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Impact of the Digital Divide on Learning Outcomes of Students in Higher Education Institutes

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ABSTRACT

Aim of the Study: The digital divide, characterized by unequal access to digital resources and technologies, poses significant challenges to students' learning in higher education institutes. This research study investigates the impact of the digital divide on learning outcomes of students in higher education.

Methodology: Through a comprehensive literature review and empirical analysis, the research explores the disparities in digital access, technological proficiency, and utilization of digital tools among students. It also examines the relationship between the digital divide and academic achievement, engagement, and overall learning outcomes. In this descriptive study the data were collected from 300 university students (ADP and BS programme) in Gugranwala District by using stratified random sampling technique.

Findings: The findings throw light on the detrimental effects of the digital divide on students' educational experiences, and provide insights for policymakers and educators to bridge the gap and foster equitable learning environments.

Conclusion: It was recommended that Higher Education Institutes (HEIs) should make digital literacy and computer skills, a mandatory requirement, for all degree programs.

Keywords: Digital Divide, Digital Equity Gap, Digital Access, Technological Proficiency, Learning Outcomes, Higher Education Institutes.

Introduction

Information and Communication Technologies (ICTs) have become an indispensable component of education, similar to its integration into many other facets of modern life, including commerce, politics, transportation, communication, and entertainment. Its beneficial effects on the processes of learning and teaching are well known. In order to provide content, reinforce students' skills, enhance the curriculum, and change the learning experience by experimenting with novel techniques, teachers successfully integrate technology into their instructional practices (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). One more notable aspect of emerging and novel technologies is their ability to facilitate collaboration, turning learning into an exciting and dynamic process. The interactive and participatory

nature of emerging technologies, especially their read/write aspect, fosters learning by enabling knowledge sharing, idea exchange, and collaborative writing (Goh & Kale, 2015).

For a society to progress effectively, students from higher education institutes (HEIs) should leverage emerging technologies to enhance their knowledge and skills. This necessitates providing physical access to different ICTs and equipping students with digital skills. Regretfully, not all students have equal opportunities to utilize ICT effectively, leading to a disparity known as the digital divide (Soomro et al., 2020).

The disparities in access to information and communication technologies, or ICTs, and the skills and expertise required to use the information obtained from connecting that exist between individuals, households, and other groups in Pakistan with varying demographic and socioeconomic backgrounds are referred to as the "digital divide" across the country. (Norris, 2001)

The term "digital divide" typically indicates the disparity betwixt individuals who have *access* to various forms of Information and Communication Technologies (ICTs) and those who do not. These forms predominantly include computers and the Internet, and occasionally encompass cellphones, especially smartphones, along with other digital software and hardware.

However, while understanding the digital divide, the first challenge lies in the varied nature of "*the concept of access*". Often, the term is used casually without recognizing its distinct meanings. Among the various meanings, the most commonly understood one pertains to owning a computer and having a network connection within the context of digital technology. Nonetheless, as claimed in Van Dijk's research in 1999, this definition represents only the second of four sequential forms of access referred to as "hurdles" or "barriers" on the way to a digitally informed and networked society.

Van Dijk's (2005) framework identifies four types of access:

1. "Psychological access" refers to the absence of any digital experience, which may be caused by disinterest, fear of computers, or a lack of appeal towards modern technology.

2. "Material access" indicates the absence of computer ownership and network connections.

3. "Skills access" refers to a lack of technology competence and digital skills brought on by a lack of user-friendliness, a lack of education, or a lack of social support.

4. "Usage access" denotes the scarcity of substantial chances to make use of digital resources.

Theoretical Framework

The theoretical foundation for this research is "Resources and Appropriation Theory," which is based on the relational view of inequality. In his famous book, The Deepening Divide, van Dijk (2005) refers to it as a theory of resources and appropriation, explaining the diffusion, acceptance, and adoption of new technologies. Four main elements that make up the theory are:

1. Disparities categorized on personal and positional level in society: This refers to various types of inequalities that exist among individuals based on their personal characteristics and social positions.

