Post-pandemic Reflections: A Literature Review of the Digital Divide in Online Learning in Pandemic

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Abstract

The COVID-19 Pandemic has had a lasting impact on our daily lives, particularly in the field of Education. The emergence of the Pandemic has forced the development of educational technology, which has made online learning the primary solution for ensuring continuity in Education. However, this rapid shift to online learning has also highlighted the persistent problem of the digital divide in Education. This study aims to conduct a critical review of the digital divide problem in online learning during the Pandemic and provide recommendations for reducing this divide in Education. The study includes three research questions and utilizes descriptive and thematic analysis to conduct a critical narrative literature review. The findings of this study present a comprehensive review and suggest possible future research directions.

Keywords: digital divide, digital literacy, online learning, literature review, COVID-19, Pandemic

1. Introduction

1.1 Introduction

The COVID-19 pandemic outbreak had a major impact on Education worldwide (World Health Organization, 2020), forcing universities and schools around the world to shift to emergency online learning in a very short period of time to control the spread of the virus. This sudden shift led to unprecedented changes in Education as teachers and students had to adapt to new forms of teaching and learning. The Pandemic underscored the importance of technology in Education, with digital technologies such as online learning platforms, videoconferencing tools, and digital assessment methods becoming key to distance education (Martzoukou et al., 2020). The shift in Education to online learning highlights significant disparities in access to digital technologies and infrastructure, especially for learners from marginalized communities, which is referred to as the digital divide, defined as the unequal distribution of digital resources across socioeconomic and geographic groups (Mathrani et al., 2021). While online learning can provide flexible and convenient learning opportunities, the digital divide exacerbates existing educational inequalities and hinders learners' ability to succeed (Vlies, 2020). This paper reviews the literature on the digital divide in online learning and provides recommendations for minimizing the digital divide in Education.

The digital divide has been a topic of interest for researchers in Education for more than a decade (OECD, 2023). Prior to the COVID-19 Pandemic, researchers identified the digital divide as a persistent problem that hindered access to digital technologies and infrastructure for disadvantaged learners (Martínez-Bravo et al., 2020). The digital divide is perceived as a barrier to learners' academic success, limiting their learning opportunities and hindering their competitiveness in the job market. Furthermore, the digital divide is seen as a symptom of broader socioeconomic disparities that need to be further addressed through educator-driven measures. The issue of the digital divide has been given new urgency due to the extensive use of digital technologies during the COVID-19 Pandemic. The Pandemic highlighted the unequal distribution of digital resources across socioeconomic and geographic groups, exacerbating existing educational inequalities (Costello et al., 2020). As a result, researchers are beginning to

see the digital divide as a critical issue that needs to be addressed to ensure equitable access to online learning.

In past studies, researchers have divided the digital divide into three different types: the access divide, the use divide, and the quality of use divide (Iberdrola, 2020). The access divide refers to the possibility of people accessing this resource. This is where socioeconomic differences between people and between countries come into play, as digitalization requires very expensive investments and infrastructure for less developed and rural areas. The access divide refers to the lack of digital skills, which hinders the handling of technology. For example, in many countries, more than half of the population does not know how to attach a file to an email. The quality of use is the divide, and sometimes they have the digital skills to find their way around the Internet but not the knowledge to use it well and get the most out of it, for example, in terms of how to access quality information.

As Mutula (2008) asserts, while we value each type of digital divide, our discussion will not be viable if we get stuck in a mud pit of economic development to facilitate the bridging of the digital divide. This means that if we focus too much on solving the access divide by improving the economy, it will be difficult to realize the significance of the research. At the same time, researchers remain convinced of the value of research on the digital divide, and in a large number of studies, attention has been paid to two other types of digital divide, namely the access divide and the access quality divide. A meta-analytic study promoted by Martínez-Bravo et al. (2020), who reviewed the last 50 years of interdisciplinary research on digital literacy, noted that Digital literacy includes two dimensions. First, skills focused on the use of technology at the personal, professional, and civic levels; and second, the ability to access information efficiently and apply it in the digital age. This corresponds exactly to the other two types of the digital divide. It is easy to see how the development of digital literacy is relevant to the challenge of addressing the digital divide. This study will be explored and analyzed in this context, so we will pay extra attention to the digital literacy challenges of educational participants and how these challenges can be used to address the issues that learners and educators may face in the digital age. The researchers emphasize that in an era where digital technologies are becoming an important part of the classroom, especially with the massive use of technology-based learning tools in Education following the Pandemic, the lack of digital literacy will challenge the production of

learning outcomes for learners for a long time. In this context, there is a need to promote digital literacy as a means of bridging the digital divide and ensuring that all learners have the skills they need to succeed in the digital age. The prevalence of technological dissonance also underscores the importance of digital literacy, where learners are unable to fully benefit from digital technologies due to a lack of digital literacy or inadequate access to digital resources.

Learners who lack access to digital technologies and infrastructure may also lack opportunities to develop digital literacy. Conversely, learners who lack the support and training to use digital technologies effectively may still struggle with digital literacy. One study noted that digital literacy is critical to discussing the digital divide because it is the ability to use digital technology effectively and critically to achieve goals. Without digital literacy, individuals may not have the necessary skills to effectively access and use the Internet and other digital technologies while possibly failing to develop correct perceptions about digital technologies, which can create a digital divide. Therefore, researchers have emphasized the need to address digital literacy to promote equitable online learning opportunities (Vlies, 2020). By promoting digital literacy, learners can overcome the challenges posed by the digital divide and fully engage in online learning. In addition, policies aimed at bridging the digital divide should be implemented to ensure that all learners have access to the necessary digital resources. This will ensure that they can benefit from online learning and access to information and resources.

From the research conducted in the past decade or so, policies aimed at universal access to digital technology have been implemented in countries around the world in order to address the digital divide (Vlies, 2020). The need to develop teachers' digital competencies to support learners in better overcoming the digital divide has been identified in the European Commission's report, Supporting Teacher Competence Development for Better Learning Outcomes in 2013 (Caena, 2014). The Government of Alberta, Canada, published the Learning and technology policy framework in 2013 to encourage teachers and other educators to promote effective and innovative use of technology in order to develop more digital resources to support students' digital literacy development (Province of Alberta, 2013). The Czech Republic proposed a 5-year program in 2015 called Digital Literacy Strategy 2015-2020, a program that aims to provide students with adequate learning opportunities to acquire digital literacy, which directly outlines the goal of digital literacy as a core competency for workers in the digital age (Ministry

of Labour and Social Affairs, 2015). Italy published the National Plan for Digital Education in 2015, in which Italy proclaims a common framework for students' digital skills and specifies the need to bridge the digital divide to promote digital opportunities as a driver of change in Education (Ministry of Education, Universities, and Research, 2015). In 2017, Austria introduced Digital Roadmap Austria in an attempt to bridge the digital divide by providing learners with more support on technology to develop digital literacy (Austrian Federal Government, 2017).

In many studies, we have seen improvements in the digital divide as a result of these national and interstate education-related strategies (Vlies, 2020). However, with the onset of the 2020 pandemic, in an environment where Education has to rely more on technology. The real experiences of students and teachers in the classroom tell the harsh truth that our current efforts are not enough to bridge the digital divide and close the skills gap in Education. Further research and action are urgently needed to address the digital divide and close the skills gap in Education.

