

## A Comparative Study of Digital Divide and Learning Outcomes between Urban and Rural Undergraduates

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### Abstract

Digital technology has become a part of the modern education systems and plays a prominent part in the way students are engaged in school and what they learn. The access to internet facilities, digital devices and technological resources, however, is unequal between rural and urban undergraduate students in developing countries such as Pakistan creating a digital gap between the two. The present study aimed to deepen the understanding of the impact of the digital divide on learning outcomes of the learners from rural and urban areas and of the key issues faced by the learners to access the Internet and literacy and involvement in digital activities. This type of research used is quantitative research, type of descriptive survey. The population studied was undergraduate students who were studying in the public universities. The total sample size was 245 students both from rural and urban area and the sampling technique used was random sampling. Data were gathered using a structured questionnaire with 5-point Likert scale. The collected data were analyzed using descriptive and inferential statistical techniques such as frequencies, percentages, mean scores and standard deviation, by Statistical Package for Social Sciences (SPSS). The findings showed that there are significant disparities between rural and urban students' access to educational opportunities online and to digital technologies. Internet connectivity was higher among the urban students, as was the availability of smart phones and laptops, and their involvement in online learning activities, than among their rural counterparts. Results also showed that digital technologies have a positive impact on students' academic achievements, communication skills, research skills, and educational engagement. Rural students, however, experienced a range of issues such as low internet connectivity, electricity shortages, financial constraints, low access to digital devices, and low digital literacy which reduced their learning. The study found the digital divide to be a major factor influencing learning outcomes of undergraduate students and leading to educational inequalities between the rural and the urban.

**Keywords:** Digital Divide, Learning Outcomes, Rural Students, Urban Students, Undergraduate Students, Digital Technology, Online Learning.

### Introduction

Rapid progress of Information and Communication Technologies (ICTs) has changed the face of education in the world. The use of digital technologies such as computers, mobile phones,

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internet and online learning platforms is a critical component of higher education. These technologies are used to access educational resources, communicate and foster independent learning. However, there is a digital divide in access, use and benefits from digital technologies (Jamil, 2021). Recent research studies have revealed that learning outcomes are significantly impacted by the digital divide. Zhao et al. (2022) found that, in rural areas, there is lower engagement with e-learning activities and a poorer academic outcome when compared to urban areas, which is caused by a lack of digital resources and digital capital.

Likewise, Mathrani et al. (2023) found that the availability of online education for rural students was also difficult, so their participation in online education was also low and their educational achievement was low. Today, digital technology is one of the most central features of today's education systems and has revolutionized the ways in which teaching and learning is done around the globe. With the development of modern information technology, educational institutions are increasingly relying on online learning platforms, digital library, virtual classroom, education application and Internet-based learning resources to enhance the quality of education and students' academic performance. Digital technology provides opportunities for students to enhance their communication, research, collaborative learning and participation in learning.

In this context, the importance of digital literacy and technological accessibility in higher education systems have become key features of the educational landscape of the world (Van Dijk, 2020). In the context of education, the role of digital technologies has increased since the outbreak of COVID-19 and a transition toward the use of online learning systems. Virtually, universities and colleges implemented virtual learning to continue teaching and learning activities during lockdown. However, this abrupt change identified significant disparities in students' access to ICTs and technology resources. Overall, students from urban areas tended to have higher access to the internet, to have a smartphone, to have a laptop and to have technological support than their rural counterparts. Consequently, rural students encountered barriers for attending online classes, accessing learning resources, and engaging in learning activities effectively (Ali & Ahmad, 2021).

Digital learning spaces enable flexible, student-centred learning in modern Higher education systems. Internet-based learning systems provide students with access to academic resources anytime, anywhere. Digital learning spaces also facilitate direct engagement between educators and learners by providing opportunities to discuss virtually, to participate in video conferences, to complete online assignments and to engage in collaborative learning activities. Therefore, digital technologies have been found to be important in some ways to improve the participation of educational activities and the school learning experiences of students (Selwyn, 2016). But with unequal access to digital technologies, there are serious educational inequalities between learners from different socio-economic and geographical backgrounds. Students without internet connectivity and technological devices are sometimes having trouble taking online classes, downloading learning materials, doing academic research, and doing assignments. These technological constraints have a negative impact on students' participation in education, communication skills, motivation to learn, and learning outcomes.

