

Online Learning Challenges Encountered by University Students Amidst the COVID-19 Pandemic: A Systematic Review of Digital Divide Perspective

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Abstract

The COVID-19 has required a rapid conversion from the conventional learning to online learning, revealing and intensifying the digital inequality amongst university pupils. The primary objectives of this systematic review study are to identify the digital divide challenges encountered by university students in online learning amidst the COVID-19 pandemic and to understand the underlying reasons contributing to these challenges. This study focuses on empirical research published between 2020 and 2023. The review utilized the seven phases of systematic review recommended by the Evidence for Policy and Practice Information and Co-ordinating Centre. A comprehensive Scopus and Web of Science search was undertaken using word string "higher education/university education/university students", "online learning/distance learning," "COVID-19/pandemic," "digital divide/digital inequality/digital exclusion," and, and the initially 190 articles were extracted.

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The criteria for inclusion restricted the number of publications that were examined to a total of 11. The analysis reveals two primary categories of digital divide challenges: the first-level digital divide, characterized by limited access to essential digital devices and internet connectivity, and the second-level digital divide, which relates to varying levels of digital competency among students. Key factors contributing to these challenges include financial constraints, geographical disparities, and inadequate technological infrastructure. Students from economically disadvantaged backgrounds and rural areas faced significant obstacles in engaging with online learning platforms, leading to adverse academic outcomes. Strategies for bridging the digital divide should be implemented in collaboration with educational institutions, government agencies, and private sector stakeholders. These strategies should focus on the enhancement of technological infrastructure, the provision of financial support, and the provision of digital literacy training programs. The review highlights the importance of understanding the digital divide in shaping future educational practices and policies, aiming to create a more inclusive and resilient higher education system in the post-pandemic era. By addressing the identified challenges, institutions can empower all students to succeed in an increasingly digital learning environment.

Keywords: digital divide, COVID-19, online learning, higher education

Introduction

Following the declaration of the new coronavirus, COVID-19, as a worldwide pandemic in 2020, governments around the world enforced stringent public health measures to control the virus's transmission and reduce the number of deaths. Entire countries were subjected to a lockdown, leading to the halting of all operations in both governmental and private institutions. As a result of the widespread transmission of the virus across several countries and continents, combined with the shutdown of educational institutions, a substantial majority of over 80% of students worldwide were unable to physically attend their respective universities and colleges ([WHO, 2020](#)). Consequently, there is no opportunity for education to be delivered in a conventional way, such as through in-person classes. During that period, individuals throughout the globe began to embrace and implement online education in their educational institutions as a way to maintain educational activities ([Sumra et al., 2022](#)).

Online education refers to a situation when students are geographically separated from their teachers and need a way of receiving instruction ([Wang et al., 2013](#)). Technology tools and internet access serves as a mediator in the interaction between learners and their instructors ([Onyema et al., 2020](#)). Digital technology is crucial for online education; thus, the absence of access to digital technology might prevent students from accessing learning opportunities. Prior to the start of the lockdown, online learning was not regarded with much seriousness. However, amidst the lockdown, some higher education institutions quickly moved to online instruction and learning. This shift has brought

attention to the disparities and significant inequalities among students ([Moonasamy & Naidoo, 2022](#)).

The unequal distribution of access of digital devices and connectivity is what gives rise to the issue that is now commonly known as the digital divide or digital inequality. It states to the uneven distribution of digital technologies, internet access, and digital literacy across various societal groups, with a particular emphasis on socioeconomic divisions ([van Dijk, 2020](#)). It is classified into three level: the digital access divide (first level), digital capability divide (second level) and digital outcome divide (third level) ([Wei et al., 2011](#); [van Dijk, 2020](#)). The notion of a digital access divide refers to disparities in the physical accessibility of technology, encompassing both accessing devices and internet connectivity. The notion of a digital capability divide denotes to the difference in the computer skill and competency while a digital outcome divide concentrations on the disparity in results that arise from an individual's engagement with technology. The pandemic has shown the unforeseen and unexpected difficulty of the digital inequality ([Shah et al., 2021](#)). Although certain learning procedures were gradually transitioned to online platforms, the pandemic not only intensified the use of digital methods in education but also worsened the existing digital gap ([García-Morales et al., 2021](#)).

The digital disparities in tertiary education pertain to the disparities in the availability and utilization of information and communication technology (ICT) among university students and the education system as a whole. These disparities can take various forms, including limited access to digital equipment, connectivity of internet, and digital skills, among

other factors ([García Zare et al., 2023](#)). Numerous studies prioritize digital divides as a crucial determinant when assessing results in online education. According to studies done in India, students—from primary school through university—have major difficulties engaging in their studies. Deficiency of resources and the acceptance of novel methods of instruction and learning that utilize digital technology throughout the pandemic have negatively affected the educational process of these students ([Maity et al., 2021](#)). Likewise, France has found that the improper use of ICT influences the outcomes of its pupils and that the digital divide in the nation makes institutions unprepared for training their instructors and pupils in the use of technology ([Youssef et al., 2022](#)).

