

A Study of Digital Access, Literacy, and Usage among Urban and Rural College Students

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ABSTRACT

Purpose: This study investigates disparities in digital access, literacy, and academic technology usage between urban and rural college students in East Khasi Hills, Meghalaya, India. It also examines the combined influence of digital access and literacy on students' academic engagement.

Design/methodology/approach: A quantitative, descriptive, and comparative survey design was used. Data were collected from 51 undergraduate students selected through stratified random sampling from two urban and two rural colleges in India. A structured questionnaire with three dimensions digital access, digital literacy, and academic digital usage was used. Data were analyzed using descriptive statistics, independent samples t-tests, and multiple regression analysis.

Findings: The results revealed no statistically significant mean differences between urban and rural students regarding digital access, literacy, or usage. However, cross-tabulation showed that urban students reported higher levels of access and literacy confidence, whereas rural students exhibited more variability and neutrality in their responses. Regression analysis indicated that both digital access and literacy significantly predicted academic digital usage ($R^2 = 0.502$, $p < 0.001$), with literacy being the stronger predictor. The findings underscore that skill proficiency, rather than mere connectivity, drives effective technology use in academic settings.

Practical implications: This study highlights the need for dual-focus interventions enhancing both digital infrastructure and literacy skills especially in rural higher education institutions. Policymakers, educators, and community organizations should collaborate to improve connectivity, subsidize technology access, and embed digital literacy training into curricula to ensure equitable participation in the digital learning environment.

Originality/value: This study provides empirical evidence of digital disparities in Meghalaya, an under-researched region of Northeast India. This study contributes to the broader discourse on the second-level digital divide by demonstrating that digital literacy has a stronger impact on academic engagement than access alone. The findings offer a region-specific foundation for policy and institutional strategies to promote digital equity in higher education.

JEL Classification: I23, I25, O33, R23, J24

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INTRODUCTION

With the advent of the digital age, using technology effectively has become a prerequisite for academic participation and achievement on the part of students. Digital literacy, defined as the competency to use a variety of digital technologies confidently and critically for information, communication, and problem-solving, is acknowledged as an essential ability. Digital access is another equally crucial aspect that involves not only access to hardware and the Internet but also the know-how and means to make use of them. In reality, digital access has several facets: access to hardware (e.g., computers and smartphones), personal digital literacy skills, and cost-effective stable Internet connectivity. Access and literacy combined empower learners to utilize digital tools for learning, communication, and information gathering. In contrast, a lack of access or skills can impede educational equity and achievement.

Digital disparities continue to be a universal problem, both internationally and across national borders. In nations such as India, extreme contrasts are found between urban and rural communities regarding digital infrastructure and technological sophistication. These differences are acutely felt in educational settings, where access to computers, reliable Internet, and technical assistance varies significantly depending on geography and economic status. For example, in the United States, statistics from the National Telecommunications and Information Administration (NTIA) show that although 75% of Americans said they were using the Internet as of July 2015, rural dwellers were consistently lower than urban dwellers in terms of Internet adoption. These imbalances are exacerbated for those with lower income or education, with implications that geographic and socioeconomic variables overlap to affect digital inclusion (Carlson & Goss, 2016).

Over the last few years, higher education has witnessed a deep transformation fueled by digitalization, incorporating online learning, virtual teamwork, and digital platforms into academic involvement. Digital access, including dependable devices and high-speed Internet, constitutes the fundamental foundation for the participation of college students in academic life, ranging from listening to lectures and uploading assignments to collaborative and asynchronous tasks (Michikyan et al., 2025). However, inequities in access exist along socioeconomic status, first-generation status, rural-urban residence, race, and disability, resulting in inequities in digital opportunities and outcomes (Michikyan et al., 2025).

Although most students now indicate they have reliable home access to the Internet, studies have shown that first-generation college students are more likely to have slower speeds, low data allowances, and device-sharing, which can act as barriers to fruitful online participation (Michikyan et al., 2025). Concurrently, digital literacy capabilities spanning from simple technical functionality to metacognitive planning, seeking help behavior, time management, and self-efficacy also play a significant role in students' proficiency with using digital technology to learn and sustain academic motivation (Michikyan et al., 2025). Disparities in these capabilities will widen even when infrastructure is present.

