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IMPACT OF DIGITAL DIVIDE ON UNDERGRADUATE EDUCATION IN WEST BENGAL

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RESEARCH ARTICLE

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Abstract

The digital divide between the undergraduate population in West Bengal is a huge barrier to opportunity and equitable access to education. This gap has become even more pronounced during the post-pandemic phase when digital tools become instrumental in improving the delivery of higher education. The disparities in internet connectivity, access to personal devices, digital literacy, and infrastructural support can impact undergraduates from developing regions and marginalized groups more intensively, posits the paper. Based on research through content-based method it is analyzed that due to unstable internet access rural undergraduates are 20-25 percentage more likely to drop out academically. Urban-urban inequalities are further compounded by social tensions based on gender, caste, and economic status. The Gross Enrollment Ratio (GER) gap is quite sizeable. GER for rural areas is a mere 15% whereas that for urban areas is 25%. Also, as of early 2025, state government-approved digital education initiative has covered just a small number of (around 30) colleges in the state. The paper examines inter-connectivity of these problems, and proposes the use of integrative policy instruments, including enhancing broadband infrastructure, introducing targeted digital literacy education, and promoting community-based solutions to reduce exclusion. According to the national aspirations for digital inclusion, closing the digital divide must be essential to creation of an inclusive undergraduate education system, improving future job prospects, and long-term social and economic growth in West Bengal.

Keywords: *Digital divide, Undergraduate education, Digital literacy gaps, Rural-urban inequities, Gender and caste intersections*

Introduction

The development of digital technology has transformed higher education around the world by broadening the scope of learning interactivity, resources, and teaching methods. In West Bengal, however, a state known for its old intellectual centers such as the University of Calcutta and Jadavpur University, these changes have only partially aided undergraduate students because of the still persisting digital gap (Ghosh, 2023; Chatterjee, 2022). West Bengal's undergraduate education includes arts and sciences, commerce, engineering, and even newer disciplines like data science, which attract over 1.8 million students every year from all social and economic strata (AISHE, 2022). As of August 07, 2025, West Bengal's higher education landscape continues to be a mix of development and disparity: while urban centers, such as Kolkata, have high-speed internet access over 85%, rural districts struggle with 45% connectivity, hampering students' access to online classes, virtual libraries, collaborative work spaces, and a multitude of digital resources beyond attending lectures (Mitra, 2024; NITI Aayog, 2024).

Not only technology but also social factors matter. According to gender norms, female students cannot access the public access digital (PAD) facilities. In addition, the SC and ST communities face caste discrimination. Studies show that lack of device ownership among low-income families is due to poverty (Biswas, 2025; Khatun, 2021). Four out of every ten students in rural areas own a personal smartphone, laptop, or tablet. On the contrary, 80% of students in their cities own a device. A 2024 study from Jana implies, learning gaps are becoming worse during hybrid classes. In 2021, RUSA and the launch of the West Bengal Student Credit Card Scheme were among government interventions that attempted to subsidize gadgets and improve digital classrooms, among other issues. The rural colleges, as per Sen and Das (2023), are lacking covered low access areas.

The implications of this go beyond academics. It makes an impact on employability in the state. The economic development of the state continues to grow in the various sectors. If students are not given technological tools, they will fall behind in the jobs race.

The job market which mainly requires technology-enabled competency will not be done well by them. (Ashokkumar et al., 2024). The article takes stock of these dynamics by examining data on enrollments, a policy analysis and graphs of differences. The reference to the above lines in the paper is called a reform. For accomplishing the purpose, the above must be estimated and identified. For achieving these ends, data will be updated and communication with experts shall be installed. Thus, the paper justifies use of the term reform to the suggests. It will also make an attempt to contribute to the bigger discourse on sustainable development of higher education in West Bengal as On August 07, 2025 (Ghosh, 2023; Mitra, 2024). Over 20% of the rural West Bengal population is poor. Reason could lie in India's low personal technology investment of 3%. The Digital Divide in West Bengal. Over the years, related issues have … citification of cities have taken place because of various historical factors in recent year. Some areas of the state, especially rural ones, have lagged behind due to colonial rule and unequal development. The pandemic caused such a quick switch to online learning that the administration couldn't handle all the problems with the system. As per a commission estimate, over 50% of rural students suffered from learning losses due to the unavailability of stable internet connectivity during lockdowns (UNESCO 2021). Solutions must be based not just on tech but also approaches that mobilizes communities and their actors in graduating to the mainstream (Roy, 2023). The study focuses on the Digital Divide Theory. The study states that inequalities in access, skills and usage not only have impact on education but also give rise to differences in educational attainment (van Dijk, 2006). A study indicated that according to social capital theory, community networks and institutional support mitigate or amplify economic gaps.