2. Resource distribution that affects inequality: This concept focuses on the allocation and availability of resources that are pertinent to the aforementioned types of inequalities.

3. Information and communication technologies (ICTs) access methods: This aspect examines the various ways in which individuals can access ICTs, including computers, the internet, and other digital tools.

4. Domains of involvement in society: This concept explores the various domains and realms in which individuals engage and participate within society.

First two elements are regarded as the causes, while the next two elements represent the phenomenon to be explained, and the probable outcome of the entire process respectively. As part of an ongoing process, the fourth element, in turn, influences the first two elements. In simple words, the allocation of resources within society and the links between category disparities will change in response to changes in involvement in different societal domains.

Additionally, a fifth element, the unique features of information and communication technology, must be considered as a side factor determining the type of inequality to be explained. This dynamic model represents the depiction of the theory, as illustrated in Figure 1 (adopted from van Dijk, 2005).
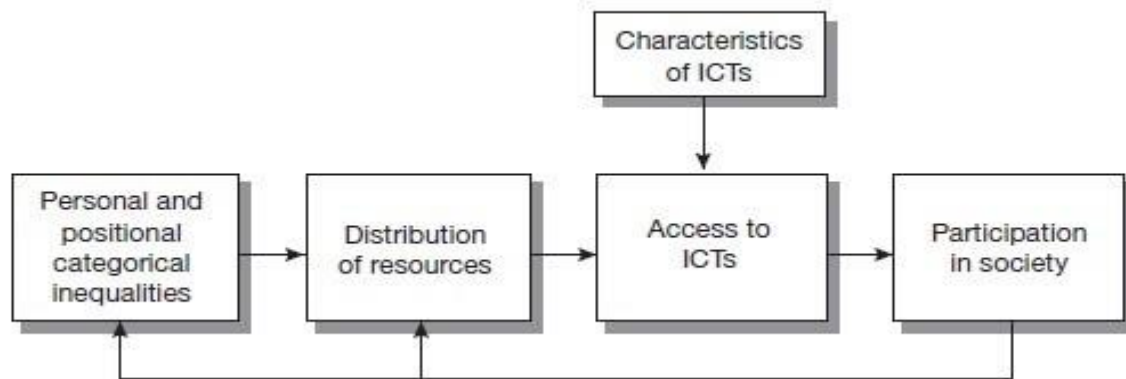

Figure 1: *A causal model of resources and appropriation theory*

The core argument of this theory can be summarized as follows:

1. An unequal allocation of resources is a result of categorical inequality in society.

2. Different people have different access to digital technology as a result of unequal resource distribution.

3. The features of digital technologies also have an impact on unequal access to them.

4. Unequal access to digital technologies results in unequal social involvement.

5. Uneven resource distribution and categorical inequality are strengthened by uneven involvement in society.

Implications of Digital Divide for Higher Education

The digital divide has far-reaching implications for education, encompassing various aspects that may not be immediately apparent. One of the primary effects is diminished academic performance, as learners without access to digital devices are deprived of valuable information that could advance their education. Additionally, students with a digital background are better equipped to embrace technology when pursuing further education, giving them a head start. Disadvantaged students, on the other hand, face obstacles in continuing their education due to limited access to digital tools, often resulting in dropout rates and the abandonment of educational paths. Moreover, learners with restricted digital access are more likely to spend an increased amount of time to accomplish their learning goals, impeding their long-term success.

The absence of access to digital tools and connectivity in the classroom can have lasting repercussions on children's lives, potentially hindering their ability to compete on an equal footing in the job market. Hence, there is a dire need to identify the digital divide among the students enrolled in higher education institutes and investigate its impact on the learning outcomes of those students.