1.2 Purpose and Research Questions

The impact of the digital divide on students' ability to engage in online learning has been demonstrated (Guo & Wan, 2022), and the emergence of a plethora of technology-enhanced classroom environments in a pandemic context poses new challenges for learners. The impact of such challenges may not only affect learners today but may also continue to affect the next generation (Mathrani et al., 2021). This is because we cannot foresee the new shocks that may be brought to the education community by future large-scale emergencies (Costello et al., 2020). Therefore, it is necessary to think about how to address the digital divide revealed during this pandemic in order to support better learning outcomes and learning experiences for future learners. The purpose of this literature review is to investigate the impact of the digital divide on online learning during the COVID-19 Pandemic and to suggest directions for future research. Through this review, we aim to help education practitioners, policymakers, and related researchers understand the digital divide issue in greater depth and to provide references and lessons for further advancing the popularity and development of online learning. This study aims to address the following three research questions.

1. What barriers do learners face in accessing online learning as a result of the impact of the digital divide on Education, and how can these issues be addressed?

2. Which groups of students are more vulnerable to the digital divide during a pandemic?
3. What educational technologies and instructional strategies can educational institutions implement that can help students overcome the digital divide and promote equitable online learning?

1.3 Significance of the Research

By reviewing existing research, this literature review aims to examine the challenges faced by educators and students in the context of the COVID-19 Pandemic that has had a dramatic impact on global Education, particularly the challenge of the digital divide and its impact on learners' online learning experiences. It is also hoped that some reflections and insights will be gained based on this to further promote educational improvement. This study focuses specifically on the digital divide and digital literacy and expects to gain insight into strategies that can help promote equitable Education. The results of this study will be relevant to policymakers, educators, and researchers interested in ensuring quality educational opportunities for all students, regardless of socioeconomic or geographic background. At the same time, policymakers can develop policies and measures based on the findings of the study to promote the popularity and growth of online learning.

In addition, this study can provide relevant researchers with research methods and research directions on the digital divide issue and promote the development of the field. We hope that the research findings can be used to inform the design of effective strategies for addressing the digital divide and promoting equitable learning opportunities for all students in educational settings.

2. Methodology

2.1 Overview of the Literature Review Study

Literature reviews have long been an important strategy for assessing the state of science. As early as 1997, Baumeister and Leary (1997) recommended literature reviews as a strategy to aid in conceptual development. Graduate students in many majors use a variety of guides throughout their academic programs to study the synthesis literature, including Green et al.'s (2006) guide

on how to conduct a literature review study or Fink's (2005) recommendations for conducting a review of the research literature await. Despite years of reporting on the extant literature on an issue, many review reports still lack the rigor necessary to provide evidence for practice (Cowell, 2012). The quality of the reviews is likely related to a lack of recognition of the review as a scientific method. A literature review is an important part of research that involves a critical analysis of the existing literature on a particular research topic. This overview will explain what a literature review is, its significance, and its value. A literature review is a critical and systematic analysis of the existing literature on a particular research topic. It involves the identification, evaluation, and synthesis of relevant studies and other sources of information to provide a comprehensive summary of the state of knowledge on the research topic (Fink, 2005). A literature review lays the foundation for research by identifying research gaps, highlighting key findings, and providing context for the research questions.

A literature review is important for building a solid foundation for scientific research. Summarising previous studies, evaluating them, and assessing their strengths, gaps, and opportunities are key steps in making progress in research (Laghrabli et al., 2015). Literature reviews help researchers identify research gaps and areas for further investigation, which can lead to the development of new research questions and hypotheses. In addition, literature reviews help to identify key concepts and themes related to the research topic and provide context for the research questions. In addition, a literature review is essential for establishing the credibility of a study because it shows the researcher's knowledge and understanding of the existing literature on the research topic (Baumeister & Leary, 1997). In summary, a literature review is a critical analysis of the existing literature on a particular research topic. It is a valuable research method that provides a comprehensive understanding of the research topic, identifies research gaps and areas ***for further investigation, and provides a context for the research question.***

2.2 Types of Literature Review Studies

The digital divide in online learning during the Pandemic has been a widely researched topic in the field of Education. A literature review is an important research method for researchers to conduct a retrospective study that provides a comprehensive summary and analysis of previous research on a particular research topic. Such a summary allows researchers to uncover additional insights from it and commit to further research in the future. Researchers can use various types

of literature reviews. This section will explore the different types of literature reviews, explain the type of literature review used in this study, and explain why.

A systematic literature review is a rigorous approach that involves an exhaustive search of all available literature on a particular research topic. The search is conducted using specific search terms and criteria, and the results are screened against predetermined inclusion and exclusion criteria. The included studies were then critically evaluated and synthesized to provide a summary of the available literature on the study topic (MacDonell et al., 2010). A systematic literature review is useful for answering a variety of research questions related to a specific research area. For example, it can be used to determine whether there is consensus among researchers on a particular research topic. It can also be used to identify gaps in the literature and provide recommendations for future research.

A scoping review is similar to a systematic literature review, but its inclusion and exclusion criteria are less restrictive. The purpose of a scoping review is to determine the extent and scope of the existing literature on a particular research topic, identify research gaps, and provide an overview of research findings (Arksey & O'Malley, 2005). A scoping review is useful in determining whether there is a sufficient body of research to answer a particular research question.

A comprehensive review is a form of literature review that combines data from both experimental and nonexperimental studies to provide a comprehensive understanding of a particular research topic. This review process includes a systematic search of the literature, a critical evaluation of the included studies, and a synthesis of the findings (Whittemore & Knafl, 2005). A comprehensive review is useful for answering broad research questions related to a specific area of study. For example, it can be used to determine whether there is consensus among researchers on a particular research topic.

A meta-analysis is a statistical method used to analyze and synthesize data from multiple studies. The purpose of a meta-analysis is to quantitatively summarise the existing literature on a particular research topic, estimate effect sizes, and identify factors that influence the results of studies (Ziegel et al., 1995).

A realist review is a form of literature review that focuses on exploring the underlying mechanisms that influence the outcomes of a particular intervention or program. The review process includes a systematic search of the literature, a critical assessment of the included studies, and a synthesis of findings to develop a theory of change (Pawson et al., 2005).

A narrative literature review is a form of literature review that provides a comprehensive summary and analysis of the existing literature on a particular research topic. Unlike other types of literature reviews, narrative literature reviews do not follow a predetermined protocol or search strategy. Instead, the review process involves a critical assessment of the existing literature and a synthesis of the findings to provide a narrative account of the research topic (Green et al., 2006). They can be used, for example, to summarise the main findings of a series of studies on a particular topic and to critically assess the quality of these studies. They can also be used to identify gaps in the literature where further research is needed.

Given the complexity of the digital divide in online learning during the Pandemic and the limited number of studies on the topic, a narrative literature review is the most appropriate type of literature review for this dissertation. The narrative literature review approach allows for a flexible and iterative process that enables the researcher to comprehensively identify and analyze the existing literature on the research topic. In addition, narrative reviews allow the researcher to critically analyze the literature and identify research gaps that require further investigation (Torraco, 2016). The flexibility and iterative process of a narrative literature review allow the researcher to conduct a comprehensive analysis of the limited research on the topic. By using the narrative review method, the researcher can synthesize the existing literature and critically analyze the findings, which will help identify research gaps and areas for further investigation.

2.3 Research Steps

The literature review is a good way to conduct research. However, the implementation may vary. Therefore, this study provides a research strategy divided into three different steps in **Table 1**. This table shows the different stages and outputs of the study as it progresses.