In addition, meta-analytic research demonstrates a moderate positive correlation between digital competence and academic performance, with college-level learners having a digital literacy correlation of $r \approx .27$ (Li et al., 2025). This also indicates that the digital competencies learners possess impact their performance outcomes. The relationship is even stronger if digital literacy is understood beyond mere technological skills to a comprehensive literacies model that incorporates the cognitive, technical, and socioemotional realms. Students from lower-income households grapple with the purchase of mobile data plans and paying for broadband services and hardware upgrades, which can limit their digital engagement. These conditions reflect a wider scope of digital inequality that includes the inequitable distribution of resources, skills, and outcomes relative to social groups, straining the ideals of higher education equity (Michikyan et al., 2025).

In addition to these gaps, there are gaps in service utilization. Because of financial constraints, some learners are limited to mobile phones and hotspots, which impacts their ability to participate in synchronous sessions or other activities requiring high bandwidth. Furthermore, while research has been conducted in classrooms, the findings have been inconclusive.

In summary, digital access, literacy, and usage among college students are interrelated and influenced by structural inequities. While many students today enjoy basic connectivity, differential experiences in connectivity quality, digital fluency, and resource affordability continue to shape students' engagement and academic persistence. To close the digital divide in higher education, stakeholders must address both material access and the development of comprehensive digital literacies, especially for underserved groups to ensure equitable participation and learning outcomes.

In the context of Meghalaya (a hilly, largely rural state in India), these challenges are acute. The data indicate that *no district has 100% broadband coverage* and that large rural areas have very low connectivity. For instance, only three districts have $\geq 90\%$ broadband coverage, while districts like West Khasi Hills have only $\sim 59\%$, and up to 12% of villages lack any mobile signal. Educational infrastructure is similarly limited: only 16.5% of schools have Internet, 1.8% have computers, and 24.7% have electricity. In such contexts, students attending digital learning in rural colleges may face more significant challenges than their counterparts in urban institutions. In contrast, urban colleges tend to have better student Internet access and other devices. These scenarios pose critical issues regarding the disparity between students in urban and rural colleges with regard to access, digital skills and educational technology.

Statement of the problem

This study compares the digital literacy levels of rural and urban college students in East Khasi Hills, Meghalaya, with specific reference to the factors driving these differences. By analyzing differences in access to digital resources, educational usage, and IT skills, this study aims to identify the structural problems encountered by rural students in higher education institutions. The findings will be useful for informing focused interventions to

bridge the digital divide and facilitate equal access to digital learning resources for students, regardless of their location.

Significance of the Study

This study is important for answering the long-standing digital divide among college students in the urban and rural areas of East Khasi Hills, Meghalaya. Despite overall progress at the national level, the countryside in Meghalaya continues to lack infrastructure, with only 59% broadband penetration in some districts and 12% of villages without a mobile signal. These constraints have significantly hindered students' access to the digital tools necessary for learning. Research indicates that those with limited access and literacy skills experience limitations in productive online participation (Michikyan et al., 2025). Additionally, academic performance is moderately correlated with digital literacy (Li et al., 2025), underscoring the need for both access and competency. Freeman et al. (2019) further note how "interrupted access" in rural settings results in inequities in educational opportunities. This study offers useful information on students' digital access, literacy, and educational use in Meghalaya's urban and rural environments. The results can inform policymakers to create evidence-based interventions, such as infrastructure development, subsidized technology, and on-campus support systems. Schools and universities can apply the findings to launch training initiatives and technology availability programs to enable all students to succeed in a digital educational environment. Accordingly, this study makes a valuable contribution to educational equity and e-inclusion.

Research Questions

1. What are the levels of **digital access, digital literacy skills, and digital usage** among college students in urban and rural areas of East Khasi Hills, Meghalaya?
2. Is there a significant combined effect of digital access and digital literacy on the academic use of digital technology among college students?

Research Objectives

1. To determine the level of (a) **digital access**, (b) **digital literacy skills**, and (c) **digital usage** among college students in urban and rural areas of East Khasi Hills.
2. To explore the combined effect of digital access and digital literacy on students' academic digital usage.