Purpose of the Study

The study aims to explore the disparities in access to information and communication technology among students and how these disparities can influence their educational experiences. It seeks to examine the various dimensions of the digital divide, such as access to computers, digital skills, the Internet, and usage opportunities.

By analyzing the implications of the digital divide for learning outcomes, the research aims to shed light on the potential barriers and challenges faced by students who do not have adequate reach to technology. It also seeks to identify potential strategies or interventions that can help bridge the digital divide and mitigate its negative effects on student achievement.

Research Methodology

Research Design

This research was descriptive in nature using a quantitative approach. Descriptive research describes what it is. "Descriptive research is the research that determines and describes the way things are; involves collecting numerical data to test hypotheses or answer questions about the current subject of study." (Gay, 2012). This research is often conducted through survey. A cross-sectional survey was conducted to identify the digital equity gap among the students of higher education institutes.

Population and Sample

The population of the study included male and female students enrolled in ADP and BS programs in both public and private sector higher education institutes (HEIs) of district Gujranwala. A stratified random sampling was done to select an appropriate representative sample. At first, stratification of HEIs was done as public and private, and then students were stratified as enrolled in ADP and BS programs. A total of 300 students were sampled from 15 selected. The sample distribution is given in table 1.

Table 1: *Frequency Distribution of the Sample*

HEIs	Students		Total
	ADP enrolled	**BS enrolled**	
Public	47	81	128
Private	42	130	172
Total	89	211	300

Instrumentation and Collection of Data

With the purpose of collecting the data, the researcher developed a questionnaire based on the van Dijk's (2005) model of access to ICTs. The first two dimensions of access i.e., psychological access and material access were combined and labelled as 'digital access', while the latter two dimensions of access i.e., skill access and usage access were combined under the label 'technological proficiency'. The questionnaire was built to identify the disparity of digital access among students of higher education institutes. It also contained statements on Likert scale investigating the implications of digital divide for learners' learning outcomes, and inquiring about the strategies for bridging the digital equity gap. The reliability of the scale determined using Cronbach alpha ($\alpha = .870$) was fairly acceptable.

Data Analysis and Interpretation

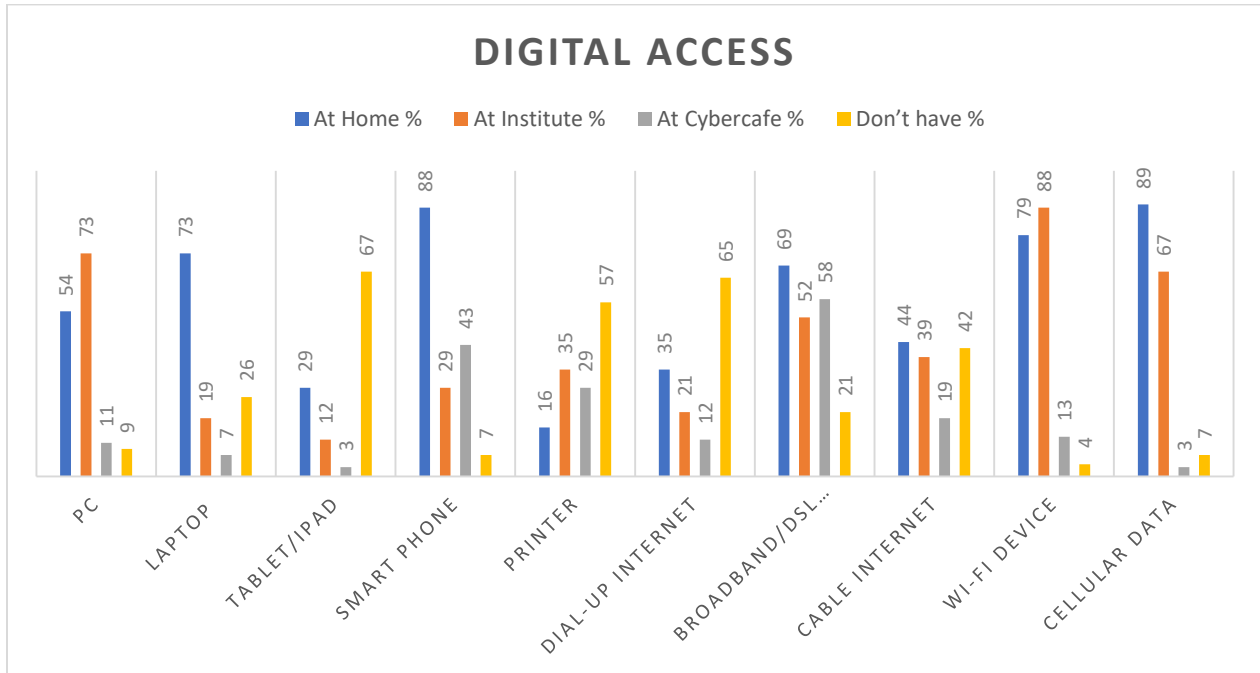*Digital Access and Its Impact on Students' Learning Outcomes*