During COVID-19 pandemic, the educational inequalities were further exacerbated when many educational institutions around the world switched to online education as the main method of

learning (Robinson et al., 2020). In Pakistan, there are still a number of obstacles for rural students in relation to online learning and digital education. Many students struggle with weak internet connectivity, power shortages, financial constraints, lack of smartphones or laptops, and the limited digital literacy. Students face challenges with weak internet, electricity problems, financial difficulties, no smartphones or laptops, and lack of digital literacy. Pupils' academic attainment, participation and communication are having a detrimental effect on these barriers. On the other hand, the technological facilities and education provided in the city positively contribute to better educational outcomes and experiences for students (Khan et al., 2022).

Researchers in education also argue that disparate access to digital technology has adverse impacts on students' communication skills, involvement in research, self-confidence in learning, and motivation. Disadvantaged students continue to be unable to access digital learning opportunities on an equal footing due to a lack of educational supports and technological infrastructure. Therefore, the digital divide still impacts pupils' educational experiences and learning outcomes in developing countries (Ragnedda & Muschert 2013). The purpose of the present study is to investigate the effects of digital divide on learning achievements among rural and urban undergraduate students. The study also examines the primary issues of the rural learners with regard to access to internet, technology resources and participation in online learning. Furthermore, the study emphasizes the need to enhance digital infrastructure, technological access and digital literacy initiatives to counteract learning disparities and boost students' academic achievement in higher education institutions.

### **Objectives of the Study**

The main aims and objectives of the study were as follows:

1. In studying the influence of the digital divide on learning outcomes of undergraduate students in both rural and urban areas.
2. Major issues students have with Internet access, Internet resources and online learning that participation.

### **Literature Review**

Students with greater technoliteracy tend to be more successful academically and more engaged in their education than those who have less access to digital technologies. Prensky (2001) created the term “digital natives” and proposed that children who have developed in a digital world are more at ease and comfortable with technology in the learning environment and with online learning activities. These students can adjust better to the virtual learning systems and the technological educational tools. On the other hand, students who have less experience with technology may find it hard to engage in digital learning experiences and conduct academic work online. Helsper and Eynon (2010) found that technology inequalities are very much linked to educational participation and academic confidence of students. Students who have better technological resources and digital competence have higher motivation in learning and better learning activity participation. The study also revealed that the disadvantages of technology have a negative effect on student confidence and participation in learning.

According to Livingstone and Helsper (2007), lack of technology and poor internet connectivity are the reasons for not allowing students from disadvantaged groups to participate in education.

These disparities hinder students' effective engagement with digital learning contexts and have harmful impacts on students' learning outcomes. The researchers concluded that the technological accessibility is a reason that is vital to educational equality in today's education systems. Jenkins et al. (2009) have found that digital participation has a positive impact on students' communication skills, collaborative learning practices and information management skills. Regular use of educational technologies can enhance students' independence in learning and problem-solving skills. Digital learning spaces also foster an interactive and learning environment among learners. Technological accessibility is also shown to have a significant impact on student satisfaction in learning and learning outcomes in research studies. Students who have stable internet connectivity and technological devices will have easy access to educational resources, online lectures, and research opportunities. However, students who are not able to access the internet or have limited access to digital facilities may experience educational stress and/or less engagement with school (Wei & Hindman, 2011).

Van Deursen and Van Dijk (2014) described digital inequality as not only related to physical access to technology but also with educational usage of technology and digital skills. Pupils who have greater digital skills are still able to use educational technologies more effectively in their studies, and pupils who have less digital skills continue to lack the full potential of using online learning systems. Greenhow et al., (2009) found that social media and digital communication positively affect students' learning interactions and learning together. Learners who are active in online learning communities tend to be more engaged in learning and motivated to learn than those who are technologically isolated. Researchers in the field of education also suggest that access to technology is important to students' involvement in research and independent learning. Access to online academic information and digital libraries can foster better research skills and analysis in students who have easy access to these resources. This means that digital technologies have a positive impact on students' learning development and their learning outcomes (Merchant, 2012).

Erstad (2010) states that digital learning environments foster creativity, innovation and students' abilities to learn independently. Students involved in online learning activities may be more confident in handling educational tasks and responsibilities. The study found that educational technologies positively influence students' participation and learning experience in school. Studies in developing countries emphasized the need for technological infrastructure as a significant obstacle for equality in education. Insufficient educational technologies, lack of technological facilities and limited internet services have a negative impact on the educational opportunities and learning development of students. This is the case in particular for students in rural areas, who do not have good technological accessibility or digital resources (Hilbert, 2011).