Previous systematic studies have examined the obstacles of online education at the university level, with a particular attention on all the stakeholders involved ([Ndibalema, 2022](#)). Nevertheless, the student plays a crucial role as a primary stakeholder in this study. When compared to other stakeholders like instructors and institutions, students encounter socio-economic and cultural obstacles that hinder their learning in tertiary education, particularly in the background of online learning. This review only focuses on the issues of digital disparity that students in higher education experience. This is because digital resources are a crucial component of online learning. Therefore, understanding the specific digital divide obstacles that students encounter and the underlying causes of these challenges will assist higher education institutions and government authorities in understanding the obstacles related to online learning. Thus, this review goals to identify and examine the challenges related to the digital divide that university students experience, providing

insights that can inform strategies to bridge these gaps and enhance the effectiveness of online education in the future.

Problem Statement

Despite the growing recognition of the digital divide as a vital determinant of educational outcomes, there remains a limited understanding of the specific obstacles faced by university pupils in this context. This gap in knowledge underscores the necessity for a comprehensive examination of the digital divide obstacles encountered by students during the pandemic, as well as the underlying factors contributing to these challenges. Addressing these issues is essential for higher education institutions and policymakers to develop targeted interventions and support systems that promote digital inclusion and equitable access to education.

Objectives

1. To identify the challenges faced by university students in online education amidst the COVID-19 pandemic within the framework of the digital divide.
2. To understand the reasons that contribute to these challenges.

Methods

A thorough literature analysis was undertaken to determine the study queries of this study, particularly about the obstacles faced by university students in online learning due to the digital inequality during the pandemic, as well as the main reasons of these obstacles. The

assessment was carried out utilizing the seven steps of systematic review as recommended by the [Evidence for Policy and Practice Information and Co-ordinating Centre, \(2007\)](#). The initial stage involved the formulation of specific conditions for eligibility (Table 1). For the purpose of this review, a decision was made taking into account the following factors.

- In terms of the literature type, only research papers containing empirical data have been chosen with open access. This implies that review articles, book series, books, book chapters, conference proceedings, and closed access have all been excluded.
- To mitigate potential confusion and translation challenges, the research efforts deliberately excluded publications in languages other than English.
- The time frame for this study spans from 2020 to 2023, as it primarily examines the challenges of digital in online learning amidst the pandemic.
- Full research papers were included in the analysis to ensure a comprehensive understanding of the study. This involved analyzing variables such as the size of the sample and the process used for selecting participants, the methods used for collecting data, and the overall strategy taken in the study.

Table 1

Criteria for inclusion and exclusion

Inclusion	Exclusion
peer-review research paper with empirical evidence	review articles, book series, books, book chapters, conference proceedings
Open access	Closed access
Year of publication 2020 - 2023	Publication outside the set period
English	Non-English
Full text	Abstract

The second phase involved doing a comprehensive search for appropriate studies related to the issue. This included a thorough review of research conducted in two prominent scientific databases, namely Scopus and Web of Science. The search was restricted to scholarly works published between the timeframe of 2020 to 2023. As per the guidelines provided by the Joana Briggs Institute (2024), the qualifying keywords are defined based on the population, Intervention, Context and Outcomes (PICO) ([Lizarondo, 2020](#)). As shown in Table 2, these keywords were employed to construct a search query for each database.

Table 2

PICO description and search string

PICO	Description	Search String
Population (P)	The focus is on university students, encapsulating both	"higher education" OR "university education"

	higher education students and those specifically in university education	OR "university students"
Intervention (I)	Methods of learning that occur online or at a distance, rather than in-person	"online learning" OR "distance learning"
Context	The COVID-19 pandemic is the specific context in which these phenomena and populations are being investigated.	"COVID-19" OR "pandemic"
Outcomes (O)	Disparities in access, skills, and benefits related to digital technology and the internet	"digital divide" OR "digital inequality" OR "digital exclusion"