Figure 2: *Distribution of the students' digital access to ICT devices and services*

Digital access to information and communication technologies (ICTs) among students was assessed using a comprehensive checklist encompassing various digital devices and software. Students were requested to indicate whether they had access to the listed devices at home, at institute, or at a cybercafe. The percentages of students reporting digital access to different ICT devices and services at each location are presented in Figure 2.

As illustrated in Figure 2, certain technologies like laptops, smartphones, cellular data, and Wi-Fi devices were accessible to a majority of the participants. Conversely, technologies such as printers, tablets, dial-up internet, and cable internet had limited accessibility among only a small proportion of the students.

The results indicated that the mean score for students' overall digital access was 2.79 (SD = 3.98). This value, ranging from 2.02 to 4.51, indicated a restricted access to a variety of ICT devices and services among students. Notably, students demonstrated significantly higher digital access at their homes (M = 3.110, SD = .794) compared to at-institute access (M = 2.828, SD = .898), and at cybercafe (M = 2.438, SD = .904).
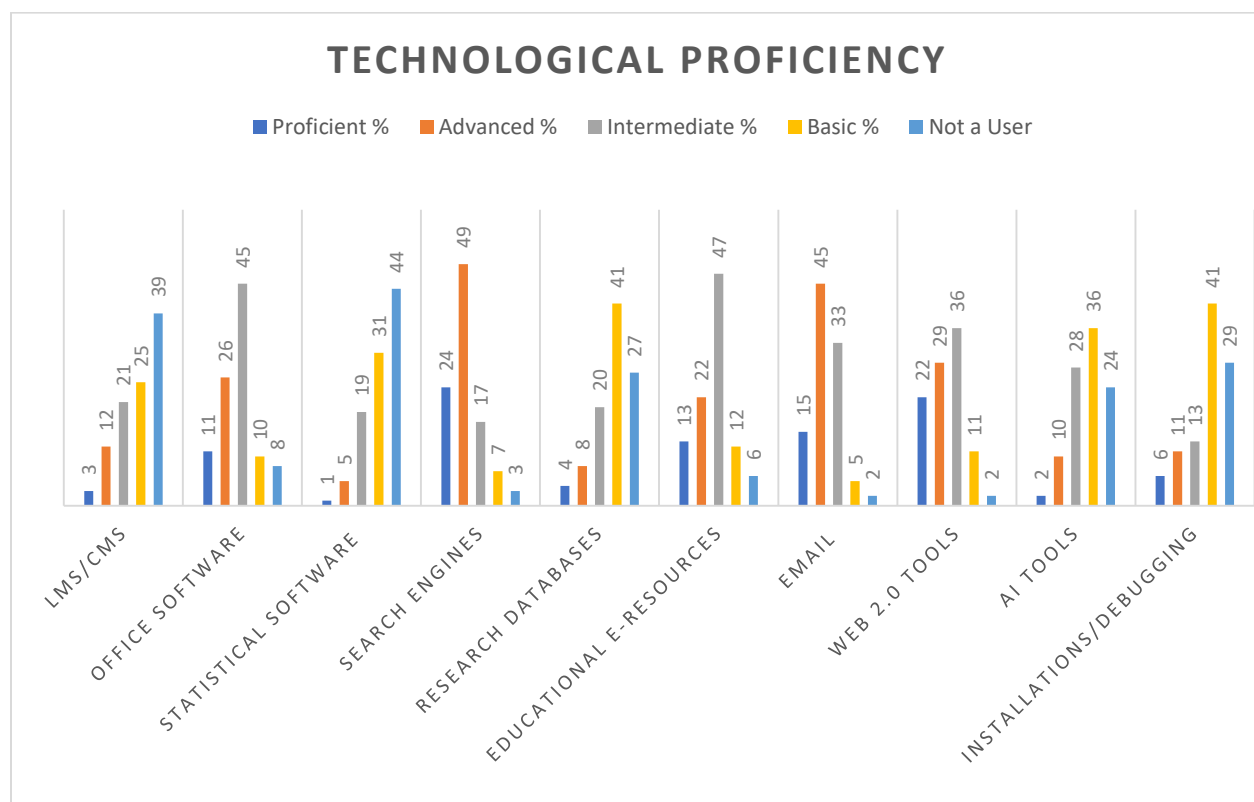
Figure 3: *Distribution of the students' technological proficiency in ICT tools and software*

