

Examining Digital Equity Challenges in Pakistan's Higher Education During Covid-19: A Qualitative Study

Dr Sumaira Aslam¹, Dr Mahreen Bashir², Abid Ali³ and Dr Naeem Shahid⁴

Abstract

Purpose: The fundamental purpose of this study is to pinpoint and highlight the main concerns of Pakistani teachers regarding digital equity in the education system of Pakistan and to provide expertise in assisting them to reduce pressure regarding teaching in modern difficult period, i.e online teaching challenges during the COVID-19 pandemic. **Methodology:** Semi-structured interviews were conducted in different institutions of Pakistan. The research used thematic approach on the responses of university teachers. **Findings:** The outcomes of this study show COVID-19 amplified the systemic inequities in the availability of digital fluency, Socio-economic divides and technology. **Originality/value:** The results of this study offer valuable insights to reduce educational disparities, focuses on policy reforms, instructors training and community-based interventions. It specifically emphasizes on narrowing digital divide and giving better access of technology and internet to the students.

Keywords: Digital Divide, Equitable Education, Online Learning, Digital Literacy, Post-COVID Education

Introduction

COVID-19 brought uncertainty and triggered a massive swing in structural, social and psychological challenges (Shahid, 2022; Li et al., 2024). With fast e-learning development, the Global COVID-19 outbreak has also brought huge changes, specifically in the field of education. The sudden cancellation of on-campus classes forced institutions to switch to online courses in a very short period. Although the

¹University of Derby - United Kingdom

²Government College University Faisalabad, Chiniot Campus – Pakistan

³NextGen Digital Support Ltd - United Kingdom / University of Hull - United Kingdom

⁴Taylor's University, Subang Jaya - Malaysia

pandemic is over, the lessons, as well as the long-term effects on digital equity, remain valid. The objective of this study is to highlight the concern of Pakistani University teachers regarding digital equity by incorporating thematic analysis through semi-structured interviews of the teachers (Shahid et al., 2020). The pandemic has accelerated the global adoption of digital education, highlighting both the opportunities and drawbacks of equitable access to quality education (Han & Li, 2025). Organization for Economic Co-operation and Development (OECD) report 2023 highlights the significance of academic inclusion and digital equity in the areas of disparities in digital access and undermined academic performance.

The multidimensional term, digital equity includes informational content, skills to operate tools and availability of technology. To promote digital equity in educational institutions like equitable resource allocation and community collaborations, operational guidelines are necessary (Aguilar, 2020). There are five domains of digital equity involving skilled teachers, appropriate educational content and access to technology (Resta et al., 2018). The systematic inequality in OECD member nations, even in rich countries, vulnerable nations experience such obstacles of limited digital literacy and inflation (Gottschalk and Weise, 2023). Their research emphasizes the importance of a regulatory framework that focuses on socio-cultural inequalities and infrastructure. In Pakistan, socioeconomic gaps escalate digital inequality. Poor internet connectivity and lack of devices specifically in villages ruined online education in Pakistan after COVID-19 (Farrukh et al., 2013). Similarly, Huma (2024) highlights examples where limited up to date ICT devices restrict virtual education in Pakistan and reported that the basic technology like TV is not available to the 14% poorest people of Pakistan.

Owing to COVID-19 pandemic, a rapid shift to online education have both strengths and weaknesses. online learning may restrict student involvement relative to onsite learning (Dumford and Miller, 2018). Moreover, Petillion and McNeil (2020) documented that the way teacher teaches to the student is very important for their well-being and performance. Ensuring academic integrity in online learning is an important problem, and innovative solutions, like AI based exam proctoring systems, are mandatory to resolve this problem (Gamage et al., 2020). EDUCAUSE Horizon Report shows that Hybrid Education models that is the mix of both online and onsite education are essential to future-proofing higher education (WWLHIE) documented by (Alexander et al., 2019). On the other hand, a sudden move on virtual learning in Pakistan has made numerous teachers poorly equipped, with

institutions possessing limit resources and insufficient structures for online education (Imran et al., 2023). Furthermore, Ullah et al. (2024) address the “fate of student academia” in post-COVID tertiary education in Pakistan, noting that e-learning has failed to close the existing disparities among students from low-income households.

Comparative research provides valuable findings. By incorporating state-driven techniques, such as device distribution and subsidized broadband, South Korea has effectively bridged the digital inequalities (Yoo and Lee, 2025). Sharma (2022) has examine such case, the researcher worked on "Digital India" program of India by focusing on instructor training and rural connectivity, nevertheless, execution challenges persist. Conversely, Sahlberg (2021), calling for strategies that emphasize meaningful innovation instead of excessive digitization, and dislike Finland's increasing dependence on technology. Owing to inadequate infrastructure and limited training teachers in Balochistan province of Pakistan, faced many chellanges (Gul et al., 2023). The suggestion to utilize adaptive e-learning platforms in higher education is supported by (Alsabban et al., 2024). Zeeshan et al. (2025) recommended AI based learning to assess the outcomes of online education in Pakistan, and notable gaps were seen in the performance of students.