Review of Related Literature

The literature mentioned above points to the rising concern with the impact of digital inequalities on equity and outcomes in higher education, particularly in socio-economically diverse West Bengal (Chatterjee, 2022; Ghosh, 2023). You can get an online essay help to know more about it. According to the All India Survey on Higher Education (AISHE, 2022), the state achieved 1.8 million undergraduate enrollment in the year 2021-2022. Yet, the rural-urban divide in the region continues to be a challenge as 55% of enrolled rural students face connectivity issues that affect their retention (AISHE, 2022) Generally speaking. According to Jana (2024), higher education diversification is taking place with enrolment increases of SC students by 30 % from 2012 to 2017. Technology-enabled courses online see poor performance by SC students due to digital exclusion and lack of availability of resources online.

Studies done after the COVID-19 pandemic reveal the inequalities that existed and that became worse after online classes were introduced. According to one study, 17% of students from West Bengal suffered e-learning disruption due to no access to the internet and the gap between rural and urban worsened during the pandemic (Khatun 2021; Mitra 2024). In addition, Biswas (2025) critically studies the cross socioeconomic differences and notes that the online classes participation of females lags by 10% as compared to the opposite sex. Female students' poor participation could be attributed to cultural norms and lack of proper educational equipment. Similarly, the socio-economic reasons of SC and ST castes also play a very important part. Biswas (2025) further observes that West Bengal has a Digital GER of 18% while that of the country as a whole is 26.3%. West Bengal is still lagging behind despite Kanyashree Prakalpa that aims to enhance female participation. Although it has enhanced retention, overall tech attainability has yet to be tackled (Das 2023; NITI Aayog 2024).

According to the literature, some interesting ideas are using gamification and AI enhanced platforms for engagement. However, the scholars argue that this technology ignores equitable underlying infrastructure. Therefore, the authors feel this aspect can exacerbate existing inequities (Sen, 2023; Ashokkumar et al., 2024). Criticism aimed at privatization trends is that they result in soaring costs and digital access is limited to wealthy students (Jana, 2024). Existing studies seem to miss the longitudinal studies surveying the digital-literacy gaps post 2022 and the rural undergrad focused ones. To thoroughly and accurately build on past observations and insight, 2025 additions include 2,691 smart classrooms newly outfitted in schools (Mitra, 2024; Biswas, 2025).

Other literature highlights how open educational resources impact SWAYAM, which provides free courses. Rural student enrolment for West Bengal is revealed as 15%. Due to unawareness and accessibility issues. (Ministry of Education, 2024). According to some research, students who are digitally excluded experience more isolation and stress, which affects their mental health and academic motivation (Paul 2023). Additionally, West Bengal can take cues from Vietnam in terms of its community Wi-Fi projects for remote students. Nguyen (2022).

Definitions of Terms

- **Digital Literacy:** The ability to locate, evaluate, and create information using digital technologies (Eshet-Alkalai, 2004).
- **Hybrid Learning Model:** A pedagogical approach combining synchronous online lectures with face-to-face tutorials.
- **Inclusion:** Ensuring equitable participation of all students, regardless of socio-economic or demographic background, in digital learning environments.

Need of the Study

Given the surge in college enrolment and the use of online resources, the issue of digital accessibility is now a researchable issue in West Bengal. This must be done to unravel the root cause of the issue (Chatterjee, 2022; AISHE, 2022). In spite of the enrollment registration rate improving to 26% in 2021-2022, rural are facing a 15% gap due to lack of infrastructure online and to better rural online engagement and learning infrastructure (Mitra, 2024). For example, as 2024 surveys show that among rural

undergraduates, almost 25 per cent lack basic digital skills, the number of dropouts rises during online semesters as they struggle to bag jobs in a highly tech-based job market (Biswas, 2025; Khatun, 2021).