Buckingham (2007) agrees that digital literacy is getting to be an important part of the educational need because learners need technological skills to participate in learning in the contemporary educational systems. Digital literacy students can search for educational information, assess digital information, and engage confidently in digital learning activities. In addition, studies on technology suggest that inequities have adverse effects on students' learning motivation and achievement. Students facing technological barriers tend to have lower levels of educational participation and lower levels of academic engagement. This means that educational institutions need to enhance technological accessibility and offer educational support systems to disadvantaged students (Witte & Mannon, 2010). This means that there are vast unequal

opportunities along socioeconomic and geographical lines for learning due to digital technology. The reviewed literature shows, that the digital divide has a significant impact on learning outcomes of undergraduate students, as in developing countries like Pakistan, rural students are still technologically disadvantaged and experience a lack of educational opportunities.

## **Research Methodology**

The present study was designed to investigate the effect of digital divide on learning outcomes of rural and urban undergraduate students. This study was aimed at exploring the disparities in internet access, internet availability, digital literacy and internet involvement between the rural and urban students. The researcher also sought to determine the major problems of students with regard to online learning and the study employed quantitative research method to obtain numerical data and use statistical analysis to analyse respondents' opinions, experiences and perceptions. This was deemed as suitable since the study was intended to make a comparative study between rural and urban students in terms of digital accessibility and learning outcomes. Quantitative research can also help researchers draw conclusions about the general population based on the sample they have studied, using statistical analysis.

The research design for the study was descriptive survey. The descriptive survey method was found to be appropriate because it is a method of collecting detailed information from many respondents within limited time period. This research design is frequently employed in educational research to investigate students' attitudes, problems, experiences and educational context. In this way, the researcher examined the relationship among the digital divide and students' learning outcomes on undergraduate students. The descriptive survey design also assisted in determining the major technological barriers that impact on the educational participation of students such as internet access, digital devices, technological infrastructure and digital literacy. Moreover, the design allows comparisons between students in rural and urban environments on access to digital learning opportunities.

The study was conducted among the undergraduate students from public universities. The population encompassed students from both rural and urban areas, as the study sought to compare their experiences of education with respect to digital access and learning outcomes. The choice of undergraduate students was made because the use of online learning systems, digital educational resources and online learning activities in higher education institutions has increased, placing greater demand on them. The number of students sampled for the study was 245 undergraduate students. The sample consisted of students from rural and urban areas to examine the differences in digital access, technological resources and learning outcomes. The sample selected was:

- 122 rural undergraduate students
- 123 urban undergraduate students

The students were selected from different departments of the college and different academic programs to ensure equal representation from each department and diversity in the study. The sample size was found to be sufficient for the collection of valid quantitative data, and suitable

for statistical analysis of the impact of the digital divide on the students' learning outcomes and participation.

The respondents were randomly selected for the study. Random sampling was considered appropriate as it provides equal opportunity to be selected in the population and less researcher bias in the selection of samples. To insure the type of data gathered was representative and adequately broad, undergraduate students in diverse disciplines of study and educational levels were sampled at random. The use of random sampling, in addition, also enabled the researcher to appropriately compare the students from the rural and urban areas in the case of internet access and availability of digital devices, participating in online learning activities and learning outcomes. The outcomes obtained from this sampling technique had enhanced reliability and validity.

The major research instrument used in collecting the data was a semi-structured questionnaire. The questionnaire had close-ended questions with Likert scale of 1-5, representing the following responses:

- Strongly Agree (SA)
- Agree (A)
- Neutral (N)
- Disagree (D)
- Strongly Disagree (SD)

The questionnaire was divided into different sections focusing on major variables related to the study. Each of the following statements contained information about:

- Availability of smartphones and laptops
- Participation in online learning activities
- Digital literacy skills
- Educational participation
- Academic performance
- Learning outcomes
- Technological challenges faced by students

The questionnaire was developed based on the literature and related research studies on digital technology, educational unequal opportunities and on line learning systems. The instrument was developed with great care to gather proper education experience related information and proper technological access information about the students.

The researcher personally visited educational institutions, and he also put questionnaires up online amongst the respondents. The respondents were briefed prior to data collection about the purpose and objectives of the research. The participants provided honest and unbiased observations and recommendations based on their experience of digital learning and technological accessibility. Confidentiality and privacy in data collection was adhered to by the researcher. Pressure from no source was placed on the public to participate in the study and respondents were made aware that the information they provided would be for academic/research only. Good collaboration with the educational institutions was achieved for data collection from undergraduate students.