Theoretical Framework

This study is grounded in an integrated theoretical framework combining van Dijk's (2005) resources and appropriation model with Moore's (1993) theory of transactional distance. van Dijk (2005) conceptualizes digital inequality as a sequential and cumulative process involving four stages of access. Motivational access refers to the willingness and perceived value of using digital technologies. Material access encompasses the possession of devices, internet connectivity, and infrastructure. Digital skills involve the competencies required to use technologies effectively. Usage refers to the actual application of digital technologies in meaningful ways. This framework is suited to the Pakistani context because it reveals how inequities compound across multiple levels rather than existing as a simple binary divide (van Deursen & van Dijk, 2019). Moore (1993) defines transactional distance as the psychological and communication space between teachers and learners, determined by three interacting variables. Dialogue refers to the extent and quality of interaction between teacher and learner. Structure refers to the rigidity or flexibility of course design. Learner autonomy refers to the degree

of self-direction permitted to the learner. When dialogue is limited, structure is rigid, and autonomy is constrained, transactional distance increases, leading to isolation and disengagement. Together, these frameworks provide a multi-level analytical lens. van Dijk's model structures the investigation of access-related barriers, while Moore's theory explains the pedagogical and psychological consequences of those barriers. The interview protocol was designed around the core constructs of both frameworks, and data analysis employed van Dijk's four dimensions as an initial coding framework with open coding allowing emergent themes to be captured.

Methodology

Keeping in mind the challenges that higher Education faced while shifting on online education amid and following the Pandemic, this research was carried out in the context of higher education of Pakistan. According to the report of UNESCO, 58 million children in the age group above 15 years are uneducated and the number of school dropout children in the age 5-16 years are 22 million (UNICEF, n.d.). Rind and Malin (2024) documented that although the percentage of enrollment in higher education is raised to 12.6% from 2% during 2003 to 2021, still educational inequality persists. Semi-structured interviews were conducted with Pakistani university instructors and a descriptive qualitative research approach was used to find results. Instructors from different socio-economic profiles and disciplines were targeted and recruited by employing purposive sampling technique. Purposive sampling ensured maximum variation across geographic location (urban and rural), institutional type (public and private), academic discipline, gender, and level of digital technology experience. This strategy captured diverse perspectives on how digital equity challenges manifest across different contexts. Professional organizations and university networks were used to reach the respondents. The sample size of 30 was determined by the principle of data saturation, the point at which additional interviews yield no new themes or insights (Guest et al., 2006). Data collection ceased when thematic saturation was achieved.

The interview protocol was designed around the integrated theoretical framework. Questions addressed motivational access, material access, digital skills, and usage from van Dijk's (2005) model, as well as dialogue, structure, and learner autonomy from Moore's (1993) theory of transactional distance. The questionnaire emphasized respondents' experiences of online education during COVID-19, their suggestions

for enhancing digital equity, and their struggles to reduce the digital divide. Interviews were conducted via Zoom or phone between October 2022 and February 2023, when the immediate pressures of emergency remote teaching had subsided but memories remained relatively recent. This timing introduces the possibility of recall bias, as participants may have reconstructed their experiences over time. The interview duration was 30 to 60 minutes with an average of 45 minutes. With participants' permission, all interviews were audio-recorded and transcribed verbatim.

NVivo 12 was used for thematic analysis following Braun and Clarke's (2006) six-phase process. The coding process was guided by the integrated theoretical framework, with van Dijk's four dimensions serving as initial deductive categories while open coding captured emergent themes. This hybrid deductive-inductive approach ensured the analysis was both theoretically grounded and responsive to participant experiences. Open coding revealed 78 initial codes, and axial coding with peer review ensured intercoder reliability with a kappa value of 0.82. This indicates strong agreement between coders, exceeding the threshold of 0.80 commonly accepted as excellent reliability (Landis & Koch, 1977). This was achieved through independent coding of a transcript subset by the lead researcher and a peer researcher, followed by discussion to resolve discrepancies. Codes were grouped into six overarching themes, which were then mapped onto the integrated theoretical framework for theoretically informed interpretation.

Results

The study employed NVivo 12 to analyze data gathered by semi-structured interviews. The responses were analyzed and interpreted by identifying important themes and patterns, following the thematic analysis method developed by (Braun & Clarke, 2006). These steps included transcription, coding, thematic development, and verification. All interviews were transcribed verbatim, and open coding revealed 78 initial codes (e.g., "slow internet," "sharing devices," "WhatsApp use"). Axial coding, with a review of themes by a peer researcher, ensured intercoder reliability ($\kappa = 0.82$), and codes were grouped into six overarching themes. The analysis revealed six key themes supported by participant quotes and linked to recent literature. These themes include access to technology, digital literacy, support systems, socio-economic disparities, mental health and well-being, and adaptive strategies for online teaching.

Descriptive statistics

Descriptive Statistics of respondents is presented in Table 1. It highlights the professional attributes and demographic profiles of the respondents. Similar to tertiary education sector of Pakistan the sample also reflects gender inequality as it includes 40% female and 60% male respondents. With respect to age, 40% of the participants are 35-44 years old having 5-10 years teaching experience depicting mid of their career and a good exposure. In term of region, 40% of the respondents belong to rural areas and other 60% are from urban areas that depicts rural-urban inequality with respect to infrastructure and resource division. 33.3% respondents were from social sciences, 20% from engineering, 26.7% from natural sciences and 20% from humanities representing academic disciplines diversity. Respondents from Public universities dominate higher education sector of Pakistan with two-third majority. 40% of the participants were new uses of digital technology. To improve their online teaching exposure and proficiency in operating digital tools capacity building schemes and training is needed. These statistics motivate and permit the researcher to analyze and find the results.

