education if students lack the financial capacity to sustain their use.

The study also revealed the prevalence of a divide in digital device use among undergraduates. Consistent with Wagner's (2000) argument, the findings indicate that owning digital devices does not necessarily translate into digital competence. Many participants struggled to navigate learning management systems, type, upload assignments, and participate effectively in online learning activities. These findings support van Dijk's (2012) proposition that digital skills are a critical stage in the appropriation of technology. They also suggest that digital literacy gaps persist even among university students, who are often assumed to be technologically proficient. In this regard, the findings challenge the simplistic assumption that younger generations are naturally digitally competent simply because they are exposed to technology.

Another important finding of this study is the connectivity divide. Participants reported persistent instability of the internet, poor network quality, and geographic disparities in connectivity, all of which negatively affected their participation in online learning. These findings support Xia (2010) and Paradiso's (2010) arguments that deficiencies in network infrastructure continue to disadvantage users

in developing countries. They further reveal how geographical location shapes educational opportunities in digitally mediated environments. Students in communities with weak internet infrastructure were compelled to temporarily relocate to areas with relatively stable connectivity to attend lectures and sit examinations. This finding demonstrates that the digital divide is spatial and heavily influenced by infrastructure inequalities.

The findings also revealed a motivational divide among some participants. While previous studies have often focused predominantly on physical and financial access, this study demonstrates that emotional fatigue, frustration, anxiety, and technological stress also influence students' willingness to participate in online learning. This aligns with Wang and Liu's (2021) argument that motivation is an important determinant of digital technology use. Participants who faced repeated technological frustrations or became overwhelmed by the pandemic environment gradually lost interest in online learning, despite having access to digital technologies. This finding is particularly significant because it extends the discussion of digital inequality beyond structural constraints to include the psychological and emotional dimensions of technology adoption and use.

The study also found that students used several coping strategies to mitigate the digital divide they encountered. These included information-seeking behaviours, a savings culture, relocation, and self-motivation. The findings suggest that students exercised agency and adaptability despite structural challenges. For instance, participants sought support from peers, Internet café attendants, university IT staff, and senior students to improve their digital skills and navigate online learning platforms. This finding aligns with van Deursen and van Dijk's (2011) argument that digital skills are acquired through continuous learning and social support. Similarly, participants adopted financial strategies, such as reducing spending on non-essential items, to prioritise Internet data purchases and other learning-related expenses. Others relocated to communities with relatively stable network connectivity to sustain their participation in online learning.

While these coping mechanisms demonstrate student resilience, the findings suggest that such individual strategies are often temporary and insufficient to address the broader structural dimensions of digital inequality in education. This supports Wang's (2021) argument that bridging the digital divide requires institutional and policy interventions rather than relying solely on individual adaptation. The findings therefore reinforce the proposition of the Resources and Appropriation Theory that the unequal distribution of resources ultimately produces unequal participation within society. In this study, unequal access to digital resources directly translated into unequal educational participation and opportunities for undergraduate students during the COVID-19 pandemic.

5.1 Practical Implications

This study has significant practical implications for higher-education institutions, governments, policymakers, and telecommunications service providers. The findings suggest that HEIs in

developing countries must move beyond emergency digital learning responses and invest in sustainable digital education systems. Universities should provide ongoing digital literacy training for students and lecturers, strengthen institutional learning management systems, and establish responsive technical support structures to assist students with online learning. Institutions may also consider implementing laptop support schemes and developing partnerships with telecommunications companies to provide subsidised Internet data packages for students.

The findings further indicate the need for governments to prioritise digital inclusion policies within their national education and development agendas. Improving internet infrastructure, particularly in underserved and rural communities, is essential to reduce geographical and socioeconomic inequalities in digital participation. Policymakers must also recognise that digital inequality is not solely a technological issue but also an economic and social problem that requires coordinated interventions across sectors. Telecommunications providers also play a role in improving network quality, the affordability of internet services, and equitable digital access for students and vulnerable populations.