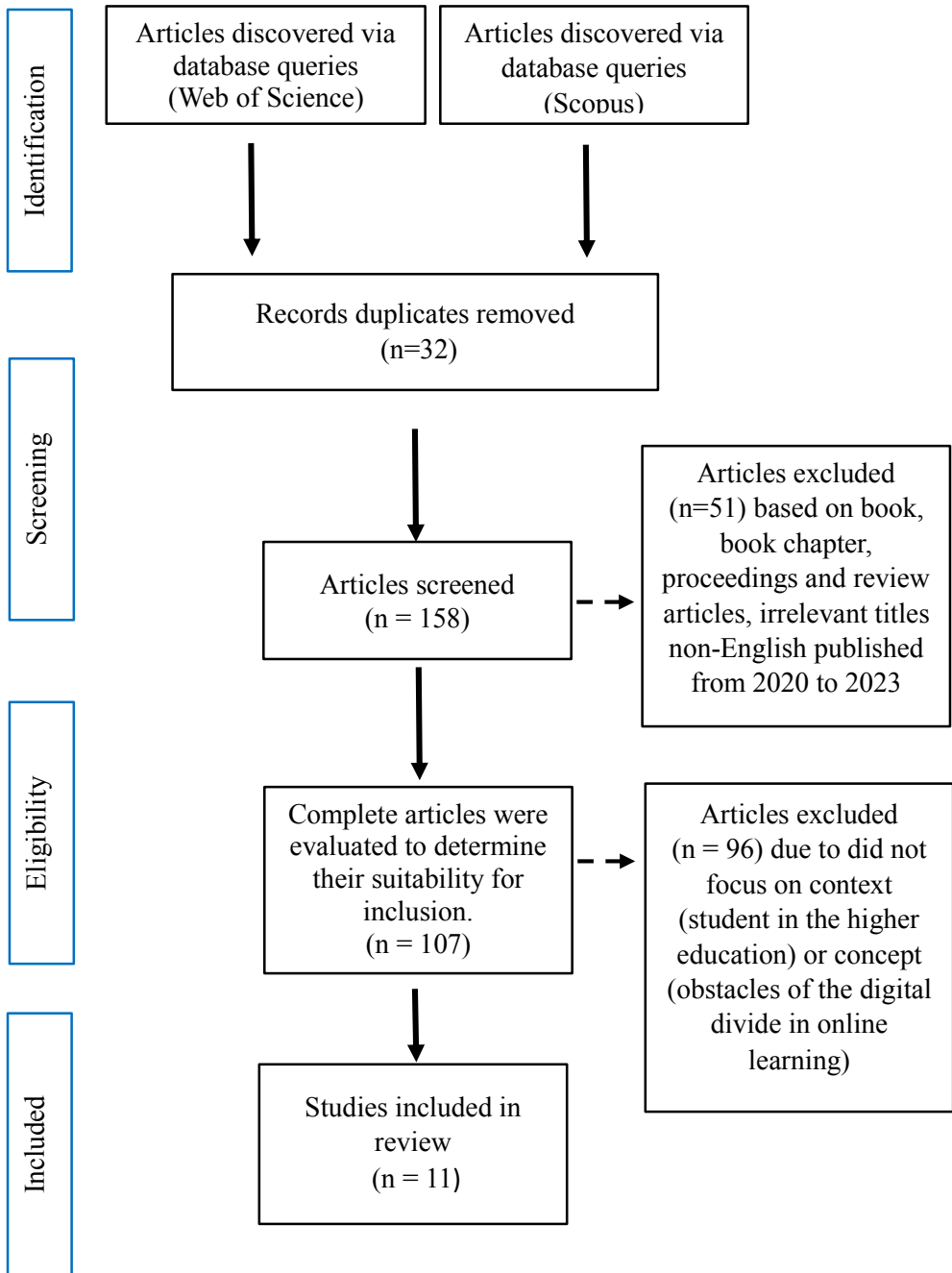
During the initial search, a total combined amount of 190 publications were retrieved from two databases. Following a comprehensive examination, an overall total of 32 duplicates were detected and consequently eliminated. In the third step, the 158 articles were screened according to the inclusion criteria specified in the previous stage (first phase). A total of 51 articles were excluded based on the screening procedure's exclusion criteria. Finally, a total of 107 complete articles analysis for eligibility. After the evaluation, a total of 96 articles were eliminated due to the fact that some of them did not address the

implications of digital disparity on online learning or the student community. After the final round of evaluation, a total of 11 articles were incorporated into the analysis. The selection process was documented using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA 2020) procedure ([Page et al., 2021](#)) (see Figure 1). The Rayyan platform was employed to maintain thorough documentation of the process of selection and screening ([Ouzzani et al., 2016](#)).

In the fourth stage, The Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields (QualSyst) were employed to assess the methodological quality of all the studies contained within the study ([Kmet et al., 2004](#)), which is a set of standard criteria for assessing the quality of primary research papers from various fields. The QualSyst tool was designed to facilitate the simultaneous assessment of various methodologies by analyzing both qualitative and quantitative research. Quantitative studies are evaluated against 14 elements, whereas qualitative studies are evaluated against 10 elements. The evaluation is based on the degree to which these criteria have been fulfilled, with a scoring system of 2 for yes, 1 for partial, 0 for no, and N/A for not applicable (Table 3). The overall score was computed without considering elements that were considered to be "not applicable." The ultimate consensus summary ratings are represented as a percentage, with greater values indicating a higher level of methodological quality.

Figure 1

PRISMA flow diagram, as derived from Page et al. (2021)



In the fifth stage, descriptive mapping was conducted to assess the research articles and their relevance to the study topic. A detailed mapping was conducted to capture three key aspects: the fundamental attributes of the study (such as publication year, country, study design, data collection method, and sample size), the specific types of digital divide issues encountered by university students and the underlying causes of these challenges, and any recommendations placed in the studies (Table 4 & 5 in the result section).

In the sixth stage, the findings were summarized. A table was developed to summarize the numerous obstacles associated with the digital divide with regard to the change to online learning during the pandemic, in order to provide a meaningful summary. The synthesis of important issues from research articles was conducted in a series of stages. While considering the stages proposed by Bazeley, the aggregative synthesis approach was implemented (Bazeley 2014, cite in [Ndibalema, 2022](#)).

The results have been divided into categories and presented in Figure 2 as a consequence of an aggregative synthesis. During this phase, the study objectives focused on identifying the issues of the digital inequality and determining the reasons of these challenges based on the included studies. These challenges were divided into two categories, which correspond to the first and second levels of digital divide challenges. Furthermore, the reasons of the issues related to the digital divide categorized into three aspects: financial constraints, geographical location, and technological infrastructure.

Discussion and conclusion comprised the seventh phase. Discuss the theme that has emerged from the reviewed articles in the discussion section. Furthermore, the discussion contained several emerging recommendations from the incorporated studies, which would serve as lessons for bridging the digital divide among university students and enhancing future practices in the context of adjusting to studying online throughout pandemic-related events.

