Digital Divide in Education: A Systematic Review of Its Dimensions and Determinants

Sangita Singla
Research Scholar
Department of Library and Information Science
Kurukshetra University
Kurukshetra

*Ajay Kumar Arora
Librarian, Markanda National College
Shahabad Markanda, Haryana
Email: ajayarora.pu@gmail.com.

Sukhbir Singh
Research Scholar
Department of Library and Information Science
Kurukshetra University
Kurukshetra

Rupesh Gaur
Librarian & Head of Dept. Lib. & Inf. Sc.
Indira Gandhi National College,
Ladwa (Kurukshetra)

**corresponding author*

Abstract

This study investigates the rural-urban digital divide impacting students through a systematic analysis of global and regional scholarship. The study concentrate on five domains: digital infrastructure, literacy skills, educational outcomes, policy measures, and governance and policy.Database searches using ERIC, LISA, LISTA, and Google Scholar found 25 studies. Twelve of these were analyzed thematically based on their methodological quality, contextual diversity, and relevance. The results show that access to technology has grown, but using it effectively remains difficult due to factors such as insufficient digital skills, insufficient institutional support, and socioeconomic differences. Digital literacy now includes more than just technical skills. It also includes critical thinking, evaluating information, and using technology ethically. Even though online and blended learning are flexible, they have made it harder for students with different levels of digital preparation to become involved. School leadership, parental education, and community involvement have a big impact on how well students learn and how much they use technology. Policy analysis indicates that digital inclusion necessitates a transition from technology-centric strategies to governance frameworks that prioritize accessibility, affordability, awareness, and accountability.The conclusions stress that bridging the digital divide necessitates cohesive, participatory approaches that integrate technological

infrastructure, educational innovation, and inclusive governance to ensure sustainable and equitable digital engagement in education.

Keywords: Digital divide, rural-urban inequality, digital literacy, blended learning, educational policy, digital inclusion, governance, ICT, technological access, educational equity, socioeconomic inequality, educational development

Introduction

Digital technologies have changed the way we learn, talk to each other, and govern ourselves, but not everyone has benefited equally. The "digital divide," which refers to differences in access to, use of, and benefits from digital tools, is a big problem around the world. The disparities in internet access, device ownership, and technological proficiency between rural and urban areas continue to influence educational outcomes and opportunities (Shruthi et al., 2023). Despite significant investments in digital infrastructure by initiatives like Bharat Net and Digital India, rural areas continue to face challenges, including unreliable electricity, high implementation costs, and limited digital awareness (Rajapakse & Gunawardena, 2021). The digital divide is more than just the availability of hardware. It includes being able to use technology in an ethical way, being able to read and write in digital form, and being able to judge information (Shopova, 2014). Students need advanced digital skills to critically analyze and use digital content in school and at work (Boro et al., 2023). Online and blended learning platforms provide flexibility and accessibility; however, they have revealed disparities in engagement and motivation among students with differing levels of digital readiness (Akpen et al., 2024). Social, economic, and institutional factors exacerbate these problems. School leadership, parental education levels, and family income significantly influence students' access to and use of technology (Smith & Gümüş, 2022). Rural students often lack digital resources and professional guidance, which limits their educational goals and academic success (Deb, 2024). To close the digital divide, we need to do more than just build up our technology infrastructure. Reforming laws, giving people more power over their finances, and systematically teaching people digital skills are all important parts. This review looks at research on the digital divide between rural and urban students. It focuses on issues related to digital infrastructure, literacy, educational outcomes, and socioeconomic policy. It combines research from around the world and from different parts to find structural, cognitive, and motivational barriers to digital inclusion and suggests ways to make sure everyone can participate in digital education.

Materials and Methods

We conducted extensive online and offline literature searches for this paper, i.e., books, research articles, and academic databases were both primary and secondary sources. We used ERIC, LISA, LISTA, and Google Scholar to search for literature. The initial searches yielded over 25 pertinent papers. Twelve studies were chosen for in-depth analysis due to their relevance, methodological robustness, and representation across various educational contexts and geographical areas. Chosen studies underwent thematic evaluation, scrutinizing patterns, consistencies, and contradictions.