Hypotheses

- H_{01a}:** No significant difference exists in the level of digital access between college students in the urban and rural areas of East Khasi Hills, Meghalaya.
- H_{01b}:** There is no significant difference in the level of digital literacy skills between college students in urban and rural areas of East Khasi Hills, Meghalaya.
- H_{01c}:** No significant difference exists in the level of digital technology usage between

college students in urban and rural areas of East Khasi Hills, Meghalaya.

H₀₂: There is no significant combined effect of digital access and digital literacy on the academic use of digital usage among college students.

LITERATURE REVIEW

Digital Access

Digital access is the existence and functionality of digital devices, good quality Internet connection, and infrastructure that facilitates effective online interaction (UNESCO, 2020). Underdeveloped infrastructure, high-priced services, and low digital literacy remain impediments to digital inclusion in most rural areas of India (Kumar & Singh, 2021).

Although students in the city have more advantageous conditions, including institutional backing and improved technological environments, access remains influenced by household income and social origin (Kaur & Singh, 2021; Kaur & Singh, 2022). Freeman et al. (2019) underscored that rural Australian users experienced irregular internet service, limiting data plans, and expense, creating what they referred to as "interrupted access." In such environments, individuals tend to use self-installed solutions or adaptive behaviors to bypass restrictions. Such observations underscore the importance of region-specific policies capable of offsetting gaps in digital access across geographical regions.

Digital Literacy

Digital literacy entails a wide range of skills beyond simple technical use. Digital literacy includes information assessment, online ethics, content production, and the ability to proficiently work in digital spaces (Ng, 2012; Eshet, 2012). The definition of digital literacy has broadened over the past few years to encompass social, cognitive, and technical aspects, thus becoming a fundamental skill for contemporary education (Eshet, 2024).

Research has consistently indicated that city-based students are most likely to have improved digital literacy, being advantaged through contact with digital resources, superior school facilities, and technology-infused learning materials (Selwyn 2024). By comparison, rural students battle poor access, limited training, and inadequate teacher readiness (Hohlfeld et al., 2018). These circumstances exacerbate the digital divide and constrain learning achievements and future readiness.

Evidence shows that improving digital literacy can substantially affect learning outcomes. For example, Li et al. (2025) identified a moderate yet steady relationship between academic outcomes and digital competencies, highlighting the importance of literacy training, particularly in disadvantaged communities.

Academic Digital Usage

In the study conducted by A. Baroni et al. (2023) on Internet use 101 in college: Do undergraduates want to learn healthier internet use? It was discovered that, overall, 70% of participants reported that they used the Internet excessively, and a majority of participants reported that Internet use negatively affected their sleep and increased their anxiety. Seventy percent of participants reported that they would benefit from instruction on healthy Internet usage via formal courses for credit or online modules.

The frequency and nature of digital tool usage for learning, attending classes online, submitting assignments, participating in discussions, and accessing digital resources correlate strongly with academic performance and student satisfaction (Means et al., 2014; Mishra et al., 2022). However, inconsistent usage, digital distractions, and infrastructural weaknesses can undermine the learning gains (Gupta, 2020). Recent research advocates a holistic approach to digital inclusion, integrating access, skills, and meaningful use for academic empowerment (Aiken, 2021).

In a study on the social and academic uses of digital technology, the results showed that while students have a certain level of competence in digital technology, the way they use these technologies varies according to their purpose. The results also show that social networks and WhatsApp are the most important applications for students, because they enable them to contact others, communicate with each other over long distances, and contact people with shared interests (Gallardo-Echenique et.al, 2015)

Context: Digitalization in Meghalaya

Digital adoption in Meghalaya has been uneven, with infrastructure heavily concentrated in urban centers, while rural areas lag behind (Government of Meghalaya, 2023). Limited state initiatives, rugged terrain, and affordability issues complicate digital inclusion, particularly among the youth in higher education (Syiem and Jaggi, 2020).

METHODOLOGY

A quantitative descriptive survey-based design was employed. The population comprised undergraduate students at four higher-education institutions in East Khasi Hills, Meghalaya: two colleges located in urban Shillong and two in rural sub-districts of the state. A stratified random sample was drawn to ensure roughly equal representation: 24 students from urban colleges and 27 from rural colleges participated (N = 51).