Table 3
Quality assessment of included studies

Item	Quant	Quali	Element	Included studies					
				Gocotano, et al. (2021)	El Said, (2021)	Asher, S. (2021)	Gan & Sun, (2021).	Moonasamy & Naidoo, (2021)	Katz, et al., (2021)
1	1		Clear Objective/Question	2	2	2	2	2	2
2	2		Suitable study design	2	2	2	2	2	2
3	5		Sample method appropriate	2	2	2	2	2	2
4			Clearly respondents' characteristics described	2	2	-	-	2	2
5			Interventional and random allocation was possible	0	0	-	-	0	0
6			Interventional and blinding of investigators was possible	0	N/A	-	-	0	0
7			possible Interventional and blinding of subjects was possible	0	N/A	-	-	0	0
8			Outcome/s and exposure measure/s well defined	2	2	-	-	2	2
9			Well define Sample size	2	2	-	-	2	2
10			Suitable Analytic methods described	1	2	-	-	2	2
11			Estimate of variance is reported for the main results	1	1	-	-	1	2
12			Controlled for confounding	2	2	-	-	2	2
13			Result described with sufficient details	2	2	2	2	2	2
14	9		Conclusions supported by the findings?	2	2	2	2	-	-
	3		Strong context for the study	N/A	1	1	2	-	-
	4		Link with the theoretical framework	2	2	2	2	-	-
	6		systematic data collection methods	2	2	1	2	-	-
	7		systematic Data analysis	1	1	1	1	-	-
	8		Use of Verification procedure/s	N/A	0	1	1	-	-
	10		Reflexivity of the account?	71%	81%	-	-	-	85%
			Total score (quantitative)	64%	80%	80%	90%	75%	Strong
			Total score (qualitative)	Good-Adequate	Strong-Good	Good	Strong	Good	Strong

Continue

Item		Included studies					
Quant	Quali	Element	Rahman, (2021)	Sumra, et al., (2022)	Alam, et al. (2023)	Garcia Zara, Zara, (2023)	Müller, (2023)
1	1	Clear Objective/Question	2	2	2	2	2
2	2	Suitable study design	2	2	2	2	2
3	5	Sample method appropriate	2	2	2	2	2
4		Clearly respondents' characteristics described	2	2	2	2	2
5		Interventional and random allocation was possible	0	0	0	0	0
6		Interventional and blinding of investigators was possible	0	0	N/A	0	0
7		Interventional and blinding of subjects was possible	0	0	N/A	0	0
8		Outcome/s and exposure measure/s well defined	2	2	2	2	2
9		Well define Sample size	2	2	2	2	2
10		Suitable Analytic methods described	2	2	2	2	2
11		Estimate of variance is reported for the main results	1	2	2	2	2
12		Controlled for confounding	0	1	1	1	2
13		Result described with sufficient details	2	2	2	2	2
14	9	Conclusions supported by the findings?	2	2	2	2	2
	3	Strong context for the study	-	-	2	-	-
	4	Link with the theoretical framework	-	-	2	-	-
	6	systematic data collection methods	-	-	2	-	--
	7	systematic Data analysis	-	-	2	-	-
	8	Use of Verification procedure/s	-	-	1	-	-
	10	Reflexivity of the account?	-	-	1	-	-
		Total score (quantitative)	68%	75%	81%	75%	79%
		Total score (qualitative)	Adequate	Good	90%	Good	Good

Source: Kmet et al., 2004, pp4-5

Full agreement, 1: partial agreement, 0: no agreement, N/A: not applicable.

Summary scores: strong (>80%), good (70–80%), adequate (50–70%) and limited (<50%)

Calculation of the summary score in percentage (quantitative)
Total sum = (number of “yes” * 2) + (number of “partials” * 1)
Total possible sum = 28 – (number of “N/A” * 2)
Summary score: total sum / total possible sum * 100

Calculation of the summary score in percentage (qualitative)
Total sum = (number of “yes” * 2) + (number of “partials” * 1)
Total possible sum = 20 – (number of “N/A” * 2)
Summary score: total sum / total possible sum * 100

Result

Eleven articles retrieved from the Scopus and Web of Science databases highlight the diverse issues related to the digital gap that university students have faced during the COVID-19 pandemic. The papers originate from many peer-reviewed journals and contain empirical study findings on the issue. Table 4 provides a summary of the main characteristics of the studies that were incorporated.

Table 4

Fundamental attributes of included studies

Author & year	Country	Research method	Target population	Data collection method	Sample size	Data Analysis
Gocotan et al. (2021)	Philippines	Mixed method	University students	online self-completion survey questionnaire and interview	639 and 20 for interviews	Simple descriptive analysis and Narrative analysis
Said (2021)	Egypt	Mixed method	University students	online self-completion survey questionnaire and interview	748 and 8 for interviews	T-tests and Chi-square Narrative analysis
Asher (2021)	Pakistan and United States	Qualitative	University students	Interview	7	Thematic analysis
Gan & Sun (2022)	The United States	Qualitative	University students	Online survey with open ended question	206	Thematic analysis
Moonasamy & Naidoo (2022)	South Africa	Quantitative	University students	Online survey	200	Descriptive analysis