Objectives of the Study

1. To investigate the impact of disparities in internet connectivity, device accessibility, and technological readiness between rural and urban areas on students' digital learning experiences.
2. Assessing students' digital literacy and ICT competencies for academic, professional, and personal advancement
3. To examine the impact of online and blended learning models on student engagement, academic achievement, and equity in both rural and urban educational contexts.
4. To examine the influence of socioeconomic and institutional factors—such as family background, educational resources, leadership practices, and community engagement—on students' digital access and academic performance.

Dimensions and Determinants of Digital Divide

a. ***Access to Digital Infrastructure***

Shruthi et al. (2023) examined technological, economic, and policy challenges in rural internet connectivity throughout India via an IEEE survey. They look at Bharat Net, PM-WANI, and Digital India programs, as well as new technologies like 5G, satellite internet, and neutral host networks. Some of the problems that have been found are high costs of implementation, unreliable power, low digital awareness, and a lack of sustainable business models. To close the gap between rural and urban areas, digital inclusion needs coordinated efforts in infrastructure development, socio-economic support, policy, and education.

Ignatiev et al. (2021) investigated the digital device preparedness of students at Saint Petersburg Mining University for blended learning in graphical sciences. Researchers used standardized questionnaires to ask 140 students about their access to devices, the reliability of the internet, and how well they could communicate with professors online. The results showed that 90% of the people had reliable internet, 95% owned computers, and most of them had the right technology for blended learning. Cluster analysis found two groups of students: those who were ready for online learning and those who needed help. Researchers proposed that institutions could incorporate advanced technologies such as augmented reality, CRM systems, and mobile applications, given students' demonstrated technological readiness. This study examines the infrastructure and methodology of blended learning in technical education.

b. ***Digital Knowledge and Skills***

Shopova's 2014 study is among the initial systematic examinations of digital literacy in higher education. At South-West University in Bulgaria, research investigated the utilization of ICTs by university students for academic purposes and their motivation to enhance digital competencies. A survey of 60 humanities students revealed that while most were adept at fundamental computer operations, they were deficient in advanced information literacy skills, particularly in locating, assessing, and ethically utilizing digital resources. Students need help from their schools and rewards for using ICT in their studies. The study examines Europe 2020's educational objectives, lifelong learning, and fundamental digital competencies. Boro, Laltlanzova, and Chanchinmawia (2023) analyzed digital literacy research among

postgraduate science students at four central universities in North-Eastern India. A thorough questionnaire sent out on paper and through Google Forms got 198 valid answers from 240 people. Students learned how to use computers and phones in the library and through user instruction. Students were good at using WhatsApp, Instagram, and YouTube, but they had trouble doing research on the internet and checking facts. The studysuggests organized campaigns to teach users and raise awareness to improve academic digital skills and information verification. Being good with technology doesn't mean you're good at thinking and judging things.

Varghese and Arya (2024) investigated digital proficiency among 860 prospective educators in Kerala, a state noted for its integration of ICT in education. This study embodies India's NEP 2020 educational framework. The descriptive survey employed a self-developed Digital Literacy Scale (informed by OECD and P21 frameworks), indicating that 71.6% of respondents possessed average digital literacy, with no notable disparities observed by gender, region, or subject specialty. Not many of the people who answered thought that their teacher education program helped them become more digitally literate. Researchers advocate for techno-pedagogical training, ongoing professional development, and contextual ICT integration in teacher education programs to facilitate 21st-century learning.