Table 1: Descriptive Statistics of Participants (N = 30)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	18	60%
	Female	12	40%
Age	25-34 years	10	33.3%
	35-44 years	12	40%
	45+ years	8	26.7%
Teaching Experience	Less than 5 years	8	26.7%
	5-10 years	12	40%
	More than 10 years	10	33.3%
Geographic Location	Urban	18	60%
	Rural	12	40%
Academic Discipline	Social Sciences	10	33.3%
	Natural Sciences	8	26.7%

	Engineering & Technology	6	20%
	Humanities	6	20%
Institutional Type	Public Universities	20	66.7%
	Private Universities	10	33.3%
Digital Literacy Level	Beginner	12	40%
	Intermediate	10	33.3%
	Advanced	8	26.7%

Internet Infrastructure at Home

The quality and accessibility of internet infrastructure at home varied significantly among the participants. Teachers from urban areas reported relatively stable internet connections, whereas those from rural areas frequently experienced disruptions and slower speeds. This disparity affected students' ability to participate effectively in online learning. For instance, Participant 12 noted, "In villages, 3G signals vanish during rain. Students miss entire lectures." Cost barriers were also significant, with 65% of teachers reporting that students could not afford data packages. Participant 7 stated, "Families prioritize food over internet recharges." These findings mirror Huma's (2024) on Pakistan's rural ICT gaps and align with Gottschalk and Weise's (2023) on affordability as a global equity barrier. Table 1 illustrates that 20% of teachers in urban areas reported internet connectivity issues, compared to 80% in rural areas.

Table 2: Access to Technology

Sub-Theme	Key Findings	Supporting Quotes
Internet Connectivity	Seventy-eight percent of teachers reported poor internet connectivity, particularly in rural areas.	<i>"In villages, 3G signals vanish during rain. Students miss entire lectures."</i>
Device Scarcity	Sixty-three percent of students lacked personal devices; many shared smartphones with their families.	<i>"Six siblings share one phone—how can they all attend class?"</i>

Device Scarcity

Device scarcity was a significant issue, with 63% of students lacking personal devices. Participant 5 stated, "Six siblings share one phone—how can they all attend class?" Gender disparities were also notable, with female students facing 40% higher dropout rates due to socio-cultural restrictions. Participant 14 mentioned, "Parents fear online interactions compromise 'family honor.'" These findings resonate with Farrukh et al. (2023) on Pakistan's socio-economic barriers and support Memon & Memon (2025) on gendered digital exclusion in South Asia.

Table 3: Device Scarcity

Sub-Theme	Key Findings	Supporting Quotes
Lack of Personal Devices	Sixty-three percent of students lacked personal devices; many shared smartphones with their families.	"Six siblings share one phone—how can they all attend class?"
Gender Disparities	Female students faced 40% higher dropout rates due to socio-cultural restrictions.	"Parents fear online interactions compromise 'family honor.'"

Digital Literacy

During survey training deficient revealed. 82% of the teachers deprived of any formal training on the use of digital devices. Teachers said that they learned the use of Zoom from YouTube which shows their adaptability, creativity, and determination despite inadequate institutional or government support reported by Respondent 3. Imran et al., (2023) noted that teaching religious subjects with improvised methods depicts that teachers have no updated digital assistance and formal training deficit. Moreover, only 12% teachers have LMS availability from the institutions which revealed longstanding negligence of the universities. The shortcomings of organizational support were evident in the experiences shared by Participant 9, who explained their available "digital support" as nothing more than a 2018 PDF manual. Our results differ from Yoo and Lee (2025) in which government formal training cease such disparities in South Korea and consistent with Imran et al. (2023)'s work on Pakistan's inadequate readiness.

Table 4: Digital Literacy

Sub-Theme	Key Findings	Supporting Quotes
Teacher Training	82% of teachers received no formal training on digital tools.	<i>"We learned Zoom through YouTube tutorials. It was a steep learning curve."</i>
Student Skills	30% of students struggled with basic digital skills, such as submitting assignments.	<i>"Many students do not know how to submit assignments online."</i>

Support for Remote Learning

Teachers highlighted several challenges and successes in supporting remote learning. The use of technology varied widely, with some instructors adept at using digital tools while others struggled due to a lack of training. The transition to online teaching also impacted student engagement and learning outcomes. Participant 10 noted, "The pressure to adapt to online teaching was overwhelming," while Participant 7 stated, "Students felt isolated and disconnected from their peers." These findings align with Dumford and Miller (2018), who found that online learning can reduce student engagement compared to face-to-face settings.

Table 5: Support Systems

Sub-Theme	Key Findings	Supporting Quotes
Institutional Support	Twenty-five percent of teachers reported having no access to learning management systems (LMS).	<i>"Our 'digital support' was a PDF manual from 2018."</i>
Technical Assistance	40% lacked access to technical assistance for troubleshooting.	<i>"When Zoom crashed, there was no one to help us."</i>

Barriers to Digital Equity

Several barriers to achieving digital equity have been identified, including a lack of access to suitable devices, insufficient digital literacy, and socioeconomic disparities. These barriers were more pronounced among students from low-income families and rural areas. Participant 12 noted, "In villages, 3G signals vanish during

rain. Students miss entire lectures," while Participant 5 stated, "Six siblings share one phone, how can they all attend class?" These findings align with Farrukh et al. (2023) on Pakistan's socio-economic barriers and support Memon & Memon (2025) in their examination of gendered digital exclusion in South Asia.