Katz et al., (2021)	The United States	Quantitative	University students	Online survey	2,913 from 30 U.S. universities	Structural equation modeling with cluster-bootstrapped standard errors and p-values
Rahman, (2021)	India	Quantitative	University students	Online survey	132	Descriptive analysis
Sumra et al., (2022)	Pakistan	Quantitative	University students	Online survey	750 students and 300 teachers.	Partial Least Squares Structural Equation Modeling (PLS-SEM)
Alam et al., (2023)	Bangladesh	Mixed method	University students	online self-completion survey questionnaire and interview	275 for questionnaire and 20 for interviews	Simple descriptive analysis and Thematic analysis
García Zare et al., (2023)	Peru	Quantitative	University students	Survey	9326	F-test (analysis of variance—ANOVA) and the Friedman test, as well as multivariate analysis
Müller et al., (2023)	France	Quantitative	University students	Online survey	2275	Robust linear regression and binomial logistic models

Source: Authors

This study examined publications within the time period from 2020 to 2023. Based on the predetermined criteria, the majority of articles (7 out of 11) were published in the year 2021. In 2022, one paper was published, while in 2023, a total of three papers were published out of eleven. The seven studies specifically examined the difficulties faced by university students from underdeveloped countries with regard to the digital divide. Meanwhile, three articles covered this issue in developed countries, and one article made a comparison between developed and developing nations. In addition, three studies employed a mixed methods approach, with two studies specifically utilizing qualitative methods for their findings. It is important to mention that most of the reviewed publications, namely six out of eleven, utilized a quantitative research methodology. The QualSyst tool was used to evaluate the quality of the methodology. The quality ranges of all the included papers are from strong to adequate.

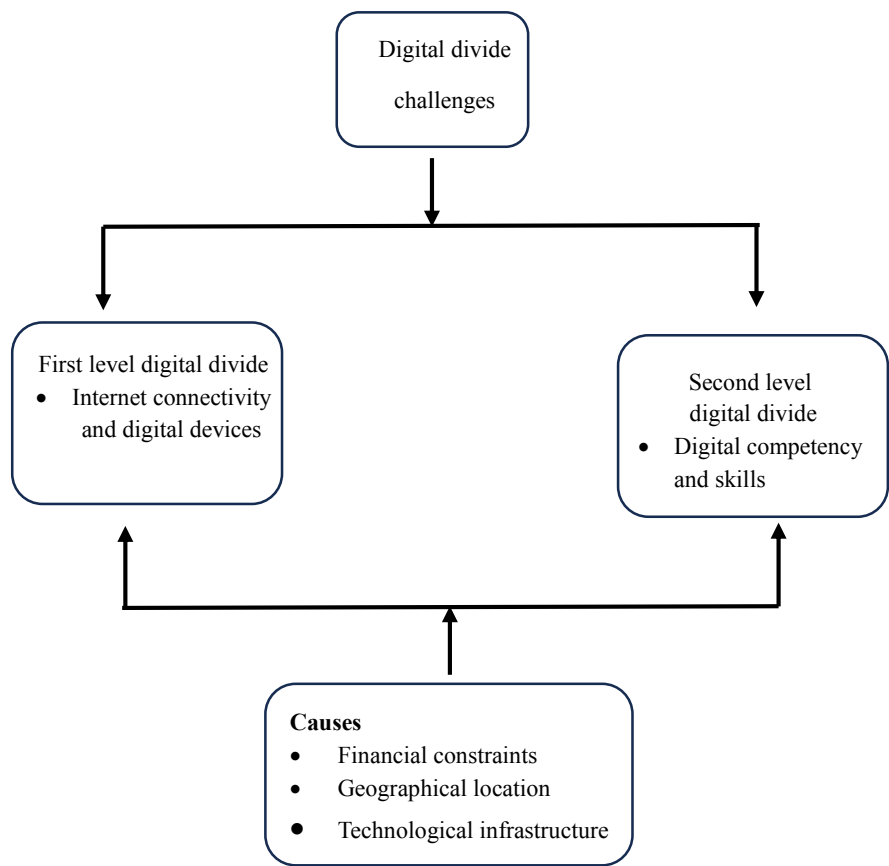
Table 5 displays the aggregated results of the studies that were incorporated. It is evident that university students faced several problems associated to the digital inequality when engaging in online learning throughout pandemic period. While many academics have discussed the many institutional and related problems associated with online learning, this study specifically examined the issues confronted by students in the context of the digital gap. In addition, Table 5 presents the causes for the issues and provides ideas to address the digital divide among students.

Synthesis of the findings

The digital divide challenges encountered by university students during the COVID-19 pandemic are categorized into two primary groups,

while the underlying causes of these issues can be categorized into three categories, as illustrated in Figure 2.