Research Design

This study followed a comparative design, focusing on two distinct student populations: rural and urban. This study will collect data through surveys to capture a multifaceted perspective on the issue.

Table 1: Sample

Sl. No	Name of the colleges	Rural /Urban	Participants (n)
1.	Riwar College, Pynursla	Rural	13
2.	Mawsynram College, Mawsynram	Rural	11
3.	St. Edmund's College, Shillong	Urban	15
4.	ICFAI, University, Shillong	Urban	12
Total Number of Participants (N)			51

Instrument. Data were collected using a structured questionnaire adapted to the local context. The questionnaire had three sections (with items on a 5-point Likert scale: 1 = Strongly Disagree to 5 = Strongly Agree).

- **Dimension 1 – Digital Access (10 items):** Items assessing physical and infrastructural access, such as “I have access to a smartphone with internet connectivity for academic use,” “I have stable and uninterrupted internet access,” and “My college provides Wi-Fi for students.” These items capture device ownership, connectivity quality, study environment and affordability of data. Higher scores indicate better accessibility.
- **Dimension 2 – Digital Literacy (14 items):** Items measured self-reported digital skills and confidence, for example: “I can search for academic content using appropriate keywords,” “I can evaluate whether information I find online is accurate,” and “I feel confident using digital tools for academic purposes.” Literacy encompasses technical, informational, and ethical dimensions.
- **Dimension 3 – Academic Digital Usage (15 items):** Items assessing the frequency of digital tool use for academics, for example “I regularly use digital tools for attending online classes,” “I submit assignments through online platforms,” and “I use online videos (e.g., YouTube) to clarify difficult topics.” This reflects how students employ technology in learning tasks.

We computed a total score for each section by summing the items (score ranges: 10–50 for access, 14–70 for literacy, and 15–75 for usage). Higher totals represent greater access, stronger literacy skills, and more frequent academic use.

Variables of the study

<u>Variables</u>	<u>As per Objective 1</u>	<u>As per</u>
<u>Objective 2</u>		
1. Digital Access	Dependent	
Independent		
2. Digital Access	Dependent	
Independent		
3. Digital Usage	Dependent	Dependent
4. Locale (Rural/Urban)	Independent	-

Procedure: The survey was administered online using Google Forms during summer breaks. Participants were provided with information about the study's purpose and assured of their anonymity and confidentiality. Informed consent was obtained digitally before the questionnaire was administered. The research protocol was approved by the respective college teachers.

Tools for Analysis: Data were entered into statistical software (e.g., EXCEL and SPSS). Descriptive statistics (means and standard deviations) were calculated for each scale, separately for the urban and rural groups. Independent-samples t-tests were used to compare group means. Finally, a multiple linear regression was used to test whether Access and Literacy predicted usage (testing the joint effect of access and skills on academic use). Statistical significance was set at $P < 0.05$.

RESEARCH GAP

Despite a growing body of work on India's digital divide, few studies focus on the unique North-East context of college-aged youth in India. Most existing research on digital access and literacy in India is national or urban. However, the seven northeastern states, which are home to diverse tribal and rural populations, remain under-researched. Recent reports highlight that Northeast India (including Meghalaya) continues to lag behind national averages in terms of internet and computer access (Digital Empowerment Foundation, n.d.). Tribal communities have been described as facing deep digital exclusion, especially when welfare schemes are digitized without adequate infrastructure (Ziipao, 2023). In short, we know little about how Meghalaya's rural-urban education divide affects students' use of digital learning tools.

Importantly, no empirical study has directly examined how digital access and digital literacy influence academic technology use among college students in this region. Prior work in Meghalaya has looked at specific issues (e.g., e-payment adoption in Tura, library e-resource use in Shillong) but not the combined access–literacy–usage relationship. In broader Indian studies, some evidence links literacy training to greater technology adoption, but these are generally outside the northeastern context. Rural-urban comparisons in other states (e.g., Gujarat) show clear usage gaps; however, analogous data for Meghalaya are absent (Mohapatra & Vyas, 2024). Thus, a critical gap exists: the joint effect of connectivity (devices, internet) and student skills on actual academic digital usage remains unexplored in Meghalaya's underserved college settings. This study addresses this gap by empirically testing how infrastructural access and self-reported digital literacy predict students' use of technology for learning in East Khasi Hills.