Table 1 Research Steps

Steps	Criteria	Outcomes

Step 1. Search the database	● Keywords: title and abstract ● Academic article databases: Web of Science, Scopus, and Google Scholar ● Study type: Empirical studies and literature reviews ● Article screener: peer review ● Time Frame: 2019-2022	● 508 papers were screened
Step 2. Visualization Check	● Eliminate duplicate articles ● Eliminating irrelevant research ● Eliminating articles that are irrelevant to educational practice	● 35 papers were screened
Step 3. Content Analysis and Critical Review	● Coding synthesis of articles ● Critical review of articles according to their different themes of concern	● Descriptive analysis of the situation of the screened articles in statistical analysis ● Thematic analysis and critical discussion of the content of the articles

2.3.1 Step 1: Search the Database

For the purpose of the literature review, quality journals were considered as the basis for selecting quality publications. Therefore, we searched three databases for research papers, namely Web of Science, Scopus, and Google Scholar. The motivation for choosing these databases was that they have a wider coverage of journals and, therefore make it easier to collect research results from researchers with different research perspectives. During the search, we searched for research articles written in English that focused on the impact of the digital divide on learners and educators. The main search terms used in this study included online learning, digital divide, digital literacy, Pandemic, learners' difficulties, educational institutions' responses, influencing factors, and student populations. We noted that the types of related articles

contained journal papers, conference papers, books, online publications on websites, etc. It is noteworthy that Smart (2011) points out that peer review is an effective standard that can sustain reliable results in the current reckless field of academic publishing. Peer review is an important aspect of scholarly publishing that ensures the quality, accuracy, and validity of research findings. The peer review process involves experts in the same research field assessing the scientific merit and originality of research papers, manuscripts, or grant proposals before they are accepted for publication to ensure that they are scientifically sound and reliable. This helps prevent flawed or biased research from being published and used to guide future research or decision-making. Therefore, the research articles that were finally screened for this study were peer-reviewed.

In terms of time frame, this study primarily screened academic articles published during the period before the Pandemic to almost the end of the Pandemic, a time frame of 2019 to 2022. This is because this timeframe reflects the difference in the level of attention researchers have paid to the digital divide in online learning compared to before the Pandemic and after the Pandemic. We look forward to seeing the numerical changes from the descriptive analysis and to seeing the subsequent analysis of the results to see the difference in researchers' perceptions of the digital divide in online learning in the context of the Pandemic. To better extend the representativeness of the studies covered in this study, the study contains research articles involving both literature reviews and empirical studies, which contain both quantitative and qualitative research and designs. Based on the initial selection criteria described above, we found a total of 508 papers, of which 73 were from the Scopus database, 128 from the Web of Science database, and 307 from the Google Scholar database.

2.3.2 Step 2: Visualisation Check

The author carefully read the titles, abstracts, and keywords of 608 papers or articles to eliminate duplicate articles and irrelevant studies discussing social issues or articles that do not incorporate educational practices. This process eliminated 473 papers, and a total of 35 papers were eventually retained for further content analysis.

2.3.3 Step 3: Content Analysis and Critical Review

This study will critically review and sort out the final 35 articles. The content analysis technique will be used to analyze the 35 articles because the technique has the potential to identify the main

areas of the research topic (Park & Woo, 2012). The content analysis techniques used in this study include two: descriptive analysis in quantitative statistical analysis and thematic analysis under qualitative methods. In the next part of this chapter, descriptive analysis will be conducted. The descriptive analysis analyses basic information about the selected articles, such as the annual trends in the number of published papers.

In the thematic analysis phase, the study divides all the contents into different themes according to the different contents of each article in the next results section for the different reflections corresponding to the three research questions presented at the beginning of the paper. Researchers claim that thematic analysis is a method that helps researchers to better understand and analyze data (Batdı & Talan, 2019). By identifying and analyzing themes, thematic analysis can provide research with deeper insights and conclusions and improve the reliability of results. In addition, thematic analysis can facilitate the generalization and summarisation of data, identify new research questions, and provide new directions and hypotheses for research. This advantage of thematic analysis can better help this study focus on the focused research questions.

2.4 Descriptive Analysis

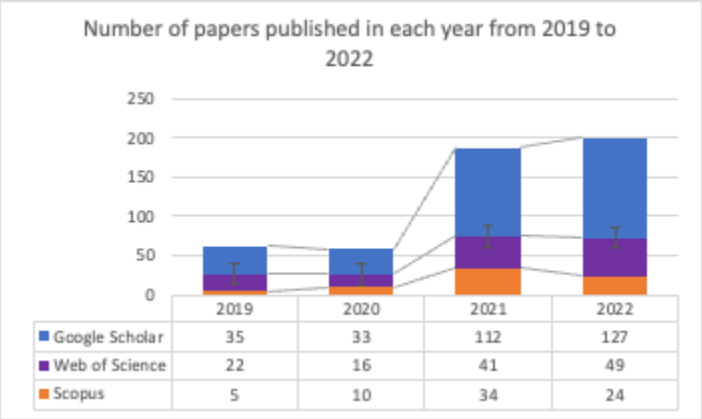

Figure 1. Number of papers published in each year from 2019 to 2022

Figure 1 shows the number of relevant papers published in each year from 2019 to 2022 after the first step of screening. With this number of statistics, we can easily see that the literature related to the digital divide and online learning produces a spurt after 2021. With the World Health Organization's declaration of COVID-19 as a global pandemic in March 2020 (World Health Organization, 2020), the education community has begun to invest more and more in

pandemic-related research. Considering that academic journals generally have a time lag for publication, this may be due to the time it takes to conduct research and the time spent in the academic publication process (Badenhorst & Xu, 2016). Based on this, we can see that in the wake of the pandemic outbreak, researchers in Education began to focus heavily on the additional challenges that the digital divide poses to Education.

3. Results

This study will use thematic analysis, which is common in qualitative research, to thematically delineate and critically discuss the content of different articles. Thematic analysis is a method that can transform data into identifiable and analyzable themes that can provide insights and conclusions. The results chapter is a key part of this study and will cover the core findings and analysis. In the results chapter, a content analysis of the literature screened for the final evaluation will be conducted, and a critical review of all research on the digital divide in online learning during the Pandemic will be presented. Through in-depth research and critical analysis, the aim is to reveal the complexity and diversity of the digital divide problem and to explore the feasibility and effectiveness of various solutions. At the same time, the limitations and shortcomings of current digital divide research will be presented. Through this critical review, we hope to provide valuable insights and suggestions for the digital divide problem of online learning in order to promote the research and development of the field.