## Data Analysis

Data collected has been analyzed using Statistical Package for Social Sciences (SPSS). The analysis of the data obtained from the respondents was conducted by using both the descriptive and inferential statistical techniques to investigate the perception of the respondents towards digital accessibility and learning outcomes. The following tools of descriptive statistics were used:

Frequencies > Percentages > Mean scores > Standard deviation

The presentive statistical techniques have been used in summarizing the student response to access internet, availability of digital resource, involvement in online learning, educational performance of students. Inferential statistical techniques such as:

- **t-test**
- **ANOVA**

These were also used to check difference between the students who live in rural areas and education and participation in learning students who live in urban areas in the social, cultural and economic dimensions including technological accessibility aspect. The researcher was able to determine that there were digital inequalities that potentially had a significant impact on students' academic performance and educational experiences through these statistical methods.

**Table No. 1**

Access to Digital Technology among Rural and Urban Undergraduate Students

| No. | Statement                                 | Rural Students (%) | Urban Students (%) | Mean | Std. Deviation |
|-----|-------------------------------------------|--------------------|--------------------|------|----------------|
| 1   | Access to stable internet facility        | 48%                | 92%                | 4.38 | .612           |
| 2   | Availability of smartphones/laptops       | 59%                | 95%                | 4.31 | .645           |
| 3   | Participation in online classes regularly | 52%                | 89%                | 4.25 | .688           |

|   |                                      |     |     |      |      |
|---|--------------------------------------|-----|-----|------|------|
| 4 | Access to digital learning materials | 50% | 93% | 4.34 | .601 |
| 5 | Digital literacy skills              | 45% | 88% | 4.20 | .711 |

Table No. 1 shows that there were many differences between students from rural versus urban backgrounds in terms of access to digital technology and opportunities for online learning. Urban students were found to have better access to stable internet facilities, smartphone, laptop and digital learning materials than their rural counterparts. The statement that had the highest mean score was “Access to stable internet facility” ( $M = 4.38$ ), suggesting high agreement among the respondents on the significance of internet access for successful participation in education. In the same way, the availability of digital learning materials ( $M = 4.34$ ) and smartphones or laptops ( $M = 4.31$ ) positively contribute to the learning opportunities and academic participation of students. The results also showed that the digital literacy skills of urban students were better than those of rural students, and that urban students were better able to attend online classes regularly. Limited Internet access and lack of digital resources were the technological challenges that were greater for the rural students. The low standard deviation scores demonstrate the responses' consistency on the perceived importance of digital accessibility and technological resources in supporting learning outcomes and participation in education for undergraduate students.