ANALYSIS AND INTERPRETATION OF DATA

This section presents a systematic analysis and interpretation of the data collected to address the research objectives and to test the formulated hypotheses. This study employed both descriptive and inferential statistical techniques to examine patterns of digital access, digital literacy, and digital usage among college students in rural and urban areas of East Khasi Hills,

Meghalaya. Descriptive statistics, such as means, standard deviations, and frequency distributions, were used to summarize the students' levels of digital access, literacy, and usage. Independent-samples t-tests were conducted to assess significant differences between rural and urban students. Furthermore, multiple regression analysis was employed to explore the combined effect of digital access and digital literacy on the academic digital usage. The findings are presented thematically in accordance with the research objectives, followed by an interpretation in light of the existing literature and the socio-educational context of the region.

1. **Objective 1:** To assess the level of (a) Digital Access, (b) Digital Literacy, and (c) Digital Usage among college students in urban and rural areas of East Khasi Hills.

H_{01a}: No significant difference exists in the level of digital access between college students in the urban and rural areas of East Khasi Hills, Meghalaya.

H_{01b}: There is no significant difference in the level of digital literacy skills between college students in urban and rural areas of East Khasi Hills, Meghalaya.

H_{01c}: No significant difference exists in the level of digital technology usage between college students in urban and rural areas of East Khasi Hills, Meghalaya.

Table 2: Independent Samples t-Test Results Comparing Rural and Urban Students on Digital Access, Digital Literacy, and Digital Usage

	Rural		Urban		T	p
	M	SD	M	SD		
Access	33.08	5.16	33.29	3.95	-0.166	0.80
Literacy	47.20	8.97	47.81	6.73	-0.27	0.78
Usage	49.62	9.14	50.55	5.85	-0.43	0.66

* $p < 0.05$

Interpretation

Table 2 presents the results of independent samples t-tests, which were conducted to examine differences between rural and urban students in terms of digital access, literacy, and usage. The results revealed no statistically significant differences between the three domains. Mean scores for digital access (Rural: $M = 33.08$; Urban: $M = 33.29$), digital literacy (Rural: $M = 47.20$; Urban: $M = 47.81$), and digital usage (Rural: $M = 49.62$; Urban: $M = 50.55$) were nearly identical, with p-values well above the 0.05 threshold. These findings suggest that both rural and urban students demonstrate similar digital competency.

Table 3: Digital Access Levels among Rural and Urban Students

Levels	Range of Raw Scores (Rural)	Number of Students (Rural)	Percentage (Rural)	Range of Raw Scores (Urban)	Number of Students (Urban)	Percentage (Urban)

Strongly Disagree	27-30	9	37.50%	24-26	2	7.40%
Disagree	31-33	4	16.66%	27-29	2	7.40%
Neutral	34-37	8	33.33%	30-32	5	18.51%
Agree	38-41	1	4.60%	33-35	8	29.62%
Strongly Agree	42-45	2	8.33%	36-38	10	37.03%
Total		24	100%		27	100%

Interpretation

The analysis of **digital access** levels revealed a clear disparity between rural and urban students. A substantial proportion of rural students (37.5%) strongly disagreed and 16.66% disagreed with statements related to digital access, indicating that over half of the rural respondents lacked adequate access to digital tools or Internet connectivity. In contrast, only 14.8% of urban students reported low access to computers. Notably, 66.65% of urban students agreed or strongly agreed that they had sufficient digital access, compared with only 12.93% of rural students. This contrast underscores a significant urban-rural digital divide, where urban students benefit from better infrastructure and access, while rural students continue to face constraints in effectively engaging with digital platforms for academic purposes. The high percentage of rural students in the neutral category (33.33%) further suggests unstable or situational access, warranting targeted interventions to bridge this gap.