5.2 Theoretical Implications

This study makes a significant contribution to the digital divide and ICT4D (Information and Communication Technology for Development) literature by reinforcing and extending the explanatory relevance of van Dijk's (2012) Resources and Appropriation Theory of the Diffusion, Acceptance, and Adoption of New Technologies in the context of higher education during the COVID-19 pandemic. The findings validate the theory's central proposition that access to ICTs is multidimensional and unfolds in successive yet interconnected stages, encompassing motivational, physical and material, digital skills, and usage access. The various forms of digital divide identified in this study, namely the access, financial, usage, connectivity, and motivational divides, demonstrate that students' participation in online learning was not determined solely by the possession of digital devices, but also by their financial capabilities, digital competencies, Internet accessibility, and willingness to engage with digital technologies. Therefore, the findings support van Dijk's (2012) argument that meaningful appropriation of technology occurs only when individuals have the motivation, material resources, skills, and opportunities required for effective ICT use.

This study further extends the theory by showing how broader socioeconomic and structural inequalities shape students' digital learning experiences in developing countries. The findings reveal that inequalities in income, geography, educational preparedness, and infrastructure significantly affected students' ability to participate effectively in online learning during the pandemic. This supports van Dijk's (2012) assertion that unequal resource distribution in society ultimately produces unequal participation in digital environments. The study also demonstrates that the digital divide is dynamic and context-dependent, as students adopted different coping strategies, such as relocation, information-seeking behaviours, a savings culture, and self-motivation, to mitigate the challenges they encountered. Consequently, this study advances theoretical conversations on digital inequality by

illustrating how students exercise agency and resilience within structurally constrained technological environments.

5.3 Limitations and Recommendations for Future Research

Like all scientific enquiries, this study has limitations. First, it focused solely on undergraduate students at selected public universities in Accra. Future studies should include private universities to examine whether profit-oriented institutional structures yield different digital learning experiences and inequalities. Comparative studies across public and private HEIs may therefore offer broader insights into this phenomenon.

Second, this study focused solely on students' perspectives. Future research should adopt a multi-stakeholder approach by examining the experiences of lecturers, university administrators, IT personnel, policymakers, and telecommunication providers. Such studies may provide a more comprehensive understanding of the structural and institutional dynamics that shape digital inequality within HEIs.

Finally, the qualitative nature of this study limits the generalisability of its findings. Future studies may employ quantitative or mixed-methods approaches to examine the prevalence and predictors of various forms of the digital divide across larger student populations and in different geographical contexts. Multiple case studies across regions and countries may also deepen our understanding of how contextual factors shape digital inequalities within higher education systems.

6. Conclusion

This study examined the forms of digital divide experienced by undergraduate students in Ghana during the peak of the COVID-19 pandemic and the strategies they adopted to mitigate these challenges. The findings revealed that the digital divide among students was multidimensional, manifesting in access, financial, usage, connectivity, and motivation. The study further established that although students demonstrated resilience through strategies such as information-seeking behaviours, a savings culture, relocation, and self-motivation, these individual coping mechanisms were often insufficient and temporary in addressing the broader structural inequalities underpinning digital exclusion. The findings therefore reinforce the argument that digital inequality in higher education extends beyond access to technology and is deeply embedded in socioeconomic, infrastructural, and institutional conditions in developing countries.

The study concludes that the COVID-19 pandemic exposed longstanding weaknesses in the digital preparedness of higher-education institutions in Ghana and intensified existing educational inequalities among students. Consequently, there is an urgent need for coordinated policy interventions to strengthen digital inclusion in higher education. Policymakers, governments, university managers, and telecommunications service providers must collaborate to invest in affordable internet access, stable digital infrastructure, institutional digital literacy programmes, and student-centred online learning systems. Without deliberate and sustainable digital policy implementation, students in developing economies may continue to face educational and socioeconomic disadvantages in increasingly technology-driven academic and professional environments.

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