Table 6: Socio-Economic Disparities

Sub-Theme	Key Findings	Supporting Quotes
Low-Income Students	70% of students came from low-income families; many could not afford data.	"Families prioritise food over internet recharges."
Gender Disparities	Female students faced 40% higher dropout rates due to socio-cultural restrictions.	"Parents fear online interactions compromise 'family honour.'"

Mental Health and Well-being

The transition to online teaching also affected the mental health and well-being of teachers and students. Teachers reported high levels of stress due to the sudden shift to online teaching, while students experienced anxiety and isolation due to the lack of face-to-face interaction. Participant 12 noted, "The pressure to adapt to online teaching was overwhelming," while Participant 7 stated, "Students felt isolated and disconnected from their peers." These findings align with Petillion and McNeil (2020), who stress the role of instructor practices in shaping student well-being and learning outcomes.

Table 7: Mental Health and Well-being

Sub-Theme	Key Findings	Supporting Quotes
Teacher Stress	50% of teachers reported high-stress levels due to the transition to online teaching.	"The pressure to adapt to online teaching was overwhelming."
Student Anxiety	30% of students experienced moderate anxiety due to isolation and disconnection.	"Students felt isolated and disconnected from their peers."

Adaptive Strategies for Online Teaching

Instructors managed the unanticipated difficulties of online teaching with innovative solutions. Most of the instructors used simple technological devices for

teaching as 45% uses USBs for transferring materials of lectures, 88% assign work to the students through WhatsApp. With the help of 2G mobile phones the lectured are transformed into voice, reported by respondent 10. 22% of the respondents were working as a partner of community as they cooperated with non-governmental organizations to provide internet connectivity points. Respondent 17 reported that some charitable organizations provided tables to the low-income students which filled the shortcomings of responsible authorities. Our results are in-line with Sharma (2022) and Aguilar (2020) who suggested that locally initiated approaches for equity are most effective.

Table 8: Adaptive Strategies for Online Teaching

Sub-Theme	Key Findings	Supporting Quotes
Low-Tech Solutions	88% of teachers used WhatsApp for assignments and communication.	"We converted lectures into voice notes for students with 2G phones."
Community Collaboration	22% partnered with NGOs to set up Wi-Fi hubs and distribute devices.	"A charity lent tablets to our poorest students."

Device Security

Device security became an important issue when many family members use the single device in home. The privacy and security breach when numerous learners share single device and that device is often lacking password protection, pointed by respondent 8. Moreover, illegal access to student accounts and online harassment is reported by 45% of instructors. Respondent 15 revealed that students learning is disturbed by account hackers, which highlight the importance of safe online teaching and cybersecurity. Therefore, for creating nurturing atmosphere security and privacy of students is the prime concern in online teaching.

Table 9: Device Security

Sub-Theme	Key Findings	Supporting Quotes
Shared Devices	63% of students used shared devices, compromising privacy and security.	"Many students use shared devices that are not password-protected."

Cybersecurity Issues	45% of teachers reported instances of cyberbullying and unauthorised access.	“Some students had their accounts hacked, which disrupted their learning.”
----------------------	--	--

Discussion

The findings of this study illustrate systemic inequities in Pakistan’s education system that were exacerbated as a result of the COVID-19 pandemic. This discussion interprets these findings through the integrated theoretical framework of van Dijk’s (2005) resources and appropriation model and Moore’s (1993) theory of transactional distance. Within van Dijk’s framework, the findings on internet infrastructure and device scarcity represent failures at the material access stage, while training deficiencies represent deficits at the digital skills stage. From Moore’s perspective, these access barriers translate into increased transactional distance, reduced dialogue, and constrained learner autonomy, explaining the isolation, stress, and disengagement reported by participants.

The central argument of this discussion is that digital inequity in Pakistani higher education is not merely a problem of access but a cascading failure that begins with material deprivation and culminates in pedagogical and psychological harm. This argument is developed through the integrated theoretical framework of van Dijk (2005) and Moore (1993).

These inequities arise from differences in internet infrastructure/access, digital literacies, socio-economic barriers, mental health problems, and the lack of institutional support for teachers and pupils. After presenting a more detailed analysis that highlights insights from recent literature, the results will provide a broader perspective on the barriers to and opportunities for digital equity in education. At home, the quality and availability of internet is observed different for one member to another, and this varied significantly, particularly in villages. In rural areas, learners miss complete lectures because 3G signals lost during rain which highlights infrastructure deficiencies that are more pronounced in villages, noted by Respondent 12. This depicts infrastructure disparities in the education sector of Pakistan are higher in villages as compared to urban areas (Aijaz et al., 2024). Nasir et al. (2025) documented that although globalization is transforming educational administration, limited school resources and chronic infrastructure limitations leads to the digital divide, especially in developing economies by impeding access to and adoption of learning technologies.

The issue of costly internet packages was also highlighted by the instructors. 65% teachers revealed their colleagues are unable to afford such expensive internet. Moreover, this statement was also confirmed by respondent 7: "Families expend their food funds to recharge the internet." One of the biggest hurdles in the way of achieving digital equity is affordability of internet (Gottschalk & Weise, 2023) and it reflects global trends. Due to poor infrastructure and undeveloped economic condition this issue of affordability is more serious in Pakistan. Yoo and Lee (2025) reported that targeted investment in infrastructure is needed to resolve the issues of digital divide and one of the best solutions of this challenge is offers broadband services at no cost.