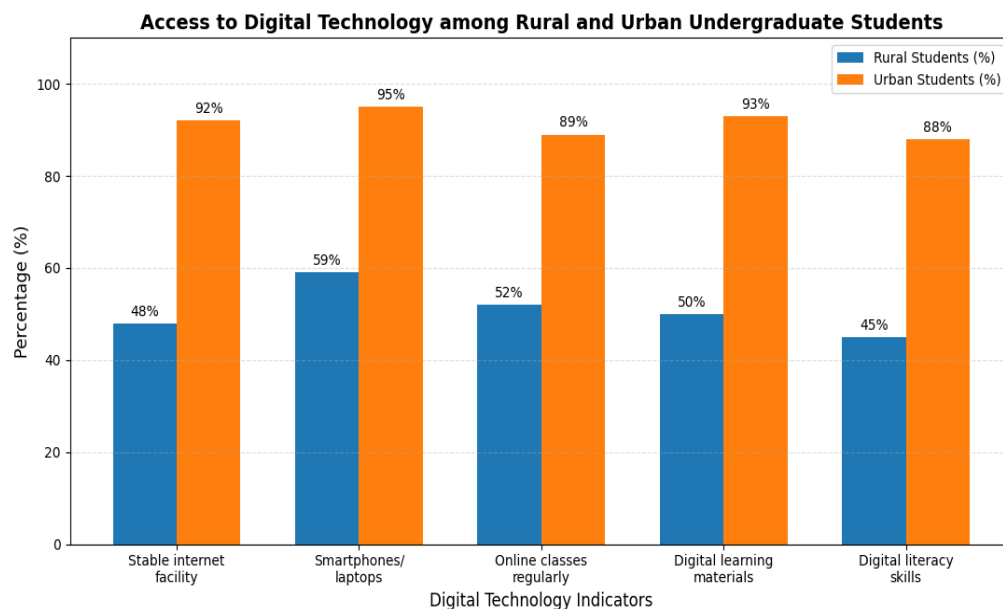


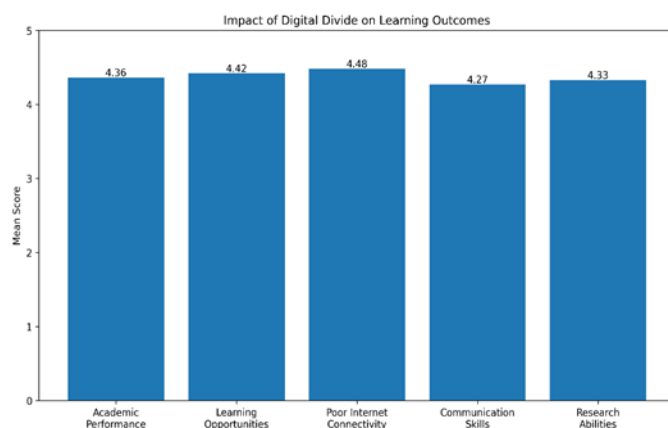
Figure 1: Percentage distribution of rural and urban undergraduate students regarding access to digital technology. The graph shows that urban students consistently reported higher percentages across all indicators, demonstrating a substantial digital divide between rural and urban populations.

Table No. 2

## Impact of Digital Divide on Learning Outcomes

| No. | Statement                                              | Mean | Std. Deviation |
|-----|--------------------------------------------------------|------|----------------|
| 1   | Digital technology improves academic performance       | 4.36 | .621           |
| 2   | Internet accessibility improves learning opportunities | 4.42 | .588           |
| 3   | Poor internet connectivity negatively affects studies  | 4.48 | .564           |
| 4   | Online learning improves communication skills          | 4.27 | .673           |
| 5   | Digital resources improve research abilities           | 4.33 | .607           |

The results presented in Table No. 2 shows that the digital divide has a significant impact on the students' learning outcomes and academic performance. The vast majority of the respondents supported that internet access and digital technologies have a positive influence on the participation of undergraduate students in education, communication skills, and research. Strong consensus between respondents was found for the statement 'Poor internet connectivity negatively affects studies' ( $M = 4.48$ ): the highest mean score was recorded here, indicating that poor internet connectivity is a serious problem when conducting academic activities and participating in online learning. Likewise, there was consensus among the respondents: Internet access enhances learning opportunities ( $M = 4.42$ ) and digital technology enhances academic performance ( $M = 4.36$ ). The results also showed that the students' research skills ( $M = 4.33$ ) and communication skills ( $M = 4.27$ ) in online learning environments were positively affected by digital resources. Students with better technological accessibility had higher levels of educational participation, learning experiences than those with technological limitations. The low SDs show the level of consistency of the respondents' perceptions that the use of digital technologies has helped improve their educational performance and learning outcomes in an undergraduate context.



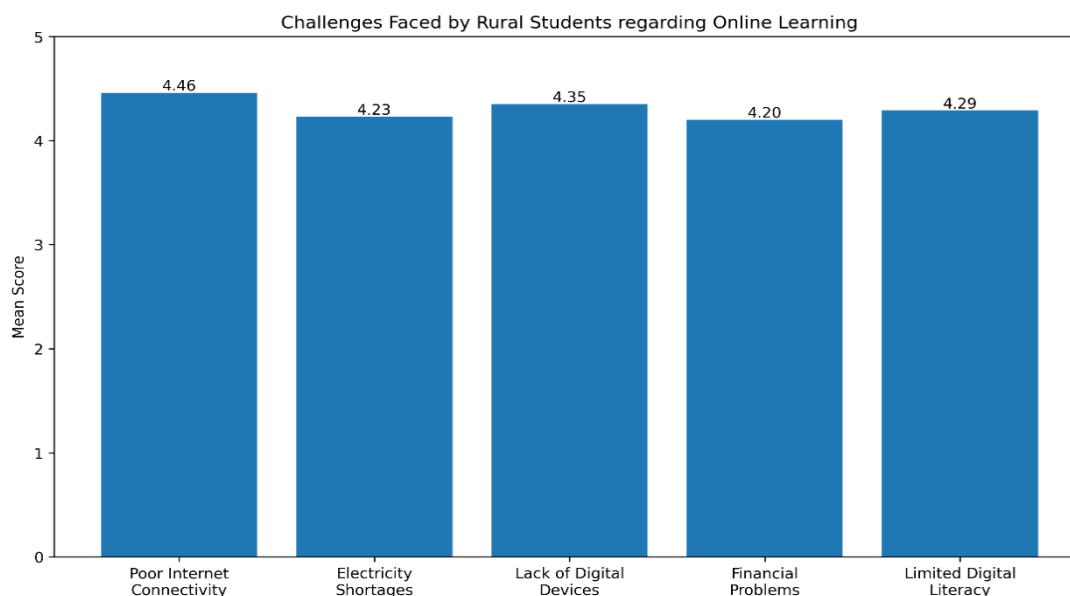
The graph indicates that digital technology has a positive impact on learning outcomes among undergraduate students. Poor internet connectivity was identified as the most significant challenge affecting academic performance. Overall, respondents agreed that internet access and digital resources enhance learning opportunities, communication skills, and research abilities.