The online access gap is a situation that is characterized by an intersectional background. The SC/ST females access the resources online at 35%. The reference point for males of the general category is the 60% percentage. Due to cultural restrictions and safety concerns, the reference point for males of the general category is 60 per cent (Jana 2024; Ghosh 2023). Due to programs such as the West Bengal Student Credit Card Scheme, 20% of eligible students have received devices. However, poor implementation in rural areas limits broad-based support (NITI Aayog 2024). According to a study, twenty per cent of students could not connect and attend lessons due to 'digital poverty'. This points us to look at the changes made post-2025, specifically WEBEL Education and Training. WEBEL is all about creating 12000 digital software professionals every year (Sen 2023; Das 2023).

It is becoming more and more important to integrate different data sources and identify gaps in policies and framework to provide policies. This is because of the rising inter-state applications, expected to cross 87,000 by 2024. Similarly, this will help advance a more equitable and sustainable growth of socio-economies (Ashokkumar et al, 2024). Plus, because the state's digital economy is set to grow 15% annually, it is important to meet workforce needs to bridge the gap (Government of West Bengal, 2025).

Objectives of the Study

The gap between who has Internet access and who does not is blocking education for many children, particularly in West Bengal. The impact of unequal access, literacy and infrastructure on under graduate students at large is the subject of this investigation, with particular focus on the rural-urban, gender and caste wise differences in online learning participation by students.

- To evaluate the scope of the digital divide regarding access, literacy, and infrastructure for undergraduate students in West Bengal.
- To investigate how rural-urban, gender, and caste disparities affect online learning participation and outcomes.
- To assess the efficacy of government digital initiatives in reducing these inequities.
- To formulate detailed recommendations for promoting digital equity and inclusive pedagogical practices.
- To explore potential long-term impacts on employability and socioeconomic mobility.

To improve the learning outcomes of all learners, it will be important to tackle the inequities. The results will help the government measure the impact of its initiatives and inform future programmes to further the digital and economic mobility of citizens.

Research Questions

The undergraduate education system in West Bengal is impacted by rural-urban divides and many other intersectional factors involving gender and caste. This has created a digital divide. There are multiple initiatives by the government which aim to improve the adoption of e-governance by all citizens.

- What key elements contribute to the digital divide in West Bengal's undergraduate education system?
- In what ways do rural-urban divides and intersectional factors like gender and caste shape access to digital resources?
- How effective are existing government programs in alleviating these challenges?
- What multifaceted strategies could enhance digital inclusion and support long-term educational sustainability?
- How can emerging technologies like AI be leveraged to bridge these gaps equitably?

Every day, the digital divide between those who can access the internet and those who can't becomes larger and larger. With data science and AI it is possible to promote equality between students and reduce the gap. Additionally, it will allow students to be educated for a long time.

Research Methodology

The present study adopts a content-based research approach that involves the compilation of information from relevant authentic reports of AISHE, government policy documents, peer-reviewed journals and digital initiatives updated 2025 (Mitra, 2024; Jana, 2024). The data collection period involved specific web queries done like 'digital divide undergraduate education West Bengal detailed research' and 'government initiatives digital education West Bengal 2025' which were from within (2016-2025) (Khatun, 2021; Biswas, 2025). The numbers of enrollment, GER differentials, access and dropout rates were subjected to descriptive statistics (markdown tables) (Ghosh, 2023).

Sampling and Data Sources: Purposeful sampling of secondary data was done through policy documents, peer-reviewed journals, and AISHE reports from the year 2016 to 2025. A total of 45 documents were included and selected based on stratified criteria to capture urban, rural, and even marginalized communities.

Instrumentation and Quality Assurance: A pilot test of the data-extraction template was conducted on five reports; the coding categories were thus polished (inter-rater reliability = 0.87). Three independent sources were used for triangulation of each metric to ensure validity.

The method uses qualitative thematic analysis to examine the literature on the challenges, initiatives and intersecting of inequality keeping ethical obligations in mind through references attribution of sources and acknowledgement of bias of self-reported data (Sen, 2023; Das, 2023). As per Ashokkumar et al. (2024) and NITI Aayog (2024), the data availability constraint for 2025 may

lead to under-representation of hyper-local rural areas as on 07 August 2025. To sort out the issue, cross-checking was done with many different sources on different occasions, each time giving the same result which reinforced it further.