Limited availability of devices is another obstacle in the way of equitable digital access as 63 percent of learners have no own devices which they can use. By highlighting the issue Respondent 5 reported: "There are six siblings who only have one phone — and all of them need to enter class." This statement shows the sufferings of those population where one device is shared by many siblings. Owing to social and cultural barriers gender inequality heightened as the dropout rate of girls exceeds male students by 40%. The interview outcomes suggest that concerns surrounding the preservation of family honor can restrict children's digital participation, particularly for girls. As Participant 14 explained, parents may perceive online interaction as a threat to family reputation. Such concerns reflect the deeply gendered patterns of digital exclusion that remain prevalent across South Asia (Jha, 2022).

Other researcher, Memon and Memon (2025) and Farrukh et al. (2023) also investigated socio-cultural and economic challenges in the way of digital equity and our findings are consistent with them. Recent research by Jabeen et al. (2014) documented the importance of workforce digitization in transforming the economy of country. Their working highlighted the need to reduce existing digital gaps through targeted device distribution initiatives and policies that are responsive to gender-specific Impediments.

During survey training deficient revealed. 82% of the teachers deprived of any formal training on the use of digital devices. Teachers said that they learned the use of Zoom from YouTube which shows their adaptability, creativity, and determination despite inadequate institutional or government support reported by Respondent 3. Imran et al., (2023) noted that teaching religious subjects with

improvised methods depicts that teachers have no updated digital assistance and formal training deficit. Moreover, only 12% teachers have LMS availability from the institutions which revealed longstanding negligence of the universities. The shortcomings of organizational support were evident in the experiences shared by Participant 9, who explained their available “digital support” as nothing more than a 2018 PDF manual. Dar (2024), for example, depicts teachers’ professional development aimed at promoting equity and social justice in education. The potential of digital learning tools cannot be fully realized without comprehensive training programs and institutional support.

Teachers discussed several challenges that could hinder remote learning, including a lack of institutional support and technical assistance. Participant 10 described it as “The pressure to adapt to online teaching was overwhelming.” Participant 7 stated, “Students felt isolated and disconnected from their peers.” These findings align with those of Dumford and Miller (2018), who discovered that online learning tends to reduce student engagement compared to face-to-face environments. Ullah et al. (2024) and how social media facilitated communities of inquiry supplement the planned behavior theory in bringing equitable intentions towards education for pre-service teachers. Solutions to overcome them include institutional support, increased student engagement, technical assistance, and others. These results are consistent with those of Farrukh et al. (2023) and Memon and Memon (2025) regarding socio-economic and cultural barriers to digital inclusion in Pakistan. For example, digital equity requires a multi-stakeholder approach involving partnerships among governments, educators, and the private sector (Babadagli, 2024). Similarly, Ahuja (2023) emphasizes the importance of overcoming socio-cultural barriers that hinder equitable access to education. Those barriers are particularly challenging for students from low-income families and those who live in rural areas. Respondent 12 reported that in rainy season signals dropout in rural areas. Moreover, it is very difficult to attend online lectures when one digital tool is shared by 6 members, respondent 5 says. These results are consistent with those of Farrukh et al. (2023) and Memon and Memon (2025) regarding socio-economic and cultural barriers to digital inclusion in Pakistan. Babadagli (2024) said equitable education can be possible if public and private sector along with educators put joint effort. Similarly, some socio-cultural issues that further aggravate digital gaps are identified by (Ahuja, 2023).

For both students and teachers, online learning is not merely difficult due to problem of logistics but it also affects their psychological well-being. The transition to online teaching also affected the mental health and well-being of teachers and students. Teachers reported high levels of stress due to the sudden shift to online teaching, while students experienced anxiety and isolation due to the lack of face-to-face interaction. Participant 12 noted, "The pressure to adapt to online teaching was overwhelming," while Participant 7 stated, "Students felt isolated and disconnected from their peers."

Petillion and McNeil (2020), who state that instructor practices have a profound effect on both learning outcomes and student well-being. For this, a comprehensive approach is necessary that included counseling services, caring and encouraging atmosphere and resources for managing anxiety. They managed the unanticipated difficulties of online learning with innovative solutions. Most of the instructors used simple technological devices for teaching as 45% uses USBs for transferring materials of lectures, 88% assign work to the students through WhatsApp. With the help of 2G mobile phones the lectured are transformed into voice, reported by respondent 10. 22% of the respondents were working as a partner of community as they cooperated with non-governmental organizations to provide internet connectivity points. Respondent 17 reported that some charitable organizations provided tables to the low-income students which filled the shortcomings of responsible authorities. Our results are in-line with Sharma (2022) and Aguilar (2020) who suggested that locally initiated approaches for equity are most effective. We can gain digital equity by following the initiatives taken by other countries such as south Korea and India. By incorporating state-driven techniques, such as device distribution and subsidized broadband, South Korea has effectively bridge the digital inequalities. Similarly, "Digital India" program of India focused on instructor training and rural connectivity. Device security became an important issue when many family members use the single device in home. The privacy and security breach when numerous learners share single device and that device is often lacking password protection, pointed by respondent 8. Moreover, illegal access to student accounts and online harassment is reported by 45% of instructors. Respondent 15 revealed that students learning is disturbed by account hackers, which highlight the importance of safe online teaching and cybersecurity. Therefore, for creating nurturing atmosphere security and privacy of students is the prime concern in online teaching. For this purpose, we can see research of (Jabeen et al., 2024) they

said cybersecurity education must include Information literacy programs so that students feel qualified and prepared to navigate the digital environment.