Figure 2
Results Synthesis



Source: Authors

Table 5

Findings on obstacles, causes and recommendations

Author and year	Obstacles faced by university students in relation to the digital divide (DD)	Reasons for obstacles	Recommendations
Gocotano, et al. (2021)	• Unavailability of network • Shortage of digital devices (majority students use mobile phone for online learning) • Lack of digital literacy skills	• Low family income • Educational background of parents • Limited infrastructure • Health issues related to technology use • Expensive internet data	• Training on technological proficiency • Adequate infrastructure • Study materials and activities • Support for low-income families • Recognition of non-Digital learning modes
Said, (2021)	• Disparities in access to reliable internet and digital devices • Internet Connectivity Issues • Lack of IT skill	• Poor IT infrastructure • Financial Constraint • Limited technical support	• Enhance technological infrastructure • Provide training and support • Improve technical support services • Develop robust communication channels • Address socioeconomic disparities • Encourage interactivity in online courses
Asher, (2021)	• Lack of access to technology • Poor internet connectivity • Limited digital skills	• Economic disparities • Lack of infrastructure • Power outages • Insufficient government investment • Inadequate teacher preparation • Cultural barriers	• Emergency preparedness • Technology training • Investment in infrastructure • Increased accessibility • Support for international students
Gan & Sun, (2021)	• Lack access to essential technology: computers and reliable internet connection • Slow internet speed • Technical issues related to software and hardware • Lack the necessary digital skills to navigate online learning environments effectively	• Low socio-economic status • Limited access to resources • Family responsibilities • Disruption of public access points • Institutional barriers	• Mobilizing resources for internet access • Institutions should implement programs that offer free laptop computers and updated software to students • Extended IT support • Creating opportunities for student interaction

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Moonsamy & Naidoo, (2021)	• Lack of internet access to basic digital tools • Lack of skills	• Location (rural areas) • Power outages • Poverty-stricken communities • High data cost	• Public and private partnership for Online provision • Training programs – both teacher and student • Investment in technology infrastructure
Katz, et al., (2021)	• Slow internet connectivity • Lack of digital devices • Lack of Familiarity with Online Learning	• Financial hardship • Prior Experiences of Being Under-Connected	• Universities should provide resources or support for students to secure reliable internet connections and access to necessary technology. • Institutions should offer technical support to help students navigate online learning platforms and troubleshoot any issues they encounter • Institutions should consider offering training programs or resources to help students develop their digital skills
Rahman, (2021)	• Low internet connectivity (rural areas) • Lack of digital devices • Lack of Digital Literacy	• Lack of Investment in Digital Infrastructure and lack of government support • Geographical Disparities • Economic Constraints • Irregular electricity • High cost of data plan	• Enhance digital infrastructure to support online learning • Reduction of data cost • Development of Innovative Techniques and Tools • Student-Friendly Content
Sumra, et al., (2022)	• Poor internet access • inadequate internet coverage (remote areas) • Lack the necessary digital skills	• Geographical inequality • Economic vulnerability • Limited institutional preparedness • Inadequate government policies • Insufficient digital infrastructure	• Development of online curriculum • Investment in infrastructure • Digital literacy programs
Alam, et al. (2023)	• Lack of access to technological devices • Inadequate internet Connectivity • Digital literacy deficiency	• Financial constraints • Infrastructural limitations • Insufficient government initiatives and support for technology integration in education	• Government subsidies for technology access • Increased digital literacy training • Improved internet infrastructure

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Garcia Zara, (2023)	• Lack of access appropriate technology devices • Lack reliable internet service at home • Lack of digital competencies	• Economically disadvantages background • Inadequate infrastructure • Insufficient digital skills training • Lack of institutional support • Social and health impacts of the pandemic	• Enhancing access to technological devices (with support university and government authority) • Improving internet connectivity • Implement digital skills training program • Continuous assessment of the digital divide and its impact on educational outcomes
Müller, (2023)	• Less digital access • Lack of quality of digital equipment	• Low socioeconomic status • Institutional support limitations	

Source: Authors

The included studies revealed two primary digital divide challenges (first and second level digital divide) faced by students of the higher institutions amidst the pandemic, along with three major causes (financial constraints, geographical location and technological infrastructure) for these challenges.

Challenges

First level digital divide – accessibility of internet and digital devices:

The first level digital divide presents two primary issues for students, namely a lack of digital devices and limited internet connectivity. In accordance with the results of the study, it has been seen that students in multiple nations encounter difficulties arising from the digital access divide. This issue has been observed among university students belonging to Pakistan, the United States, Bangladesh, South Africa, India, Peru, and the Philippines ([Alam et al., 2023](#); [Asher, 2021](#); [Gan & Sun, 2022](#); [García Zare et al., 2023](#); [Gocotano et al., 2021](#); [Moonasamy & Naidoo, 2022](#)).

The inadequate availability of digital devices contributes to diminished academic performance among university students. This problem had significant effects on their capacity to attend online classes, engage in virtual discussions, and submit assignments on schedule. Students without personal computers or smartphones had to rely on shared devices or smartphones with limited data plans, making it difficult to keep up with the demands of online learning ([García Zare et al., 2023](#)). As per the research conducted by [Gocotane et al. \(2021\)](#) and [Rahman, \(2021\)](#), a significant trend is the predominant use of mobile phones, with examples

like 78% in the Philippines ([Gocotano et al., 2021](#)) and 82% in India ([Rahman, 2021](#)) for online class participation and academic activities.

Hence, students may encounter challenges in successfully accomplishing their academic responsibilities, such as effectively engaging in online exam, making assignments, and delivering timely PowerPoint presentations. According to [Alam et al. \(2023\)](#), a significant proportion of students, approximately 59 percent, encountered difficulties in submitting their academic work on time in an e-learning environment. In addition to that, a low or unreliable internet connection, hence posing challenges for students in terms of accessing online materials and engaging in virtual classrooms with smoothness and efficiency ([Gocotano et al., 2021](#)). Consequently, these challenges led to unfavorable academic consequences, such as receiving poor grades or experiencing unfavorable outcomes in their academic performance.