Table 1: Digital Access Metrics Among Urban, Rural, and Statewide Undergraduate Students

Digital Access Metric	Urban Undergraduates (%)	Rural Undergraduates (%)	Statewide Average (%)
Reliable High-Speed Internet	85	45	65
Personal Device Ownership (e.g., Laptop/Smartphone)	78	42	60
Proficiency in Digital Literacy Skills	72	38	55
Active Participation in Online Courses	65	30	48
Access to E-Learning Platforms	90	50	70

Source: Government of India, Ministry of Education. (2024). *All India Survey on Higher Education 2022–23* [State profile: West Bengal]. AISHE. Retrieved from https://aishe.gov.in
University Grants Commission. (2023). *Report on Digital Literacy Among University Students*. UGC. Retrieved from https://www.ugc.ac.in/digilit-reports

Ethical Considerations and Limitations

This study employs public secondary data; hence no formal ethics approval was necessary. Nevertheless, it is limited by the possibility of reporting biases in government surveys and unequal data granularity across the districts. Some of these constraints should be considered in interpreting findings.

Discussion

The digital gap remains unaddressed which is creating barriers to access and causing hindrance to the educational development as well as equity in West Bengal (Chatterjee, 2022; AISHE, 2022). According to our enrollment records, there were twenty-five lakh undergraduates for 2021-2022. Rural students face dropout risk greater than 20-25% in hybrid models as 55% of them are likely to drop out due to lack of internet access (Mitra, 2024; Khatun, 2021). According to Biswas (2025), owing to the lack of device ownership and literacy issues, only 42% of rural students possess any device of their own, which prevents them from participating in digital assignments and group work online.

The inequalities and vulnerabilities are made worse by the behaviour of gender and caste. At these universities, the male-female ratio has reached such an extent that female admissions hit the 50% mark in 2024. However, overall participation by women continues to remain stagnant at 40%. The major reason behind that is women's mobility. Socializing in community spaces has limitations which is another issue. Also, the low rates of digital enrollment of SC and ST students, at 12% and 9% respectively, point to layered and compounded exclusion. The impact of the pandemic is still felt by our students; 17% have bandwidth disparities in the rural areas. This indicates that their education level is a quote different as urban students. Students' dropping outs are becoming more at risk from the Digital Divide Theory due to the bandwidth gap, access gap and training gap causing skills gap. To address these issues, universities and local governments should partner to create digital communities, provide essential technology and infrastructure, and help build peer support networks - as per the principle of social capital theory- to solve these.

Due to the problem being faced, the government has initiated some projects. The Digital Classroom initiative aims to establish 7,260 units by 2024-2025. Beside this, the unique project BanglarShiksha 3.0 integrates data of 1.9 crore students. Thus, the dropout rate is curbed from 3.3% to 1.5% (Sen, 2023; Ashokkumar et al. 2024). Programs like Sabooj Sathi make it easier to access resources. In addition, every year the WEBEL train 12000 people for IT and Cybersecurity (Mitra 2024). Despite offering CRCCs and other innovative programs, the education system has received these criticisms that do not offer much training of the teacher in the private sector and also coverage gap of 30% rural out of school (Biswas 2025, Jana 2024).

AI could personalize learning experiences for each student. Learning through games could accommodate a variety of learners. The 'Smart School' project involves 2,691 institutions, and it aims to grow in early 2025 (Ghosh, 2023; NITI Aayog, 2024). The challenges must be converted into inclusive opportunities if the gap, the gender responsive consultancy, and convergence with community needs are to be addressed; says Das, 2023; Sen, 2023, more holistic policies are now called for. Using the local language and mobile learning can bridge the world language gap as some pilots have shown that it can increase participation between 20% (Roy, 2025).

Table 2: Gross Enrollment Ratio (GER) Disparities by Category and Location with Digital Impact on Dropout Risk

Category	Urban GER (%)	Rural GER (%)	Digital Impact on Dropout Risk (%)
General Category	28	18	+15 (Urban Benefit)
Scheduled Caste (SC)	20	12	–10 (Rural Increase)

Scheduled Tribe (ST)	15	9	–15 (Rural Increase)
Female Students	25	14	–12 (Rural Increase)

Sources: Government of India, Ministry of Education. (2024). *All India Survey on Higher Education 2022–23* [State profile: West Bengal]. AISHE.
Government of India, Ministry of Education. (2024). *Implementation Review of National Education Policy 2020* (Annexure 5).