c. *Effects on Learning*

Akpen et al. (2024) conducted a review of 18 peer-reviewed articles (2019-2024) regarding the influence of online learning on student performance and engagement. This PRISMA-based review compiled results from global higher education settings. Several studies show that the flexibility and accessibility of online platforms improve academic performance, while others show that they make students less interested and less connected to their peers. For online learning to work, you need good technology, good teaching methods, motivated students, and fun lessons. Online learning is most effective when it strikes a balance between flexibility and meaningful engagement strategies, such as multimedia tools, discussion forums, and instructor feedback. Authors advocate for innovative pedagogical methodologies and the assurance of universal access to digital technology to sustain online engagement and achievement. Gandhi and Umair (2025) critically analyze the effects of technological disparities on the quality and accessibility of rural education in the International Journal of Research Publication and Reviews. The digital divide, or differences in access to ICT, makes education less fair and slows down economic growth. Qualitative surveys, interviews, and case studies uncover substantial issues: inadequate infrastructure, low digital literacy, insufficient teacher training, and restricted internet access. The study shows the link between India's problems with rural education to global trends by using the views of UNESCO, the World Bank, and the ITU. The study also provides actionable recommendations such as enhancing Digital India and BharatNet, promoting private sector collaboration, training educators, and creating community digital centers. Quantitative data and regional comparisons may enhance generalizability.

d. *Institutional and socioeconomic determinants*

Smith and Gümüş (2022) examine the capacity of school leadership to alleviate socioeconomic disparities in the academic performance of Danish public-school students. Longitudinal

multilevel data were analyzed to examine the effects of leadership capability and teacher-leader dialogue on reading and mathematics outcomes among 2,100 teachers and 5,700 students. Leadership did not directly affect achievement; however, communication between teachers and leaders weakened the link between a school's socioeconomic status and student achievement, especially in math. Interactions between teachers and leaders help to level the playing field in schools. Leadership practices that promote collaboration and accountability in low-SES schools can have an indirect effect on student achievement.

Rathee (2024) studied the socioeconomic factors that influence the academic achievement of children aged 5 to 12 in Jhajjar, Sonipat, Rohtak, and Gurugram. The mixed-methods study involving 80 children and 8 educators demonstrated that family income, parental education, educational resources, and parental engagement significantly impact student learning. Caste and family size exhibited negligible effects, contesting traditional social hierarchies. Having access to resources and parents who are involved in their children's education improves learning for people of all social classes. School-community partnerships and campaigns to raise awareness can help low-income parents and close learning gaps. This study endorses policy-level educational equity initiatives in developing nations.

Deb (2024) investigates the impact of socioeconomic background on educational aspirations among rural and urban students in Barasat Subdivision. Interviews and focus group discussions with students, parents, and educators indicate that urban students have better educational resources, parental support, and career guidance than rural students, who have lower family income, poor infrastructure, and limited access to higher education. Thematic analysis reveals that disparities in resources, parental education, cultural norms, and gender roles influence aspirations. Differences in education go beyond grades to include goals, so educational policy needs to be inclusive and address both material and motivational gaps. To make education fairer, we need better infrastructure, more community awareness, and laws that are more focused.

e. *Governance and Policy*

Rajapakse and Gunawardena (2021) examine the governance and policy challenges that emerging countries encounter in relation to digital inclusion. Authors critique the frameworks for implementing digital policy and public participation in Asia and Africa. Governance issues related to digital inclusion need fair access, digital literacy, and policy-making that includes the public. The authors suggest a Digital Inclusion Framework (DIF) that includes accessibility, affordability, awareness, and accountability. To keep digital inclusion going, governments need to spend money on public digital infrastructure and use participatory governance models. This post-pandemic study transitioned from analyzing the digital divide via access to evaluating it through governance and inclusion frameworks.

Szabó (2024) presents an extensive digital divide model for global digital transformation. Research employs structural, cognitive, and motivational frameworks to analyze variances among individuals, organizations, and nations. This theoretical study examines economic, social, educational, political, and technological disparities that inhibit the utilization of digital technology, distinguishing it from prior research focused on infrastructure and access. To close the digital divide, we need both macro (national/regional) and micro (organizational/individual)

interventions. To measure digital progress, research uses global indexes such as DESI, DII, DiGiX, and ADII. Digital transformation that lasts needs infrastructure, cognitive empowerment, motivational incentives, and education that includes everyone.