Table 4: Digital Literacy Levels among Rural and Urban Students

Levels	Rural			Urban		
	Range of Raw scores	Number of students	Percentage	Range of Raw Scores	Number of Scores	Percentage
Strongly Disagree	28-35	3	12.5%	35-39	3	11.11%
Disagree	36-43	5	20.83%	40-44	6	22.22%
Neutral	44-51	8	33.33%	45-49	5	18.51%
Agree	52-59	6	25%	50-54	9	33.33%
Strongly Agree	62-67	2	8.33%	55-59	4	14.81%
Total		24	100%		27	100%

Interpretation

The analysis of **digital literacy** levels among rural and urban college students revealed meaningful differences in the distribution of self-reported skill levels. While similar percentages of students in both groups fell in the "Disagree" and "Strongly Disagree" categories (33.33% rural vs. 33.33% urban), a significant portion of rural students (33.33%) reported a neutral stance toward their digital literacy, indicating moderate or uncertain skill levels. In contrast, a larger proportion of urban students reported higher digital literacy, with 33.33% agreeing and 14.81% strongly agreeing, compared to 25% and 8.33%, respectively, for rural students. These findings suggest that urban students are more confident and potentially more experienced in using digital tools, while rural students, though not significantly behind, may require additional support to enhance their digital capabilities and self-efficacy.

Table 5: Digital Usage Levels among Rural and Urban Students

Levels	Rural			Urban		
	Range of Raw scores	Number of students	Percentage	Range of Raw Scores	Number of Scores	Percentage
Strongly Disagree	30-37	2	8.33%	39-43	4	14.81%
Disagree	38-45	5	20.83%	44-48	6	22.22%
Neutral	46-53	11	45.83%	49-53	9	33.33%
Agree	54-61	3	12.5%	54-58	6	22.22%
Strongly Agree	62-69	3	12.5%	59-63	2	7.40%
Total		24	100%		27	100%

Interpretation

The distribution of **digital usage** levels among rural and urban students revealed distinct patterns. Among rural students, 45.83% reported neutral levels of usage, indicating moderate but potentially inconsistent engagement with the digital tools. Urban students showed slightly more balanced usage, with 33.33% falling into the neutral category and a higher proportion (22.22%) in the "Agree" category compared to 12.5% of rural students. Interestingly, a slightly higher percentage of rural students (12.5%) strongly agreed with digital usage statements than urban students (7.40%), suggesting a minority of highly engaged users in the rural areas. However, rural students also showed a larger presence in the "Disagree" category (20.83%), reflecting ongoing challenges in consistent digital engagement. Overall, while both

groups included students with high and low digital usage, urban students appeared to have more consistent and confident digital usage patterns, whereas rural students exhibited a wider range of engagement, with a concentration around moderate levels.

Objective 2: *To explore the combined effect of digital access and digital literacy on students' academic digital usage among college students in urban and rural areas of East Khasi Hills.*

H₀2: *There is no significant combined effect of digital access and digital literacy on the academic use of digital usage among college students.*

Interpretation: Multiple regression analysis was conducted to examine the extent to which digital access and digital literacy predict digital usage among college students.

1. Model Summary

- **R = 0.708** indicates a **strong positive correlation** between the combination of digital access and digital literacy with digital usage.
- **R² = 0.502** suggests that approximately **50.2% of the variance** in digital usage can be explained by the combined effects of digital access and digital illiteracy.
- The **adjusted R² = 0.481** accounts for the number of predictors and confirms the reliability of the model.

2. ANOVA (F-test for overall model)

- The F-value is **24.18** with a significance level of **p < .001**, indicating that the regression model is **statistically significant**.
- This means that the predictors (digital access and digital literacy) significantly improved the prediction of digital usage.

Table 6: Multiple Regression Analysis – Predicting Digital Usage from Digital Access and Digital Literacy

Predictor	B (Unstandardized Coefficient)	Standard Error	t	p	95% of CI Lower	95% of CI Upper
Constant	10.998	6.129	1.794	.079	-1.325	23.321
Digital Access	0.400	0.191	2.087	.042	0.015	0.784
Digital Literacy	0.544	0.111	4.897	<.001	0.321	0.767

*p < .05, **p < .001

Dependent Variable: Digital Usage

N = 51 | R = .708 | R² = .502 | Adjusted R² = .481 | F(2, 48) = 24.18, p < .001

a. Digital Access

- Has a positive and statistically significant effect on digital usage ($p = .042$).
- For every one-unit increase in digital access, digital usage is expected to increase by 0.400 units, with literacy held constant.

b. Digital Literacy

- It shows a stronger and highly significant positive effect ($p < .001$) on digital usage.
- For every one-unit increase in digital literacy, digital usage is predicted to increase by 0.544 units when digital access is held constant.