3.1 The Online Learning Boom in a Pandemic Context

The COVID-19 Pandemic had a major impact on the world, leading to a global health crisis, economic recession, and social disruption. The Pandemic disrupted the education sector, leading to school closures and the suspension of traditional face-to-face instruction. As of April 2021, the United Nations Educational, Scientific, and Cultural Organization reports that 1.6 billion learners in more than 190 countries have been affected by school closures (UNESCO, 2021). Many institutions have turned to online learning as an alternative solution to ensure continuity in Education. In some cases, governments are providing financial assistance to support the

transition to online learning, while educational institutions are investing in technology infrastructure and providing training and support for educators (Fuchs, 2022). Online learning in emergencies has become the norm during pandemics, with institutions adopting a variety of approaches to ensure educational continuity. This involves the use of various technological tools, such as learning management systems, videoconferencing, and educational apps (UNESCO, 2020). Online learning has several benefits, including increased flexibility and accessibility, personalized learning experiences, and increased learner engagement and motivation (Spring & Graham, 2017). Since mid-February 2020, a quarter of China's 250 million full-time students have resumed learning through online platforms, with two online work software programs provided by Tencent, China's largest social networking company, Online Learning, providing tremendous support for real-time online learning. This led directly to the largest online learning event in Chinese educational history (Yu et al., 2021). In addition to the massive support provided by online technology tools and systems, some school districts are forming unique partnerships, such as the one between the Los Angeles Unified School District and PBS Radio, which quickly established a partnership after the Pandemic to provide a diverse array of educational broadcasting services to local schools (Slavin & Storey, 2020). Traditional media outlets such as the BBC are also promoting a boom in online learning through virtual classrooms and other means. The proliferation of such educational technologies in a pandemic context has greatly increased the potential for online learning. However, online learning also poses a number of challenges, many of which are due to the digital divide, especially for learners from disadvantaged backgrounds (Martzoukou, 2020). The resulting explosion of online Education during the Pandemic has led to the challenges of the digital divide ***emerging in Education in a more significant way.***

3.2 Digital Divide Challenges from Online Learning

Adedoyin and Soykan (2020) conducted a study immediately after the start of the Pandemic about the challenges that participants in online learning education may face during the Pandemic, and their study provided a great deal of input to subsequent research on online learning. They made an interesting point that has guided much of the research specific to online learning during pandemics. Specifically, their view is that crisis response migration from a pandemic should not be equated with effective online learning or digital transformation of universities but rather should be viewed in the context of emergency distance learning platforms. In addition, they

explore different types of online learning formats. They compared two types of online learning, asynchronous online learning and synchronous online learning, and then realized that for online learning to be effective and efficient, faculty, organizations, and institutions must have a comprehensive understanding of its strengths and limitations. Guo and Wan (2022) further explored this topic by realizing that while synchronous learning live courses are not limited to physical locations, students cannot change course content and learning time. This type of online learning is less flexible than online courses that are recorded in advance and can be viewed by students at any time, as compared to the characteristics of asynchronous learning.

As we know, the Pandemic went through several highs and lows and brought about multiple lockdowns. Different countries had different attitudes towards the pandemic during the pandemic. The study by Azionya and Nhedzi (2021) focused on transactions in South Africa. Although a growing number of studies have examined technology adoption in teaching and learning in South African higher education institutions following the COVID-19 lockdown restrictions, there is still a need for studies that explicitly consider students' use of technology and assessment in this emerging context (Azionya & Nhedzi, 2021). Previous research has identified the lack of digital infrastructure, affordability, and skills as the main digital divide challenges facing emerging economies. In this context, Azionya and Nhedzi (2021) provide a deeper analysis of the digital divide dilemmas students may face during the Pandemic, and they suggest the need to be mindful of the inevitability of the fourth industrial revolution, digital inequality, and technological barriers to student learning online, environmental and contextual barriers for students, historical and institutional barriers/differences to online teaching and learning challenges. In their study, it was claimed that students expressed mistrust of the methods used by universities and their impact on marginalized students. Due to resource disparities, universities are shifting teaching and learning online. This rapid shift is particularly significant in the South African context, where stark disparities in Internet connectivity and infrastructure remain for historically disadvantaged universities. This study found that students are concerned that the rapid shift to online learning at universities is not inclusive. To the author's knowledge, this study is the first to analyze the Twitter usage of distance or online learning by students, activists, and sympathizers during the COVID-19 lockdown in South Africa. In addition to this, in China, Guo and Wan (2022) argue that the distribution of digital resources replicates the inequalities inherent in the social structure. According to Sánchez-Cruzado et al. (2021), in

Spain, teachers at all levels have been forced to make urgent adjustments in methodology, subject content, and teaching materials, seeking to shift to online teaching at an unprecedented rate. This process created an educational catharsis that clearly revealed major deficiencies in digital literacy in the Spanish educational system, especially among teaching staff. In India, Bast's (2021) study claims that the "digital divide" has been a buzzword in recent years, but no comprehensive study has analyzed this issue in the context of online learning in India.

In addition to differences between countries, the digital divide challenges vary across different types of educational participants, and Adedoyin and Soykan (2020) categorize and attribute the challenges faced by learners, which have been recognized by other researchers (Quang & Tri, 2021). Based on this, the author combined the studies of other researchers to further classify the dilemmas of these different types of educational participants (Mathrani et al., 2021; Martzoukou et al., 2020; Frei-Landau & Avidov-Ungar, 2021).

3.2.1 Learner's Dilemma During the Pandemic

In terms of challenges for learners, we classify these challenges into internal and external factors. First are the internal factors, specifically those that will have a direct impact, such as the individual learner's ability and skills.

Digital literacy: Rofiah et al. (2022) directly point out that there is a significant lack of training in digital literacy among Thai students, which leads them to dislike online learning during the Pandemic because it affects their understanding.

Student self-awareness: In their study on the digital divide, Guo and Wan (2022) noted that the interaction term between device condition and pre-pandemic ranking was significantly negative. This result suggests that when equipment conditions are improved, top-ranked students are less likely to suffer from the analysis of factors influencing the decline in student learning outcomes. Thus, online learning is more focused on students' ability to learn on their own.

Second, we will explore other external factors that have had an impact. The digital divide challenges posed by these external factors are closely linked to the actual learning experience of students and thus also deserve to be explored in depth.

Intrusive impact: This intrusive impact manifests itself in two ways. One is that students are often influenced by something else unexpectedly when their learning environment is not

sufficiently secure. Specifically, the intrusion may come from family members, friends, pets, etc. This intrusion is likely to cause distractions during the online learning process. In addition, such interruptions may cause learners to feel embarrassed and thus have mood swings that prevent them from returning to class more quickly (Susaie et al., 2022). Another aspect is that online learning is almost a shock for students because they do not have any choice in this regard. Mann et al. (2021) claim in their study that sometimes, in some cases, students do not have other learning options, as shown in the coronavirus pandemic. Therefore, there is no debate about who should and should not study online because, in some cases, students have no choice.

Social and Economic: One's experience of COVID-19 transition to online learning is heavily influenced by one's cultural background and origin (Frei-Landau & Avidov-Ungar, 2021). Due to socioeconomic differences among students, certain students rely on school-provided computers and free Internet, and school closures are expected to slow their transition process. It is clear that students from poor backgrounds face difficulties in staying on track to attend school due to the outbreak of COVID-19. Research shows that as poverty levels in communities increase, Internet accessibility declines rapidly, making broadband connections unaffordable for students without Internet access or those with low Internet access. These students are more likely to fall behind or experience barriers to online learning. During the COVID-19 blockade, students in urban areas of India were much more receptive to online learning than students in rural areas, students who used computers, students who used mobile devices, and students who responded to email as their primary mode of communication (Bast, 2021).

Technology resources: Online learning relies heavily on technology devices and Internet connectivity, and educators and learners with poor Internet connections may face barriers to accessing online learning when the digital divide gets in the way (Frei-Landau & Avidov-Ungar, 2021). The reliance on technological devices and their availability poses significant challenges for institutions, educators, and learners. Students using outdated technological devices may have difficulty meeting some of the technological requirements of online learning. In response to this particular challenge, Tan et al. (2022) provided new insights in a recent study in which the researchers examined whether student motivation changed after the implementation of virtual collaborative learning in an emergency online learning environment. Based on the results of the study, it was evident that even though 30% of the students were at a disadvantage in terms of

Internet connectivity, they outperformed the rest of the students overall. This observation is consistent with student's satisfaction with the collaborative learning activities designed for the subject and the perceived support they received from their small group members. They, therefore, present a study on bridging the motivation of disadvantaged students under the digital divide through a collaborative learning approach. Specifically, this one addresses excessive technology dependence by providing new directions where well-designed curricular activities can make collaborative learning approaches effective, even in virtual conditions.