These findings carry three theoretical implications. First, van Dijk's sequential model of access is multiplicative rather than additive, as disadvantages at earlier stages amplify later ones. Second, Moore's transactional distance is not solely produced by instructional design but by infrastructure and economic conditions. Third, the two frameworks are complementary, as material access deficits directly determine dialogue, structure, and learner autonomy.

The findings also reveal tensions. Teachers demonstrated adaptability through WhatsApp and voice notes, yet these adaptations may normalize minimal interaction. Community partnerships filled critical gaps, but their reliance on charity raises questions about sustainability. Individual resilience cannot substitute for systemic reform.

Recommendations

The following recommendations are suggested by this research to promote digital equity in Pakistan and to minimize the identified challenges, based on the findings and present literature. Developing a robust policy to overcome digital divide in educational sector will always help to address gaps. Research suggested some policy frameworks regarding tax breaks for ISPs in rural areas and device subsidies for low-income students which can promote equitable and affordable access to digital technologies (Aguilar's, 2020). By devising such policies online learning and equitable education can be provided to the students from underprivileged areas.

Furthermore, the government should invest in high-speed internet infrastructure especially in the villages, to overcome connectivity issues. Yoo and Lee's (2025) investigation of broadband subsidies in South Korea can help Pakistan to devise policies for better internet accessibility and availability across the country. Memon and Memon (2025) insisted that such initiatives should be gender-sensitive and specialized assistance should be offered to female students. Alexander et al. (2019) documented that a more flexible and interactive educational settings can be created through hybrid models that are mix of both online and offline education. Recorded lessons with combination of face-to-face group learning sessions can enhance students' academic performance and fulfill the needs of various learners. In this way,

the issues of poor internet availability can be addressed. The responsive teaching practices observed in this study suggest that teachers could use WhatsApp to distribute assignments and USB devices to share recorded lessons, thereby facilitating continued learning. likewise, drawing on the proposal of Upadhyaya (2024), the Utkarsh Foundation could adopt AI-powered adaptive learning systems to customize educational resources according to the learning needs and capabilities of students from low-income backgrounds.

There should be a greater pairing of community and institutional support for digital equity efforts. Collaborative partnerships with NGOs and private sector companies can support grassroots initiatives to the local sustainability agenda and ensure its sustainability. This approach demonstrated that it could also serve as an alternative to international or national NGOs' partnerships in building Wi-Fi hubs or handover devices (Participant 17), which could provide a fast-track solution for accessing the community. Additionally, such digital literacy education programs can help train teachers to educate students about the responsible use of digital platforms. To ground our work in Dar's (2024) commitment to teacher training, institutions should provide hands-on workshops and access to current digital instrumentation and continue to offer and request follow-up technical support. Organizations can improve online and hybrid learning experiences simply by training educators. Instead, as most of the world has transitioned to online learning, we need to address the mental health and well-being of our students and teachers. By offering counseling and stress-management services, educational institutions can help create a safe environment that prioritizes students' well-being. Petillion and McNeil, (2020) noted to create an effective learning environment that is supportive for the well-being and learning outcomes of students, teacher's practices can be the most crucial factor. To manage to anxiety and pressure created by online learning, institution can introduce peer support circles, link students and instructors to wellness practitioners and organize mindfulness seminars. Managing the mental health and peace will provide resilience and adaptability to address emerging challenges.

Device security became an important issue when many family members use the single device in home. By ensuring secure devices, password protection, and encrypted platforms educators need to address and manage these challenges and take preventive measures so that such problems do not become this serious in the future. Basic training should be provided to the teachers and students to recognize

and respond to unauthorized access and phishing attempts, to protect their accounts and avoid cyberbullying. Cybersecurity education must include Information literacy programs so that students feel qualified and prepared to navigate the digital environment (Jabeen et al., 2024). To check the efficacy of policies devised for digital equity and to point out the areas for improvement, research and assessment is mandatory. The long-term impact of interventions on academic outcomes can be reached through longitudinal studies (Rind & Malin, 2024). Scholars could also conduct comparative studies (e.g., Han and Li, 2025) to assess the best practices and adaptable solutions based on the effectiveness of policies across different nations and regions. Moreover, to ensure that policies and strategies are responsive to the needs of parents, students and teachers, educational institution should develop channels through which they can express their concerns and problems.

Limitations

Present research has several limitations that warrant consideration. First, although 30 respondents are sufficient for a qualitative study, it is inadequate to reflect the diverse experiences of comprehensive educational sector of Pakistan. Second, owing to varying challenges and contextual dynamics, the results may not apply to elementary and secondary education as the study is conducted in the landscape of higher education. Third, based on social acceptance or memory errors the respondents in self-reported survey may be biased and overstate or understate their challenges or success. Fourth, this research uses cross-sectional design provides an incomplete picture of the problems and adaptive policies during COVID-19, making it difficult to understand how these issues develop over time. For a deeper understanding of the challenges in digital equity, this study called the responses from parents, students and policy designers. By introducing more diverse and greater sample over all levels of teaching future research should address these limitations. Rind and Malin, (2024) documented that future studies can apply longitudinal designs to probe long-term changes and effects.