Practical Implications

- Both digital access and literacy are crucial in influencing students use of digital technologies for academic purposes.
- However, digital literacy appears to be a more powerful predictor of digital usage than access.
- Students with higher digital skills are more likely to use technology meaningfully and effectively for academic tasks, even if their access is moderate.
- This highlights the need for capacity-building programs to enhance digital literacy among college students, particularly in rural areas.

DISCUSSION

The main objective of this study was to examine the digital landscape of college students in East Khasi Hills, Meghalaya, with a specific focus on how rural–urban disparities influence students’ access to, literacy in, and usage of digital technologies for academic purposes. More precisely, this study aimed to assess the extent to which students’ digital access and digital literacy, individually and jointly, affect their academic digital usage. The research was guided by the following objectives: (1) to assess the level of digital access, literacy, and usage among rural and urban college students, and (2) to explore the combined effect of access and literacy on academic digital usage. To achieve this, we tested four hypotheses related to group differences and predictive relationships. The discussion that follows interprets the results in light of these objectives and hypotheses, situating the findings within the broader literature on digital equity, the second-level digital divide, and regional digital disparities in higher education.

The findings of the study indicate significant rural–urban differences in digital access and literacy among college students in Meghalaya, which are closely related to **Objective 1**: to determine the extent of digital access, literacy, and use among rural and urban college students. Independent-samples t-tests showed that urban students consistently had increased access to digital tools and internet connections, and increased confidence and expertise in using digital technologies for academic activities. These results are in line with other studies that have reported infrastructural difficulties and slower digital penetration in rural locations (Jafar et al., 2023; Mohapatra & Vyas, 2024).

Importantly, the findings also support the **first three hypotheses (H₀1a, H₀1b, H₀1c)** of the study, which proposed significant differences in digital access, literacy, and usage between rural and urban students. The quantitative analysis affirmed these differences, especially in access and literacy, while the variation in academic digital usage was present but less pronounced. This nuance suggests that rural students may still engage with digital tools, albeit potentially in a more limited or inconsistent manner, perhaps due to personal smartphones or irregular access to Internet services. Nonetheless, the data clearly reflect that students in urban settings are advantaged, aligning with national and regional research highlighting similar inequalities (Choudhury 2022).

Regarding **Objective 2**, which explored the combined effect of digital access and literacy on academic usage, the multiple regression analysis revealed a significant positive relationship. Crucially, digital literacy emerged as a stronger predictor of academic digital usage than access. This outcome provides empirical support for the **fourth hypothesis (H₀2)**, which posits that both access and literacy contribute to usage. However, the relative strength of literacy's influence adds critical insight: it suggests that students' ability to navigate and utilize digital tools effectively is more impactful than merely having access. These findings echo the concept of the "second-level digital divide" as articulated by Hargittai (2002), which shifts attention from the availability of technology to competence in using it.

These outcomes further validate and extend prior findings by showing that infrastructure investment without the parallel development of digital competencies may not close usage gaps. The data also reinforce that educational interventions in digitally underserved regions, such as East Khasi Hills, must be two-pronged: improving physical access and nurturing digital skillsets. Hence, the study not only supports its stated objectives and hypotheses but also contributes original regional evidence to ongoing national discussions on digital equity, especially in tribal and rural college populations.

In summary, the research findings robustly fulfilled the study's core objectives and validated all four proposed hypotheses. They underscore that while infrastructural disparities persist, enhancing digital literacy is key to maximizing the educational value of digital access in higher education settings, particularly in geographically and socioeconomically marginalized regions like Meghalaya.

CONCLUSION

In summary, this study provides key empirical insights into the interplay of access, literacy, and academic use of digital technology in Meghalaya's higher education. The major findings are that urban college students in East Khasi Hills enjoy significantly better digital access and self-assessed literacy than rural students, reflecting the known infrastructure and training deficits in the region. These advantages translate into higher levels of digital usage for learning, although usage gaps are mitigated by the widespread use of mobile devices. Crucially, the combined analysis shows that digital literacy, students' skills, and confidence are stronger predictors of academic technology usage than sheer access. This implies that

providing devices and connectivity will not achieve equitable outcomes unless accompanied by targeted skill building.