3.2.2 Instructors' Dilemmas During the Pandemic

Digital literacy: Developing teachers' digital literacy is an equally important factor in addressing the challenges of the digital divide. Teachers often face inequalities in their instructional design process due to inadequate digital literacy. To address such issues, although researchers have begun to understand digital inequality in such a nuanced way, they have paid little attention to learning space inequality (Bahadur Singh et al., 2021). That is, how digital space is interconnected with physical space and how this interconnectedness affects user access and outcomes. This spatial inequality was also found in the survey to directly affect the ability of teachers to unfold instructional design. Rofiah et al. (2022) mentioned in their study that teachers' limited experience with online instruction and the challenges of support can have serious negative effects, especially for low-level students.

Assessment and monitoring: It is worth noting that online learning encompasses not only the classroom delivery process but also the post-class testing and assessment process to determine student learning outcomes. Assessing student learning through online learning tools during the Pandemic will be very different from previous forms of assessment. This difference will create challenges for teachers when designing assessment situations and will affect the participation of different students in the assessment. Based on the challenges of the digital divide that may exist for students, teachers will need to design assessments that are more challenging based on this challenge (Noorbehbahani et al., 2022). In addition, Balderas and Caballero-Hernández's (2020) study focused on a particularly serious phenomenon during the Pandemic of online learning - online exam cheating. This concern about cheating also has another negative impact, as teachers seem more concerned with preventing students from cheating than actually measuring their students' learning.

Teacher Preparation: Frei-Landau and Avidov-Ungar (2021) recognized that in a recent literature review on online learning during the Pandemic, the issue of the digital divide has not received sufficient attention in the context of COVID-19 online learning, especially in the area of teacher education. Thus, from their expectation to understand the structural and cultural barriers to learning equity in teacher education in times of crisis from the perspective of the digital divide.

Sánchez-Cruzado et al. (2021) assert that most teachers are urged to innovate with the help of information, which should not only talk about the ability to evaluate, store, and retrieve information in a knowledge society but also develop the skills to make the most of this information and eventually transform it into knowledge and share it. They argue that it is clear that the need to train teachers in the use of digital technologies in Education is not only to meet the needs of virtual formats, which are key to real educational innovation and bridging the digital divide but also to trigger real change in the educational process.

While online learning during the Pandemic became a major trend, some faculty refused to move to online learning due to concerns that student equity or engagement would be compromised or that they could not afford the time required to design and teach online courses that maintain equity and engagement. This led Goin Kono and Taylor (2021) to realize the value of examining how inequities rooted in the digital divide affect faculty practice and pedagogy and how this research may help bridge the gap in culturally sustained pedagogy challenged by the digital divide in online teaching. The researchers found that some teachers were even able to provide students with more focused and personalized learning experiences with more feedback and one-on-one connections than face-to-face time would allow. This study demonstrates the resilience and challenges experienced by faculty at a large public urban university in adapting to full-distance learning in the context of a global pandemic of trauma. Additionally, the researcher realized that faculty were able to provide a more focused and personalized learning experience for students through feedback and one-on-one contact. Based on this, an important finding to consider is that in times of crisis, faculty adopt practices that meet the needs of students and their communities that are culturally sustainable. The researcher also reflects on the fact that culturally sustaining pedagogy is more than a set of practices; it is a fundamental re-imagining of the purpose of Education as a critical, emancipatory system and a redefinition of the role of students and the role of teachers to respond to the needs of their communities. The focus of this research

is to place greater emphasis on viable solutions for teachers to address the challenges posed by the digital divide that will directly impact student learning outcomes online. The adoption of pedagogies that are responsive to students' cultural and community needs during the global Pandemic suggests that teachers who are flexible, simple, and caringly adaptable reduce barriers to learning for many students. In this context, elements such as flexibility, reducing coursework to the basics, and personalization all of which stem from the caring ethos of the teacher. These supports are effective in mitigating educational inequities in the rapid shift to online learning. This can help alleviate equity issues related to the digital divide. Limitations of Goin Kono and Taylor's (2021) study include the fact that it was conducted in a specific time period and may not be applicable to other situations. In addition, because their study used only teacher narratives as a data source, it provides limited insight into how students experience a shift in distance learning. Future research should focus on further engaging with culturally sustaining pedagogy in online learning by focusing on action and emancipation so that we may address the ongoing social issues associated with higher Education. It would also be beneficial if student experiences were taken into account when conducting this type of research.

3.2.3 Institutional Dilemmas During the Pandemic

The rapid shift in online Education following the implementation of emergency city closure policies by governments presents educational institutions with just a sliver of time to plan an effective online education system, which is a huge challenge (Kalsoom B. et al., 2022).

Curriculum compatibility: Although some researchers have demonstrated that online learning learning content will be relatively supportive for knowledge transfer in the social sciences. However, for courses in certain fields that require hands-on knowledge acquisition, this will turn out to be a great challenge. A study on the field of clinical medicine and nursing found that students who study online in this field often face additional challenges (Al-Balas et al., 2020). Therefore, educational institutions need to think about how to provide appropriate support to target learners in different fields.

Additional resources and support: Online teaching and learning require digital technologies such as learning management systems, appropriate gadgets, and Internet connectivity to be effective (Mhlanga et al., 2022). Therefore, educational institutions have to invest more in technology support, which may include building electronic platforms, integrating existing applications into

the school system, etc. Of concern is the adequacy of the technical support provided by the institution regarding online learning. This support is likely to be in the form of a learning management platform. For example, Аршад (2021) suggests that the use of pre-pandemic learning management systems may not be sufficient to meet the increased demand for online learning after the Pandemic, and Kalsoom B. et al. (2022) claim that learners began to use technology more frequently to support learning after the Pandemic, which placed a greater burden on schools' digital resource provision. Mhlanga et al. (2022) argue that institutions should strive to build digital capacity because the digital technology gap is still wide. Although people may resist change, technology can complement and assist educators in their efforts. In addition, a shift to a focus on online learning can aid in the achievement of educational equity by increasing accessibility. As telework becomes the norm rather than the exception, institutions must invest not only in telework infrastructure and digital tools but also in designing systematic and structured approaches for the new era, which requires a different work ethic and organizational culture as well as new support mechanisms for faculty, staff, and students to help them develop new skills, improve morale, maintain social connections, and create an overall sense of belonging and well-being (Martzoukou, 2020). From a management perspective, given this "new normal" created by the Pandemic, a review of existing connectivity gaps, support mechanisms, and training needs that may exist in the libraries of educational institutions has been and will continue to be a key factor in facilitating a smooth transition to online work and learning.