Research Gaps in Studies of the Digital Divide

***Too much focus on access*:** A lot of research looks at how people can get to digital infrastructure (like the internet, devices, and electricity), but not enough looks at how those resources are used to learn and improve skills.

Limited Digital Literacy Analysis: Research generally assesses fundamental computer or internet skills instead of information evaluation, critical thinking, or ethical digital conduct. Insufficient Longitudinal and Comparative Studies: Limited research investigates long-term advancements or contrasts rural and urban areas to assess the impact of infrastructure enhancements on education.

Weak Educational Outcomes Focus*:* Research frequently examines online learning platforms without evaluating the impact of digital access on student motivation, engagement, and academic achievement.

Overlooked Institutional and Community Factors: Limited research investigates the influence of school leadership, teacher competence, community support, and cultural context on student digital engagement.

Poor Socioeconomic Integration: Socioeconomic research examines income and parental education without addressing their impact on institutional resources and policy execution.

***Policy Implementation Gap*:** The majority of policy research emphasizes formulation over the implementation, monitoring, and evaluation of digital inclusion programs. Few studies look at digital participation inequality by bringing together technology, education, and government.

Underrepresentation of Developing Countries: The literature lacks substantial data from rural or resource-limited contexts, thereby favoring wealthier nations.

Need for Interdisciplinary Research: There aren't enough thorough, data-driven studies that examine technology, education, and society from different angles to develop long-lasting, fair solutions.

References

Akpen, C. N., Asaolu, S., Atobatele, S., Okagbue, H., & Sampson, S. (2024). Impact of online learning on student's performance and engagement: a systematic review. Discover Education, 3(1), 205.

Boro, B., Laltlanzova, R., &Chanchinmawia, F. (2023). Digital Literacy Skills among the Postgraduate (PG) Students: a study of selected Central Universities of North East India. College Libraries, 38(II), 40-49.

Deb, A. (2024). Bridging the gap: A case study on the role of socioeconomic background in shaping educational aspirations of rural and urban students in Barasat Subdivision, West Bengal, India. The Academic, 2(12), 190–204.

Gandhi, G., & Umair, R. (2025). The digital divide's effects on education in rural areas. International Journal of Research Publication and Reviews, 6(5), 4447–4449.

Gunawardena, H. and Rajapakse, N. (2021). Policy for digital inclusion and governance. Policy Development and Governance, 5(2), 45–56.

Ignatiev, S., Folomkin, A., Shamrov, I., Trubetskaya, O., & Moroz, O. (2021). Availability of student devices for integrated graphics science education. World Transactions on ETE, 19(2), 196–202.

Phillips A, K., Smyth, J. D., and Stenger. (2025). The COVID-19 pandemic exacerbated the digital divide between urban and rural areas regarding internet access and online engagement. Rural Sociology, 90(3), e70012. https://doi.org/10.1111/ruso.70012

Rathee R (2024). Bridging the gap: Looking at how socioeconomic factors affect the academic performance of primary school students in Haryana, India. Educational Administration: Theory and Practice, 30(5), 14428–14438. https://doi.org/10.53555/kuey.v30i5.6660

Shopova, T. (2014). Enhancement of digital literacy among university students. Efficiency and Responsibility in Education and Science, 7(2), 26–32. https://doi.org/10.7160/eriesj.2014.070201

Shruthi, K. A., Ihita, G. V., and Chaudhari, S. (2023). Survey on internet connections in rural India. IEEE Access, 11, 1–25.

Smith, E., and Gümüş, S. (2022). School leadership and socioeconomic achievement gaps: Tackling disparities in student achievement both within and between schools. International Journal of Educational Research, 112, 101951. https://doi.org/10.1016/j.ijer.2022.101951

Szabó RZ (2024). Cognitive basis for bridging the digital divide. Infrastructure, Policy, and Development, 8(16), 10082. https://doi.org/10.24294/jipd10082

Varghese J and A. K. Arya (2024). Investigating 21st-century digital literacy competencies in prospective educators for comprehensive learning. Indian Journal of Educational Technology, 6(2), 282–290.