Technological proficiency was assessed across five levels: proficient, advanced, intermediate, basic, and not a user. The findings revealed variations in students' technological proficiency across different ICTs, ranging from a mean score of 3.84 (SD = 3.63) for office software to a mean score of 1.88 (SD = 3.58) for statistical software. Overall, students exhibited a 'basic level' tend to be 'intermediate level' of technological proficiency, with a mean score of 2.73 (SD = 2.87).

Results and Discussion

Digital Divide Disparities in Higher Education

The findings highlight the disparities in digital access and technological proficiency among students in higher education institutes. It reveals variations in access to devices, internet connectivity, and digital literacy skills, contributing to the digital divide.

Impact on Learning Outcomes

The analysis demonstrates the negative impact of the digital divide on students' learning outcomes. Students with limited digital access and lower technological proficiency experience difficulties in accessing educational resources, engaging in online learning, and developing essential skills for academic success.

Strategies for Bridging the Digital Divide

The research study discusses potential strategies and interventions to bridge the digital divide in higher education. These include improving infrastructure, providing equitable access to digital resources, enhancing digital literacy programs, and fostering supportive learning environments.

Conclusion

This research study emphasizes the critical importance of addressing the digital divide in higher education institutes to ensure equitable learning outcomes for all students. By recognizing the impact of limited digital access and technological proficiency on students' educational experiences, policymakers and educators can implement targeted interventions to bridge the gap and foster inclusive learning environments that promote academic success.

Recommendations

The following recommendations are proposed in this research article to address the digital divide in higher education:

1. Higher Education Institutes (HEIs) should make digital literacy and computer skills a mandatory requirement for all students to ensure that students are equipped with the necessary knowledge and skills to navigate the digital landscape effectively.

2. Future studies should explore practices and policies that assist parents in creating a suitable learning environment at home for their children, incorporating the use of technology.

3. The government bodies, corporations, and school administrations should work together to provide the necessary resources and support to disadvantaged and underserved students to bridge the digital divide effectively.

4. Institutions should invest in upgrading their technological infrastructure, such as internet connectivity and access to digital devices, to ensure equitable access for all students.

5. Institutions should develop and enhance digital literacy programs to equip students with the necessary skills to navigate and utilize digital technologies effectively. These programs can include training sessions, workshops, and online resources designed to improve students' digital competencies.

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