3.3 Vulnerable Student Populations in the Pandemic

An issue that is difficult to ignore is the additional challenges that may be faced if it is a vulnerable student population. In a pandemic setting, disadvantaged student groups may be classified into many different categories, including having a particular status or having a specific socioeconomic background and health barriers, among others (Mhlanga et al., 2022). The first response we have when referring to disadvantaged groups in traditional conceptions is students who face difficulties in terms of economic conditions. Indeed, disadvantaged students may face additional challenges during a pandemic, although a large number of educational institutions have attempted to provide online learning opportunities to avoid the impact of the lockdown on educational disruption. However, these disadvantaged groups of students affected by poverty have difficulty accessing adequate resources. Adenosine and Soykan (2020) suggest three

perspectives to support these students, and they argue that institutions can work with the telecommunications industry to either subsidize the cost of Internet subscriptions or provide free browsing data to students and instructors as part of their corporate social responsibility. Institutions should also consider providing additional resources, such as laptops and tablets, for those who cannot afford them to ensure equitable access during this time. Educators may need to develop alternative assessment methods that are more accessible and less dependent on technology so that all students have equal access regardless of socioeconomic status. Quang and Tri (2021), in their own study, analyze the ideas presented by Adedoyin and Soykan (2020) and state that while these solutions do not improve challenges faced by disadvantaged groups in online learning, they do face some real-world obstacles. They argue that it is difficult to obtain sufficient additional financial support from educational institutions as a basic consideration of the country's economic and social situation, so it would be more valuable to consider asking educators to use more accessible teaching methods in the learning process.

Guo and Wan's (2022) study provides a more national perspective by asserting that in China, disadvantaged groups may not have access to online learning tools and materials. In this context, analyzing the digital divide in online learning can provide valuable insights into the development of digital Education in China and the world. They found that students with higher family socioeconomic status were less likely to be disturbed by unexpected events while attending live classes, which coincides with the findings of Azionya and Nhedzi (2021). The researchers concluded that home background influences students' device and network status, as well as their adaptation to online learning, which in turn affects learning outcomes. Despite ensuring continuity of learning in the face of disruptions in school-based Education, online learning does add a new element to educational inequality. This finding confirms the concern that technology may widen existing inequalities.

The reflections of these researchers can be of great help in facilitating solutions to the difficulties of disadvantaged student groups. At the same time, Li et al. (2021) realize that vulnerable student populations during a pandemic may not only be students who face challenges in terms of financial conditions but that such challenges may also arise from a student's international student status or physical and mental health, among others. This innovative perspective brings more

room for thought, and a growing number of researchers are beginning to focus on these student populations.

3.3.1 International Students

Researchers have noted that international students often face more digital challenges than local students. According to a recent survey, students in developing countries had less access to online learning tools before the Pandemic, and international students tend to come from developing countries (El Said, 2021). It also means that there is already a digital divide in place, and international students need to use digital educational tools to receive courses. However, for those who have not been exposed to these tools, the learning process may become more difficult. These students may need more time to get used to these tools. In addition, international students may need to take online courses at different times due to time zone differences. This may result in some students needing to attend classes at very early or very late hours, which may have a negative impact on the student's learning and life. Also, international students may feel isolated and lost because they are not able to interact socially and culturally in a face-to-face classroom environment. This may affect students' emotional well-being and learning outcomes. In a study by Chirikov and Soria (2020), it was noted that international students are most concerned not with the university itself but with health safety issues.

3.3.2 Culture and Gender

Some researchers have found that both different cultures and genders can act as divides at the starting point of access to Online Education. Frei-Landau and Avidov-Ungar's (2021) study found that others are free to deal with the challenges associated with effectively managing their learning process, while Bedouins, in contrast to their counterparts, must struggle from the beginning to obtain the necessary resources to provide them with the initial learning conditions already enjoyed by learners in the mainstream population. This initial gap eventually led to a path where stronger mainstream learners thrived while members of disenfranchised minority groups struggled to close the gap. This study's exploration exemplifies the online learning challenges faced by Bedouin and Jewish pre-service female teachers during the pandemic period of online learning. The researcher argues that cultural aspects and values should be addressed to mitigate the digital disadvantage of gender and minority learners and to ensure social inclusion in teacher education. In addition, the challenges of culturally based constraints should be addressed,

considering the learners' family and sociocultural values and roles. The primary significance of this study relates to the need to consider learners' family and sociocultural backgrounds and values, as the findings suggest that this aspect has significant implications regarding participants' learning pathways. These findings correspond to previously documented findings regarding the role of gender and region relative to the digital divide, but the current study emphasizes the combined role of gender-based cultural values, which may undermine learning in times of crisis.

Bast (2021) notes on the impact of the gender digital divide that while males are more receptive to computers overall, a recent survey conducted in India revealed that female students use smartphones at a higher rate than male students. The study by Sánchez-Cruzado et al. (2021) further observes the impact of the gender digital divide in online learning. Considering the gender digital divide, male pre-service teachers use ICT more effectively than female teachers and, therefore, must provide additional digital support primarily, but not exclusively, to females. A recent survey conducted by Mathrani et al. (2021) found that when asked how online learning affects overall student learning, female students felt more disadvantaged than male students. Although there were more female students in urban areas compared to males, Mhlanga et al. (2022) in South Africa again claimed that gender proved to be the most influential factor affecting teachers' perceptions of the use of digital tools in the classroom, over all other factors.

3.3.3 Mental Health Challenges of Students

The mental health challenges of students in a pandemic context refer to the psychological and emotional difficulties that people may experience as a result of a crisis like COVID-19. These may include feelings of anxiety, depression, fear, or loneliness. Maqsood et al. (2021) in their study discuss how these mental health issues can be addressed by providing a technological database as well as offering online counseling services in universities across Pakistan to allow students and staff to cope with their emotions during this difficult time. However, the researcher also noted how the use of online counseling services may be affected by differences in the digital divide among students. Since this study lacks context-specific analysis of students' mental health challenges, future research may be able to focus more on the mental health issues that may arise for students in different scenarios.

3.3.4 Universal Design for Learning Support

The UDL principles describe how to design a physical environment to maximize accessibility for all users, especially those with physical limitations and disabilities. In addition, the UDL recognizes that there is no "standard learner" because learners have different neural networks, which can affect their learning process. Dickinson and Gronseth's (2020) research focuses on both Universal Design for Learning and surgical Education, and they argue that the task of surgical educators is to continue quality education in this ever-changing work and learning environment, and the UDL framework provides a lens for strategically planning curriculum and instructional decisions. By incorporating flexibility into curriculum design from the outset, needs, characteristics and environmental constraints can be addressed to continue quality surgical Education during this difficult time.

3.4 Assessing the Bridging of the Digital Divide in Online Learning

Through the lens of a human rights framework, Roda and Perry (2022) identify three significant factors that students can identify that disproportionately impact the quality and equity of higher Education during mass migration to distance learning: lack of face-to-face, experienced human feedback to hone critical thinking; access to functional technology; and compromise in digital learning environments students' attention spans. The researchers argue that human rights "standards" allow for a more nuanced assessment of whether the emergence of the digital divide in online learning promotes or undermines students' rights to higher education based on merit; issues such as protecting student privacy, encouraging freedom of expression and assembly, allowing equitable access to scientific advancement, and fostering a sense of dignity among students are critical to assessing our own offerings of the digital divide in online Education are key factors.

In addition to assessing from a human rights framework perspective, researchers have proposed an approach to assessment using a dual strategy (Pal & Vanijja, 2020). The researchers argue that both the System Usability Scale (SUS), a Human-Computer Interaction (HCI)-based approach, and the Technology Acceptance Model (TAM), an Information Systems (IS)-based approach, can be used. This uniqueness lies in the fact that this is probably the first time that these two popular approaches are used together.

3.5 Effective Educational Strategies in the Post-Pandemic Era

Although the Pandemic has gradually become a thing of the past, the discussion about the challenges of the digital divide that people face in online learning continues unabated. Mann et al. (2021), in their recent study, present an interesting insight into whether schools should immediately revert to the pre-pandemic state if the Pandemic becomes history. In this section, we will explore the possibility of answering this question from a different perspective. Hays (2019) states bluntly that in the midst of this crisis, it is increasingly evident that beyond the obvious challenges and growing uncertainty, COVID-19 may be providing the basis for planning future sustainable, cohesive, independent, and robust strategies to deal with the problems that have occurred is an evolving educational reality. This means that valuing the changes that the Pandemic brings to our Education will likely change the future impact of Education on the next generation.