However, research conducted by [Said \(2021\)](#) found that students' academic performance, as measured by their grades, was not negatively impacted despite the challenges posed by limited digital infrastructure and a lack of experience with online education.

Second level digital divide – Digital competency and skills:

The digital capability divide, also referred to as the second level digital divide, is a concept that concerns the level of technological literacy and computing proficiency that individuals possess ([van Dijk, 2020](#)). Students who possessed limited knowledge and experience with digital tools and platforms encountered challenges when attempting to navigate online learning environments. Their limited competence in utilizing social

networking sites, learning management systems, and video conferencing platforms posed a hindrance to their capacity to actively engage in online educational settings ([Alam et al., 2023](#); [Gan & Sun, 2022](#)).

Moreover, [Gocotane et al. \(2021\)](#) discovered that a significant proportion of students (40%) possessed limited computer literacy skills, which could potentially hinder their proficiency in fulfilling various academic responsibilities, such as creating videos and presentations using diverse platforms. According to [Asher \(2021\)](#), it was observed that students in Pakistan were unprepared for the challenges posed by online learning. The majority of individuals experienced frustration due to their inability to comprehend writing assignments on online platforms.

Causes

Financial constraint:

During the COVID-19 pandemic, the digital divide among university students was significantly impacted by economic constraints ([Alam et al., 2023](#)). A significant number of students coming from economically disadvantaged backgrounds had financial constraints that hindered their ability to acquire digital devices and continue internet access. Consequently, students encountered difficulties in accessing online educational resources and participating consistently in virtual instructional sessions ([Alam et al., 2023](#); [Gan & Sun, 2022](#); [Katz et al., 2021](#)).

During the pandemic, pupils only able to cover their basic needs, difficult to afford the good internet connectivity to continue their education online platform, as a result they difficult submit their academic work on time ([Gocotano et al., 2021](#)). Due to financial limitation, a

significant number of students share their desktops or laptops at home with their siblings, resulting in a limited amount of time to complete academic activities such as sending emails, accessing instructional courses, and completing academic assignments([Asher, 2021](#)).

Geographical location:

A substantial factor contributing to the exacerbation of the digital disparity has been the geographical location, particularly in rural and remote regions. The presence of inadequate technological infrastructure in these locations has led to the emergence of slow or unreliable internet connections, hence posing challenges for students in terms of accessing online materials and engaging in virtual classrooms with smoothness and efficiency. [Moonasamy & Naidoo \(2022\)](#) asserted that a significant proportion, approximately 58 percent, of students coming from rural regions express dissatisfaction with online education mostly due to inadequate connectivity to the internet. Consequently, these students have difficulties in achieving academic success when compared to their urban counterparts.

Technical infrastructure:

The digital divide is influenced by the availability and quality of technology infrastructure, including power supply (electricity supply) and steady internet connectivity. Power is an essential component within the context of digital platforms. Frequent power outages can have an adverse effect on online learning. According [Ashar, \(2021\)](#), power outages are a common occurrence during the summer season in Pakistan. A significant number of students rely on reconditioned desktop computers that can only

function when there is a continuous supply of electricity. The efficacy of distance teaching and learning in Pakistan has been substantially impeded by the challenges of limited resources, frequent power outages, and inadequate connectivity. Students who experienced unreliable broadband internet connections encountered greater difficulties in effectively navigating and accessing online course platforms ([Katz et al., 2021](#)) .

Discussion

Due to COVID-19 outbreak, the conventional leaning pattern has been shifted to online distance learning and this has increased the dependency of the persons on digital sources ([Müller et al., 2023](#)). Based on the study of [Alam et al., 2023](#), pupils who do not have or have limited access to the advancement in digital resources experience a setback of their learning and academic accomplishments compared to students who enjoy easy access to the said resources. This systematic review synthesized findings from several studies, indicating the digital divide challenges that students encountered in adapting to online learning. The discussion focuses on the consequences of these challenges, the underlying causes and potential strategies for addressing the digital divide.

An important obstacle that has been highlighted is the insufficient availability of essential digital devices and reliable internet connectivity. A significant number of students, especially those from socioeconomically disadvantaged families, faced challenges in engaging in online classes due to insufficient resources, such as a lack of digital devices and limited internet access. The problem was worsened in rural regions, where there

is generally a lack of technical infrastructure. For example, a significant proportion of students, particularly those from rural regions, lack of digital devices for online learning ([Gocotano et al., 2021](#); [Moonasamy & Naidoo, 2022](#)). This is in line with previous research, which indicates that families with lower incomes are more likely to rely on smartphones and frequently lack access to multiple internet-enabled devices, such as tablets, PCs, or laptops ([Anderson & Kumar, 2019](#)). Due to the disparity in digital devices for academic work, students tend to have lower average grades ([Gonzales et al., 2020](#)).

Besides access limit, the review of the literature reveals that students' digital literacy remains another factor due to which students cannot conveniently access and utilize online learning platforms ([Asher, 2021](#); [Gan & Sun, 2022](#)). According to [Asher's \(2021\)](#), many students claimed lack of preparedness to undertake online learning and struggling with certain technologies and learning platforms. Such a state of unpreparedness is not only reveals in the ability to contribute to the learning processes, but also results in frustration and isolation. However, study conducted by [Said, \(2021\)](#) indicates that, Despite students' limited access to digital devices or technological infrastructure and their limited or no prior experience with online learning, they showed the same academic performance as far as grades are concerned.