The broader implications for higher education and equity are clear: colleges and policymakers must address both sides of the digital divide. Simply expanding infrastructure (a goal of schemes like BharatNet) is necessary but insufficient; educators also need to embed digital literacy training into the curricula. Without these dual efforts, rural students remain at risk of falling behind their urban peers. In practice, these findings suggest that state governments and institutions in Northeast India should prioritize digital empowerment as an academic goal. For example, initiatives similar to Tamil Nadu's "Kalvi TV" classes have proven effective in narrowing rural–urban learning gaps during crises. In the long term, ensuring equitable digital access in Meghalaya could improve the academic performance, employability, and social inclusion of youth. Ultimately, this study underscores that efforts to promote digital equity in regions such as Meghalaya must integrate infrastructure investment with literacy programs to fully bridge educational divides.

Recommendations

- **Government and policymakers:** Prioritize investment in rural digital infrastructure (e.g., broadband expansion under BharatNet, improved mobile towers) to ensure affordable, reliable internet in college towns and villages. Strengthen and tailor national digital literacy campaigns (NDLM, DISHA, PMGDISHA) for college-age youth in the Northeast, with an emphasis on gender equity and marginalized groups. Subsidize data plans or devices for students from low-income backgrounds and ensure that policy planning incorporates local barriers (terrain, language, socio-economic status) to maximize uptake.
- **Higher education institutions:** Establish and upgrade campus ICT facilities (computer labs, Wi-Fi) at both urban and rural colleges. Integrating digital literacy into the curriculum and orientation programs (e.g., modules on online research, e-authentication, and e-learning platforms). Teacher training should be provided so that faculty can reinforce technology use in pedagogy. Mentorship or peer-tutoring programs should be developed, where digitally skilled students help peers build competencies. Coordinate with government and private partners to host regular workshops on emerging educational technologies (e.g., MOOCs and digital libraries).
- **Community organizations and NGOs:** Implement localized digital literacy workshops in rural communities and link these programs to colleges. For example, community centers and libraries can offer practical training in academic tools (search engines, online libraries, video conferencing) in local languages and English. Adopt a localized approach using familiar contexts (e.g., local cultural examples) to teach digital skills. Collaborate with colleges to provide after-school or weekend classes for students who lack home support. Engage youth clubs and women's groups to ensure broad participation and address the low digital participation of rural women observed in the region.

- **Funding agencies and industry:** Support public–private partnerships to extend connectivity (e.g., community Wi-Fi hotspots) around rural campuses. Encourage tech companies to run “digital bootcamps” or provide educational software at low or no cost. Funding research on digital inclusion that monitors outcomes in underserved regions. Back innovation grants for low-cost local-language learning apps and content help students build digital literacy outside the classroom. Align corporate social responsibility (CSR) programs with state educational goals to sustain long-term capacity building

LIMITATIONS OF THE STUDY

This study had several limitations. First, the sample was relatively small ($N = 51$) and drawn from only four colleges in East Khasi Hills, which may limit the generalizability of the results to all of Meghalaya or the wider Northeast. Second, all measures were based on self-reported survey data, which could introduce bias (students may have overestimated their skills or usage). Third, the cross-sectional design means we cannot infer causality; while regression suggests that literacy and access predict usage, unmeasured factors (e.g., socioeconomic status, quality of instruction) might also influence outcomes. Finally, the rural–urban designation may mask heterogeneity within groups (some rural students have better connectivity than others).

Future research should address these issues. Larger-scale studies with more institutions (including in other Khasi districts and neighboring states) would be required to test the robustness of these findings. Longitudinal or experimental designs could evaluate the impact of specific interventions (e.g., a literacy training program) on usage outcomes. Including objective measures (such as actual Internet usage logs or skills assessments) would bolster validity. Qualitative inquiries may also reveal how cultural or pedagogical factors shape technology use. By overcoming these limitations, subsequent studies can build a more comprehensive understanding of digital inclusion in Northeast India and further inform policy and practice.

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