3.5.1 The Importance of Priori Digital Literacy Knowledge in Learning

Researchers are aware that students are considered to be digitally competent when they enter higher education studies, either for undergraduate studies or for further studies (Martzoukou et al., 2020). Therefore, to a certain extent, students can make the switch in learning style relatively quickly. But from an institutional perspective, it is a different story; Guppy et al. (2021) claim that most higher education institutions have little pre-existing capacity to teach fully online, even in terms of teaching courses or the response of UK academic staff. The researchers suggest that prior proficiency with technology is important for both faculty and students and that when students are digitally literate enough to support the reduction of the digital divide, the impact of curriculum transitions will be less than one might expect. Researchers in Thailand have found a similar situation, with Rofiah et al. (2022) research believing that students' existing digital knowledge can better help them cope with challenges. In addition, the researchers make the interesting point that the challenges posed by online learning are not limited to the students themselves but often come from the environment in which they live. Their study found that students were more confused about their self-confidence in academic achievement and that this lack of self-confidence was strongly related to learning in the home environment (Guppy et al., 2021). Students who reported experiencing the most difficult challenges in the home environment, particularly the lack of dedicated study space and too much noise, also reported lower confidence in learning. This means that if online learning is not used as a regular means of instruction, students will once again face the threat posed by this challenge each time they

experience a large-scale disaster and have to switch instructional modes. While this study brings different thinking to the table, because this was an online survey conducted during a pandemic when students were still adjusting to the online learning environment, their responses may have been influenced by the current environment rather than the possible long-term impact of such a change.

3.5.2 How Learners in the Digital Age Learning

The online learning brought about by the pandemic does bring many challenges to the digital divide, but at the same time, it also provides a sudden opportunity to better address digital disparities. Rahmat et al. (2021) describe the core findings of the study and discuss how online learning in the age of digital technology can be a promising solution for all educational communities and interested parties. The researchers argue that in this technological era, smart teaching practices are considered to be concerned with the procedures and arrangements that must be carried out using technological means. At the same time, they describe how teacher scalability and support with Web 2.0 tools can better support the differentiation that comes with mitigating the digital divide and provide great support for students on their journey to learn the technology of the digital age. The study concluded that online courses are often easier than regular classes. Typically, web-based learning phases only allow each student to take turns, and in almost all cases, this assumes more prominent communication and more criticism between the student and the instructor guide.

3.5.3 Support for the Development of Digital Competencies of Educational Participants

The study by Sánchez-Cruzado et al. (2021) declares that digital literacy is not a reality that facilitates the teaching and learning process and that there is an urgent need for training programs to help teachers reach an optimal level of digital skills. They used the ACDC (Analysis of Common Digital Competencies) tool in their study, which consisted of 100 questions, six related to general population characteristics and 94 related to digital skills assessment. Their study also conducted a detailed descriptive analysis showing that Spanish teachers had an overall good self-perception of their level of competence in using technology tools effectively when teaching online or implementing innovative educational models. In addition, multiple linear regression models showed the relationship between demographic characteristics, such as gender and age, and teachers' level of competence in using technology tools effectively in distance learning

courses or other forms of online educational delivery methods. This paper is unique in that it provides a comprehensive analysis of Spanish teachers' digital skills competency levels and proposes effective training programs to improve their digital literacy. Diz-Otero et al. (2022) build on this study in more depth and propose specific continuing education programs to develop teachers' digital literacy, thereby supporting the mitigation of the digital divide in Education. The digital divide in Education.

While these two studies do provide good support for developing the digital literacy of education participants, the sample sizes of these two studies are not as large as they could be. However, both studies had relatively small sample sizes, which may affect their accuracy. In addition, both studies focused only on specific countries and did not consider other regions or countries. It is also worth noting that when it comes to the participants' digital literacy levels, the source of the data was only the participants' self-reports, which may be potentially biased. However, a cross-national or cross-regional study could be considered for the next study, and a mixed data collection could be attempted (Fetters & Molina-Azorin, 2018). Possible data collection methods should include creating assessment scales for observation and rating and matching with teachers' self-reports, which would better ensure the credibility of the data analysis results.

4. Discussion

The concept of the digital divide has been frequently mentioned in the field of educational research over the past decades but has not been the main focus of educational researchers in recent years. After the outbreak of the 2020 pandemic, online learning has become the most suitable alternative to traditional forms of teaching and learning, offering the possibility of continuous educational delivery. In the process, educational technology has been widely valued, and tools and strategies related to online learning have been used extensively. This presents opportunities for the development of educational technology as well as potential challenges for those involved in education in schools. In terms of opportunities, we can see that more and more educators are willing to experiment with technology tools as a means of supporting the voice of

learning, and this process has seen a plethora of new technologies being used in education, including but not limited to artificial intelligence, chatbots, data mining, online interactive platforms and more. According to researchers, the educational technology market has skyrocketed rapidly following the pandemic. Behind this boom lies a hidden danger, with the digital divide being the biggest obstacle limiting the gap between education participants and technology. This digital divide is not only a problem for learners but also for educators and institutions, and in this context, it is important to think appropriately about the digital divide and implement sound strategies to narrow it. After a data analysis and a critical narrative review, we will answer the three research questions posed at the beginning of this study. (1) What barriers to accessing online learning do learners face as a result of the impact of the digital divide on education, and how can these be addressed? (2) Which groups of students are more vulnerable to the digital divide during the pandemic? (3) What educational technologies and instructional strategies can educational institutions implement that can help students overcome the digital divide and promote equitable online learning? After a critical review of the peer-reviewed articles selected for this study, we realize that there are indeed many pressing issues to be addressed and that valuable solutions have emerged for some of them. In this chapter, we also discuss the limitations of this study and make some specific recommendations for future research in this area.

4.1 Discussion of the Research Questions

4.1.1 Research Question 1: What Barriers Do Learners Face in Accessing Online Learning As a result of the Impact of the Digital Divide on Education, and How Can These Be Addressed?

The literature review has revealed several barriers learners face in accessing online learning due to the digital divide. As Adedoyin and Soykan (2020) pointed out, learners from disadvantaged backgrounds may lack access to digital devices and reliable internet connectivity, hindering their ability to participate in online learning. Furthermore, Martzoukou et al. (2020) highlighted that insufficient digital literacy skills can also pose a significant challenge for learners trying to navigate online learning platforms. Guo and Wan (2022) emphasized that the digital divide can exacerbate existing educational inequalities, particularly for students from lower socioeconomic backgrounds. To address these barriers, Azionya and Nhedzi (2021) suggested that educational institutions should collaborate with telecommunications companies to provide subsidized internet access and devices to students in need. Additionally,

Sánchez-Cruzado et al. (2021) stressed the importance of offering digital literacy training and support to both students and educators to ensure they have the necessary skills to effectively engage in online learning.