The present study investigates three primary factors contributing to the issues of the digital divide: financial constraints, geographical disparities, and lack of technology infrastructures. Financial limitations have arisen as a major obstacle, preventing students from obtaining the digital devices and internet connectivity. Specifically, pupils from poor

socioeconomic backgrounds tend to have limited access to digital resources compared to their peers from middle or upper-class backgrounds ([Gonzales et al., 2020](#); [Robinson et al., 2020](#)). They have expressed that they priorities fulfilling their fundamental requirements rather than accessing educational materials, hence further restricting their capacity to participate in online learning. According to [van Dijk \(2020\)](#), an uneven allocation of resources results in disparities in access to digital technology. This, in turn, can lead to unequal involvement in society, exacerbating existing inequalities in resource distribution.

Geographical disparities also play a vital role, as students in rural and remote areas often face additional obstacles related to connectivity and technological infrastructure. Previous research suggests that the majority of students in many nations, particularly those in rural regions, are unable to connect to the internet ([Esteban-Navarro et al., 2020](#); [Ruiz-Martínez & Esparcia, 2020](#)). Sri Lanka serves as a notable illustration of differences in internet access across urban, rural, and estate sectors. In 2021, the estate sector had a lesser utilization of internet in comparison to urban and rural locations. The estate sector had a utilization rate of 26% for internet, whereas urban areas had rates of 61.2% for internet, and rural regions had rates of 42% for internet % ([Department of Census and Statistics, 2021](#)). Consequently, these regional differences have an adverse impact on pupils originating from remote and rural regions.

In order to address the digital divide among students, higher education institutions must implement an active strategy. Recommendations from the reviewed studies emphasize the importance of investing in technological infrastructure, providing financial support for

students, and enhancing digital literacy training programs. For example, while [Said \(2021\)](#); and [Gan & Sun, \(2021\)](#) provided guidelines on what institutions should do to enhance online learning, institutions should train their students on the technological competence, and adequate facilities should be in place to meet the technological needs of the students. Hence, institutions need to adopt policies such as provision of cheap or free internet connection, provision of digital equipment and training that would prepare the students with necessary skills to succeed in online classes.

In addition, the development of sustainable solutions that address the digital divide necessitates collaboration among educational institutions, government agencies, and private sector stakeholders. Policymakers should prioritize investments in technology infrastructure, particularly in marginalized areas, to ensure that all students have equitable access to educational resources ([García Zare et al., 2023](#); [Moonasamy & Naidoo, 2022](#)).

In general, the future of online education is significantly impacted by the challenges presented by the digital divide during the COVID-19 pandemic. Higher education institutions can establish a more inclusive and equitable learning environment that enables all students to succeed by comprehending and resolving these challenges. Continued research is necessary to monitor the evolving nature of the digital divide and to inform ongoing efforts to enhance access and equity in higher education.

Limitation

This study contains certain constraints that should be acknowledged. Initially, it primarily focuses on the challenges faced by

university students, which may restrict the understanding of the digital divide to a narrow perspective; future research should incorporate insights from educators and institutional stakeholders to offer a more inclusive view of the problems arising from the quick change to online learning during the pandemic. Furthermore, the review is restricted to research that has been published in journals and undergone peer review, potentially omitting valuable information from grey literature, conference proceedings, or books that could offer alternative viewpoints on the issues encountered by students and the effectiveness of strategies implemented to address the digital divide. Furthermore, the review's focus on English-language publications may introduce a language bias, leading to the exclusion of relevant studies published in other languages and, consequently, important insights from non-English-speaking regions. Finally, this study investigates the difficulties linked to the digital disparity amid the COVID-19 epidemic, it is crucial to recognize that the digital inequality is a complex and evolving issue influenced by technological advancements, policy changes, and socioeconomic factors, necessitating ongoing research beyond the pandemic period to fully understand these dynamics.

Conclusion

The COVID-19 has catalyzed a rapid change to online learning, exposing and intensifying the pre-existing digital divide among university students. This systematic review has identified critical challenges faced by students, including limited access to digital equipment, inadequate internet connectivity, and varying levels of digital competency. These challenges

have significant implications for students' academic performance and overall educational experience, particularly for those from economically disadvantaged backgrounds and rural areas.

Overall, the pandemic taught educational institutions the importance of having a possibility plan to survive with future unanticipated situations similar to COVID-19. To address the issues arising from the digital divide, it is crucial to implement a comprehensive approach that combines community involvement, educational institutions, and partnerships between the government and private sector. This approach aims to ensure equal access to digital learning environments and enhance academic performance for all students. To enhance the accessibility and affordability of digital resources for university students, it is crucial for the government to offer financial assistance. Moreover, it is crucial for universities to build partnerships with telecommunications and internet service providers in order to offer affordable or complimentary Wi-Fi access to university students. Furthermore, educational institutions employ a comprehensive program to train teachers and staff in IT capabilities, providing efficient technical assistance. In addition, community members should utilize public libraries to obtain free digital devices and establish community centers with complimentary computers and internet access. These levels of collaboration are essential for closing the digital divide. Furthermore, it will be critical to maintain the dedication to narrowing the digital disparities in order to promote a higher education system that is both inclusive and resilient during the post-pandemic era.

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