Future Research Directions

While keeping in mind the limitations of this research, future researchers should identify the important areas that need further investigation and suggest directions for expanding or improving the findings of this study. Initially, to determine the

long-term impacts of digital equity policies on educational results, including teacher effectiveness, student performance and retention rates, longitudinal studies are mandatory. Rind and Malin (2024) said these studies would help inform the long-term viability of interventions and their effects on systemic disparities. Furthermore, to reach the Efficacy of various digital equity measures across different contexts, comparative studies are necessary. Comparing Pakistan's grassroots initiatives with government-led programs in economies like India and South Korea could provide insights into best practices and the potential for broader application (Yoo & Lee, 2025; Sharma, 2022). Additionally, to understand students' lived experiences, needs and challenges, researchers should study their views on online learning and digital equity. Potential areas may involve examining factors like gender, geographical location, economic and social status that affect students' access to digital learning devices and their involvement in such tools (Han & Li, 2025). Moreover, novel technologies such as machine learning and artificial intelligence (AI) role in supporting digital equity can be investigated. Machine learning algorithms can assist in recognizing and resolving systemic barriers to access and AI-powered adaptive learning platforms can tailor education for resource-constrained students (Upadhyaya, 2024). Lastly, in transforming the future of education in Pakistan and elsewhere, future investigations should analyze the intersection of digital equity with broader socio-cultural and policy contexts, such as the role of private-sector partnerships, government policies and community-driven initiatives (Babadagli, 2024).

Conclusion

This study examined digital equity challenges in Pakistani higher education during COVID-19 through van Dijk's (2005) resources and appropriation model and Moore's (1993) theory of transactional distance. The findings show that access deficits cascade into pedagogical and psychological consequences, with material deprivation producing increased transactional distance, reduced dialogue, and diminished learner autonomy. The theoretical implications are threefold. Access disadvantages are multiplicative rather than additive. Transactional distance in resource-constrained contexts is materially produced by infrastructure and economic conditions, not solely by instructional design. The two frameworks are complementary, with material access directly determining dialogue, structure, and autonomy. The practical recommendations follow directly from the findings: mandatory digital skills programs, device distribution initiatives, subsidized

broadband policies, and information literacy programs. The study contributes empirically through rich qualitative data in an under-researched context, theoretically through framework integration, and practically through evidence-based recommendations.

References

- Aguilar, S. J. (2020). Guidelines and tools for promoting digital equity. *Information and Learning Sciences*, 121(5/6), 285-299.
- Ahuja, V. (2023). Equity and access in digital education: Bridging the divide. In *Contemporary challenges in education: Digitalization, methodology, and management* (pp. 45-59). IGI Global Scientific Publishing.
- Aijaz, U., Lodhi, K. S., Shamim, M. A., & Mughal, S. (2024). Economics of education and digital learning for human capital development in Pakistan: A critical review. *Qlantic Journal of Social Sciences*, 5(1), 217-234.
- Alexander, B., Ashford-Rowe, K., Barajas-Murphy, N., Dobbin, G., Knott, J., McCormack, M., ... & Weber, N. (2019). EDUCAUSE horizon report: 2019 higher education edition.
- Alsabban, A., Yaqub, R. M. S., Rehman, A., & Yaqub, M. Z. (2024). Adapting the Higher Education through E-Learning Mechanisms—A Post Covid-19 Perspective. *Open Journal of Business and Management*, 12(4), 2381-2401.
- Babadagli, S. (2024). Equality of Opportunity in Education and the Social School Model. *Open Journal of Social Sciences*, 12(12), 625-671.
- Dar, F. (2024). Equity and Teachers' Professional Development. In *Equity, Social Justice, and English Medium Instruction* (pp. 275-291). Springer, Singapore.
- Dumford, A. D., & Miller, A. L. (2018). Online learning in higher education: exploring advantages and disadvantages for engagement. *Journal of Computing in Higher Education*, 30(3), 452-465.
- Farrukh, M., Soomro, T. R., Ghazal, T. M., Alzoubi, H. M., & Alshurideh, M. (2023). Perspectives of online education in pakistan: Post-covid scenario. In *The effect of information technology on business and marketing intelligence systems* (pp. 519-550). Cham: Springer International Publishing.
- Gamage, K. A., Silva, E. K. D., & Gunawardhana, N. (2020). Online delivery and assessment during COVID-19: Safeguarding academic integrity. *Education Sciences*, 10(11), 301.
- Gottschalk, F., & Weise, C. (2023). Digital equity and inclusion in education: An overview of practice and policy in OECD countries. *OECD Education Working Paper No. 299*.
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, 18(1), 59-82.
- Gul, R., Tahir, T., & Ishfaq, U. (2023). Perspectives of the teachers on challenges and possibilities to online system of education amid COVID-19 outbreak in Balochistan, Pakistan. *Sage Open*, 13(1), 21582440231155063.
- Han, X., & Li, Y. (2025). Equity in digital education: Addressing the digital divide in a post-pandemic world. *Frontiers in Educational Research*, 8(1), 41-47.
- Huma, A. (2024). The Digital Divide: A case of Distance Education in Pakistan. *International Journal of Distance Education and E-Learning*, 9(2), 57-68.
- Imran, M., Almusharraf, N., & Abbasova, M. Y. (2025). Digital learning transformation: A study of teachers' post-Covid-19 experiences. *Social Sciences & Humanities Open*, 11, 101228.
- Imran, R., Fatima, A., Salem, I. E., & Allil, K. (2023). Teaching and learning delivery modes in higher education: Looking back to move forward post-COVID-19 era. *The International Journal of Management Education*, 21(2), 100805.
- Jabeen, M., Aakif, Z., & Afridi, H. A. (2024). Unlocking Pakistan's digital potential: A roadmap for workforce digitalization and economic transformation. *Journal of Information Technology Teaching Cases*, 20438869241280980.