4.1.2 Research Question 2: Which Groups of Students Are More Vulnerable to the Digital Divide During a Pandemic?

The literature review identified several groups of students who are more vulnerable to the digital divide during a pandemic. Guo and Wan (2022) found that students from lower socioeconomic backgrounds and those living in rural areas face greater challenges in accessing online learning resources. El Said (2021) noted that international students often encounter additional barriers, such as language difficulties and limited access to technology in their home countries. Frei-Landau and Avidov-Ungar (2021) highlighted the challenges faced by minority groups, such as the Bedouin community in Israel, who may lack the necessary infrastructure and support to participate in online learning effectively. Maqsood et al. (2021) also pointed out that students with mental health challenges may struggle to engage in online learning, particularly if they lack access to adequate support services. Dickinson and Gronseth (2020) emphasized the importance of considering the needs of students with disabilities and ensuring that online learning platforms are accessible and inclusive.

4.1.3 Research Question 3: What educational technologies and teaching strategies can educational institutions implement to help students overcome the digital divide and promote equitable online learning?

The literature review highlighted various educational technologies and teaching strategies that educational institutions can implement to help students overcome the digital divide and promote equitable online learning. Rahmat et al. (2021) suggested that adopting mobile-friendly learning platforms and applications can make online learning more accessible to students who primarily rely on smartphones for internet access. Tan et al. (2022) demonstrated the potential of collaborative learning approaches in engaging and motivating students, even in virtual environments with limited connectivity. Sánchez-Cruzado et al. (2021) emphasized the importance of providing ongoing technical support and resources to assist students in navigating online learning platforms. Diz-Otero et al. (2022) proposed the implementation of targeted professional development programs to enhance educators' digital literacy skills and their ability

to create inclusive online learning experiences. Goin Kono and Taylor (2021) highlighted the value of culturally sustaining pedagogies in addressing the needs of diverse learners and promoting digital equity. By implementing these technologies and strategies, as suggested by the reviewed literature, educational institutions can create a more equitable and inclusive online learning environment that addresses the diverse needs of students affected by the digital divide.

4.2 Limitations of the Study

As with any research, this study has several limitations that need to be acknowledged in order to ensure the validity and reliability of its findings. First, the study's narrow focus on the digital divide and its impact on education during the pandemic limits its ability to explore other factors that may influence online learning, such as pedagogy, teacher-student relationships, and digital literacy skills. This narrow scope may also have limited the study's ability to provide comprehensive solutions or recommendations for reducing the digital gap in education caused by COVID-19.

Secondly, the study does not provide a detailed analysis of how different socioeconomic backgrounds and family values/roles may affect students' access to online learning resources. Socio-economic status and family values can significantly influence students' access to technology, internet connectivity, and supportive learning environments. These factors are critical to understanding the digital divide and developing inclusive and equitable online education strategies.

Third, the study does not discuss the potential ethical implications of implementing the proposed strategies. Any intervention aimed at bridging the digital divide and improving online learning may raise ethical issues, particularly in relation to the collection and use of student data. Ethical issues must be taken into account when developing and implementing any online education strategy.

Fourth, the relatively small sample size of the study limits the generalisability of the findings to other educational settings post-pandemic. A larger and more diverse sample would have allowed for a more comprehensive analysis of the impact of the digital divide on education during the pandemic and the effectiveness of different interventions.

In conclusion, while this study contributes to the growing literature on the digital divide and its impact on education during a pandemic, it has several limitations. Addressing these limitations in future research could help to develop more comprehensive and inclusive strategies for online learning, taking into account the different needs and challenges faced by students.

4.3 Suggestions for Future Research

The literature review has unveiled several areas that warrant further investigation to better understand and address the digital divide in education. Future research should focus on conducting longitudinal studies to examine the long-term impact of the digital divide on student learning outcomes, career prospects, and socioeconomic mobility (Guo & Wan, 2022). By tracking students' progress over time, researchers can identify the most effective interventions and strategies for bridging the digital gap and promoting digital equity.

Moreover, future studies should explore the role of emerging technologies, such as artificial intelligence and adaptive learning systems, in personalizing learning experiences and supporting students affected by the digital divide (Sánchez-Cruzado et al., 2021). As these technologies continue to advance, it is crucial to investigate how they can be harnessed to create more inclusive and accessible online learning environments.

Additionally, research should delve into the intersectionality of the digital divide with other forms of educational inequity, such as race, gender, and disability (Frei-Landau & Avidov-Ungar, 2021). By examining the compounding effects of these factors, researchers can develop more comprehensive and targeted solutions that address the unique needs of diverse learner populations.

Furthermore, comparative studies analyzing the digital divide across different countries and regions can provide valuable insights into best practices and inform global policy decisions (Martzoukou et al., 2020). By identifying successful initiatives and strategies employed in various contexts, researchers can contribute to the development of evidence-based approaches to tackle the digital divide on a global scale.

Lastly, future research should prioritize participatory action research methodologies that actively involve students, educators, and communities in the co-creation of solutions to address the digital divide (Goin Kono & Taylor, 2021). By engaging these stakeholders as equal partners in the

research process, scholars can ensure that the resulting interventions are culturally relevant, contextually appropriate, and responsive to the actual needs and experiences of those most affected by the digital divide.

5. Conclusion

The COVID-19 pandemic has shed light on the pervasive issue of the digital divide in global education, exposing the profound disparities in access to digital resources and the far-reaching implications for students' learning experiences and future prospects. As online learning became the norm during the pandemic, it became clear that the digital divide transcends the boundaries of education, affecting students' lifelong development and career opportunities. The complex interplay of socioeconomic factors, geographical location, and technological infrastructure has exacerbated the digital divide, creating significant obstacles for students from disadvantaged backgrounds.

Addressing the digital divide requires a multifaceted and collaborative approach involving educational institutions, governments, and private sector partners. Investments in digital infrastructure, particularly in underserved communities, are crucial to bridge the connectivity gap and ensure reliable access to online learning platforms. Additionally, digital literacy initiatives must be prioritized to equip students and educators with the necessary skills and knowledge to effectively navigate and utilize digital technologies, fostering a more inclusive and empowering learning environment.

Governments play a vital role in developing policies and allocating resources to support digital equity in education, including funding for technology infrastructure, subsidies for internet access and devices, and the development of digital literacy programs. By prioritizing digital inclusion as a key policy objective, governments can create an enabling environment that encourages innovation, collaboration, and the sharing of best practices among educational institutions.

Moreover, the rapid advancements in artificial intelligence, particularly the widespread adoption of large language models, present both opportunities and challenges in addressing the digital divide. These powerful AI tools have the potential to revolutionize education by providing personalized learning experiences, intelligent tutoring systems, and automated assessment and feedback. However, it is crucial to ensure that the development and deployment of AI in education are guided by principles of equity, accessibility, and inclusivity. Efforts must be made to prevent the exacerbation of existing disparities and to ensure that the benefits of AI-powered

educational tools are accessible to all students, regardless of their socioeconomic background or geographical location.

As we navigate the post-pandemic era and embrace the transformative potential of AI in education, it is imperative that we maintain a strong focus on bridging the digital divide. This requires a sustained commitment from all stakeholders to prioritize digital equity, invest in the necessary infrastructure and resources, and develop inclusive AI-powered educational solutions. By harnessing the power of technology and AI responsibly and equitably, we can create a more resilient and inclusive educational landscape that empowers all students to thrive in the digital age.

In conclusion, addressing the digital divide in education remains a critical challenge that demands urgent attention and concerted action. The emergence of large language models and AI-powered educational tools presents both opportunities and responsibilities in our efforts to bridge the digital gap. By adopting a comprehensive approach that encompasses digital infrastructure, literacy initiatives, policy interventions, and the responsible integration of AI, we can work towards a future where every student has access to high-quality education and the tools needed to succeed in an increasingly digital world.

Appendix

List of Literature Used in This Literature Review

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