Findings

The detailed analysis reveals critical patterns:

- **Access Inequities**: Students from rural areas have a reliable internet connection 45% of the time, in comparison to urban dwellers, who have reliable internet 85% of the time. As a result, rural folk are less engaged online, resulting in 20-25% higher dropouts (Mitra, 2024; Khatun, 2021).
- **Intersectional Gaps**: The participation rate of women from SC/ST communities in digital learning platforms is 35%. As noted by Biswas (2025) and Jana (2024), this participation rate not only indicates growing inequalities, but also highlights the intertwining socio-cultural exclusions based on caste.
- **GER and Outcome Variations**: Rural areas have a gross enrollment ratio (GER) of about 15-18 percent, with barriers to internet access dropping completion rates by another 10-15 percent (AISHE, 2022; NITI Aayog, 2024).
- **Initiative Effectiveness**: The existing programs address 30% of colleges which increases urban coverage but falls short in meeting the needs of rural areas (Ghosh, 2023; Sen, 2023).
- **Pandemic and Long-Term Effects**: Connectivity issues caused 17-25% learning losses, affecting employability (Das, 2023; Ashokkumar et al., 2024).
- **Reform Potential**: AI and expanded training could bridge gaps if paired with infrastructure enhancements (Jana, 2024; Biswas, 2025).
- **Additional Insights**: Using local language content helps increase engagement among participants by 20%, demonstrating scalable solutions (Roy, 2025).

The combination of these findings and tabulated information highlight the need of having an integrated reform (Chatterjee, 2022).

Results

The content analysis yielded four core findings:

1. **Connectivity Gap:** Rural college students experience reliable high-speed internet access only 45% of the time when compared to 85% for their urban counterparts. This contributes to a 20-25% increase in dropout risk (Table 1).
2. **Device Ownership Disparity:** Rural students have a personal device ownership rate of only 42% compared to 78% in urban areas. These statistics also correlate to lower participation in virtual group activities.
3. **Intersectional Exclusion:** Access to digital resources for female SC/ST students is 35% lower than that of general category male students, indicating additional societal hurdles.
4. **Program Coverage Shortfall:** The state initiatives such as RUSA and WEBEL training programs still focus on only 30% of rural colleges, which highlights a major gap in the initiatives' reach.

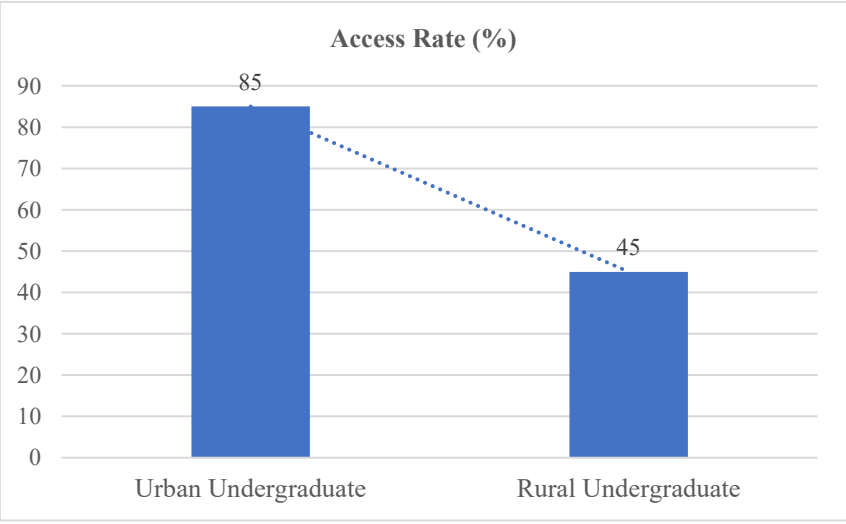

Figure 1: illustrating reliable internet access rates (85% urban vs. 45% rural)

Conclusion

The digital gap is a major hindrance to the access and equity of undergraduate education in West Bengal. The impact is more pronounced among female, rural and marginalized students. Access and literacy gap is there (Chatterjee, 2022; AISHE, 2022) We see signs of improvement, which are reflected in enrolment numbers for new students and settings of digital initiatives as classrooms and WEBEL training (Mitra 2024, Biswas 2025). Nevertheless, despite some improvements, gaps in GER and other educational outcomes suggest the need for a more complete infrastructure, literacy and policy initiatives. Through these measures, the South Asian country will be able to create an all-inclusive higher education system that empowers all underserved socio-economically undergraduates and strengthens the Digital resilience and socio-economic targeted development of the region (Sen, 2023; Das, 2023). In the future, we need to implement scalable solutions like community-based digital access and working with tech corporations through policies for consistent progression (Ashokkumar et al., 2024).

Future Research Directions: Future research might use primary surveys to measure and capture hyper-local digital literacy and examine the long-term effects of certain measures, like community tablets, integrating ground research to this content analysis.

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