Table No. 3

### Challenges Faced by Rural Students regarding Online Learning

| No. | Statement                                                 | Mean | Std. Deviation |
|-----|-----------------------------------------------------------|------|----------------|
| 1   | Poor internet connectivity affects online learning        | 4.46 | .572           |
| 2   | Electricity shortages create learning difficulties        | 4.23 | .688           |
| 3   | Lack of digital devices affects educational participation | 4.35 | .611           |
| 4   | Financial problems limit access to technology             | 4.20 | .704           |
| 5   | Limited digital literacy affects learning outcomes        | 4.29 | .633           |

Table No.3 indicates the key challenges of rural undergraduate students on online learning and digital education. Poor Internet connectivity, lack of access to electricity, lack of digital devices, financial constraints, and limited digital knowledge were found to significantly impact students' educational engagement and learning. Overall, the findings showed that the students strongly believed that the lack of an internet connection, lack of access to electricity, lack of digital devices, financial constraints, and limited digital knowledge affected students engagement and learning outcomes to a great extent. The mean score for the statement “Poor internet connectivity affects online learning” recorded 4.46 (strong agreement) among the respondents, thus reflecting their high agreement on how poor internet connectivity has a detrimental impact on the educational activities and academic performance of students. Similarly, respondents were in consensus about the negative impact of not having digital devices on educational participation ( $M = 4.35$ ) and on the lack of digital literacy on the learning outcomes ( $M = 4.29$ ). The results also showed that electricity problems cause learning difficulties among the students ( $M = 4.23$ ) and financial issues also cause limitations in using technological resources and educational resources and opportunities online ( $M = 4.20$ ). Such technological constrains limit the degree to which a student can engage with the online learning activities in a negative way impacting learning. Low standard deviation values show that there is consistency in respondents perception.



As demonstrated in the graph, there are multiple challenges for rural students when taking part in online education. Poor internet connectivity ( $M = 4.46$ ) topped the list of barriers, followed by lack of digital devices ( $M = 4.35$ ). There was a consensus that impediments regarding technological literacy, financial literacy and digital literacy have a negative influence on the involvement in online learning and the results of online learning.

## Discussion

The results of the present study indicated that there was indeed a digital divide that made a difference in the learning results of rural and urban students in their undergraduate studies. Widespread access to internet connectivity, smartphones, laptops and digital learning materials to improve the learning performance of the urban students, educational participation, communication and research skills. The rural students, however, experienced many challenges including poor internet service, lack of technological devices, lack of use of technology, shortage of electricity and financial problems affecting their learning experiences and performance. Another important finding of this study was that students who had higher access to digital technologies and had higher digital skills were more engaged in online learning, research and collaborative learning activities related to education. Digital tools also enabled students to learn on their own and it fostered their trust in learning participation. These results are similar to the previous studies which have recognized the unequal access to technology as a key reason for educational inequality among students of various geographical and socioeconomic backgrounds. The study finds therefore, that the key to educational equity and better learning outcome for undergraduate students is to achieve the lessen digital divide to solve the challenges of insufficient Internet access coverage, inadequate affordable digital devices and digital literacy programs.

## Conclusion

The present study found that learning outcomes are still significantly affected by the digital divide even for rural and urban undergraduate students. Accessible and available internet connectivity, digital devices and digital literacy skills were found to create notable differences in the participation in education and academic achievements. Rural students experienced slightly less access to digital technologies, insufficient infrastructure, finances and opportunities to learn compared to their urban peers. The study findings emphasise the vital role of digital access and digital literacy in effective learning, school engagement and future skills development in higher education. Steps must be taken to improve internet infrastructure, increase access to low-cost technological tools and foster digital literacy initiatives – especially in rural regions – so as to diminish educational disparities and to make sure children have access to this same equity in all learning areas.

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