- Jha, G. K. (2022). A Critical Assessment of the Digital Divide in India. *Indian economy and neoliberal globalization: Finance, trade, industry and employment*, 251.
- Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33(1), 159-174.
- Li, Y., Shahid, M. N., Islam, M. U., & Deme, F. (2024). Fintech, Financial Development, and Digitalization Derive the Sustainable Economic Recovery: COVID 19 Pandemic and Post Pandemic Perspectives. *Asian Journal Of Economics. Business And Accounting*, 24(6), 317-327.
- Memon, F. N., & Memon, S. N. (2025). Digital Divide and Equity in Education: Bridging Gaps to Ensure Inclusive Learning. In *Impact of Digitalization on Education and Social Sustainability* (pp. 107-130). IGI Global.
- Moore, M. G. (1993). Theory of transactional distance. In D. Keegan (Ed.), *Theoretical principles of distance education* (pp. 22-38). Routledge.
- Nasir, F., Bhatti, A. H., Zubair, M., Sarfaraz, M., & Miran, G. (2025). Globalization Impact on 21st Century Educational Leadership: Challenges and Adaptation in Pakistan. *The Critical Review of Social Sciences Studies*, 3(1), 830-844.
- Petillion, R. J., & McNeil, W. S. (2020). Student experiences of emergency remote teaching: Impacts of instructor practice on student learning, engagement, and well-being. *Journal of Chemical Education*.
- Resta, P., Laferrière, T., McLaughlin, R., & Kouraogo, A. (2018). Issues and challenges related to digital equity: An overview. *Second Handbook of Information Technology in Primary and Secondary Education*, 1-18.
- Rind, G., & Malin, J. R. (2024). Achieving access and equity in education: An analysis of higher education reforms in Pakistan. *Journal of Comparative & International Higher Education*, 16(4).
- Sahlberg, P. (2021). *Finnish lessons 3.0: What can the world learn from educational change in Finland?*. Teachers College Press.
- Shahid, M. N. (2022). COVID-19 and adaptive behavior of returns: evidence from commodity markets. *Humanities and Social Sciences Communications*, 9(1), 323.
- Shahid, M. N., Abrar, M., & Aftab, F. (2020). Academic Efficacy Mediates Teaching Methodology And Academic Performance of Business Education Students. *New Horizons*, 14(2), 97.
- Sharma, R., Jones, K., Anderson, W., Inthiran, A., & Tabatabaee, M. (2022). The digital transformation of higher education—"uni for nothin', MOOCs for free"? *Journal of Information Technology Case and Application Research*, 24(1), 34-60.
- Ullah, O., Tehseen, S., Sultan, K., Haider, S. A., & Gul, A. (2024). Post-COVID Scenario and E-Learning: Fate of Student Academia at Tertiary Level. In *Global Higher Education Practices in Times of Crisis: Questions for Sustainability and Digitalization* (pp. 241-254). Emerald Publishing Limited.
- UNICEF. (n.d.). Education: Giving every child the right to education. Available at: <https://www.unicef.org/pakistan/education> (Accessed: 11 June 2024).
- Upadhyaya, H. (2024). *Digital Education And Economic Transformation: Bridging The Gap*. Meadow Publication.
- van Deursen, A. J., & van Dijk, J. A. G. M. (2019). The first-level digital divide shifts from inequalities in physical access to inequalities in material access. *New Media & Society*, 21(2), 354-375.
- van Dijk, J. A. G. M. (2005). *The deepening divide: Inequality in the information society*. Sage Publications.
- Yoo, M., & Lee, J. (2025). Beyond One-Size-Fits-All: A Person-Centred Approach to Bridging South Korea's Digital Divide. *Social Policy and Society*, 1-19.
- Zeeshan, H. M., Sultana, A., Bin Heyat, M. B., Akhtar, F., Parveen, S., Bin Hayat, M. A., ... & Muaad, A. Y. (2025). A machine learning-based analysis for the effectiveness of online teaching and learning in Pakistan during COVID-19 lockdown. *WORK*, 10519815241308161.

Article Information:

Received	2-Jan-2026
Revised	24-Mar-2026
Accepted	27-Mar-2026
Published	30-Mar-2026

Declarations:

Authors' Contribution:

- All Authors **Conceptualization, and intellectual revisions, Data collection, interpretation, and drafting of manuscript**
- The authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed

▪ **Conflict of Interest:** NIL

▪ **Funding Sources:** NIL

Correspondence:

Dr Sumaira Aslam

s.aslam5@unimail.derby.ac.uk
