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Student Perspectives on the Integration of ICT in Secondary Education: Evidence from Alipurduar District, West Bengal

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Abstract
This study investigates student perspectives on the integration of Information and Communication Technology (ICT) in secondary education within Alipurduar District, West Bengal a geographically peripheral, tribal-dominated region characterised by limited digital infrastructure. A descriptive survey method was employed with 200 secondary school students (Classes IX and X) selected through stratified random sampling from eight schools across rural, semi-urban, and urban areas. A structured Likert-scale questionnaire served as the primary data collection instrument. The study hypothesises that students in Alipurduar hold moderately positive attitudes towards ICT in learning, yet face substantial infrastructural and pedagogical barriers to its effective integration. Results reveal that 68.5% of respondents demonstrated positive perceptions of ICT integration, while only 37.5% of sampled schools had functional internet connectivity. Statistically significant gender differences were observed, with male students exhibiting stronger positive ICT attitudes. The study confirms that inadequate infrastructure, insufficient teacher training, poor connectivity, and language barriers in digital content collectively hinder effective ICT integration. Targeted policy interventions are recommended to accelerate digital equity in secondary education across the district. Data used in this study pertains to the period up to 2021.
Keywords: *ICT integration, secondary education, student perspectives, Alipurduar district, West Bengal*

Introduction

Information and Communication Technology has fundamentally transformed global education, reshaping pedagogical practices, student engagement, and learning outcomes across all levels of formal schooling. In the Indian context, this transformation gained institutional momentum through the ICT@Schools scheme under the National Policy on Information Technology (2012), which mandated digital tool integration across secondary schools nationwide. The importance of ICT in driving learning outcomes has been empirically validated; Fernández-Gutiérrez et al. (2020) demonstrated through a large-scale multi-context study that ICT access and usage, when structured appropriately, contribute significantly to improved academic outcomes at the secondary level. West Bengal initiated its own ICT-in-schools scheme as early as 2005, extending the programme to 343 additional schools in 2007–08 and incorporating it within the Rashtriya Madhyamik Shiksha Abhiyan (RMSA) framework from 2009 onwards. Despite these policy-driven efforts, the ground reality in peripheral districts such as Alipurduar remains markedly different from urban centres. Alipurduar, carved as a separate district from Jalpaiguri in 2014, is predominantly rural and tribal in character, sharing borders with Bhutan and Assam. Its secondary schools are largely government-run, resource-constrained, and

serve significant Scheduled Tribe and Scheduled Caste populations. ICT integration in this context is not merely a pedagogical concern but a matter of educational equity and social inclusion. According to UDISE+ 2020–21, only 18–24% of secondary schools in West Bengal possessed functional internet connectivity or computer labs (Ministry of Education, Government of India, 2022), placing the state far behind digital integration benchmarks set by Kerala and Tamil Nadu. The National Achievement Survey 2021 further noted that while West Bengal's Class III learning scores stood at 62.7% against the national average of 59%, significant rural-urban disparities persisted at the secondary level disparities accentuated by digital exclusion (NCERT, 2022).

The role of student perspectives is particularly crucial in evaluating the effectiveness of ICT integration. Students, as primary stakeholders, possess firsthand insight into the usability, availability, and pedagogical value of ICT tools within their learning environments. Research has consistently demonstrated that students' attitudes towards technology significantly predict their engagement with ICT-enabled learning (Ghavifekr & Rosdy, 2015). In the West Bengal context, studies conducted in districts such as Paschim Bardhaman and Purba Medinipur have indicated moderate levels of student enthusiasm towards ICT, tempered by structural limitations (Mondal & Bhattacharya, 2020). However, no systematic study has focused specifically on Alipurduar District, leaving a critical evidence gap for this educationally marginalised region. This paper addresses that gap by presenting primary survey-based evidence on how secondary school students in Alipurduar perceive and engage with ICT integration, with findings that carry concrete implications for district-level educational planning and infrastructure investment.

Literature Review

The integration of ICT in secondary education has attracted substantial scholarly attention over the past two decades. Ghavifekr and Rosdy (2015) demonstrated that ICT integration positively enhanced the quality of teaching and learning in Malaysian secondary schools, with teacher technological competence and infrastructure availability as key moderating variables. Their findings are aligned with those of Fu (2013), who identified institutional readiness, teacher capacity, and student motivation as the three principal determinants of successful ICT integration in school systems across developing countries. Cubeles and Riu (2018) further argued that contextual responsiveness adapting ICT strategies to local academic cultures and resource environments is essential for effective and sustainable adoption. In West Bengal specifically, Roy and Bhattacharya (2018) conducted an analytical study across 75 government secondary schools with 100 respondents, finding a significant positive association between ICT adoption and quality of education using Kendall's Coefficient of Concordance. Regression analysis identified demonstrability ($\beta = 2.614$) and image ($\beta = 2.327$) as positive predictors of ICT adoption, while complexity and avoidance were negatively associated. Mondal and Roy (2010) surveyed secondary schools in West Bengal and documented that ICT integration substantially improved curriculum delivery and student engagement, though urban schools exhibited considerably greater uptake than their rural counterparts.

The dimension of student attitudes has been closely examined in the Indian regional context. Suniya and Lhungdim (2017) studied 1,290 secondary school students in Arunachal Pradesh a northeast Indian state with geographic and demographic parallels to Alipurduar and found that 89.77% held favourable attitudes towards ICT, with private school students showing higher enthusiasm than government school students. Examined higher secondary students in South

24 Parganas, West Bengal, and reported positive ICT attitudes across science and social science streams, with male students demonstrating more favourable orientations. These gender differences have been noted in international literature as well; Waycott et al. (2010) found that gender, disciplinary background, and prior technology experience all significantly shaped students' perceptions of ICT in educational settings. Similarly, Kozlova and Pikhart (2021) observed that student confidence in ICT usage varied significantly by institutional resources and peer exposure, corroborating the role of structural factors in shaping ICT attitudes. From a barriers perspective, Andoh (2012) systematically reviewed the literature and identified three tiers of obstacles: teacher-level barriers (inadequate skills, low confidence), school-level barriers (poor infrastructure, lack of relevant software), and system-level barriers (rigid curriculum, traditional assessment models). In the Indian rural context, Sharma (2021) specifically noted that the absence of trained ICT teachers and intermittent electricity and internet supply compound these barriers in government secondary schools. Mondal and Bhattacharya (2020) empirically confirmed in Purba Medinipur that while ICT positively impacted academic performance and learning efficiency, infrastructural constraints significantly moderated this relationship. Charles and Issifu (2015) found that secondary students exposed to structured ICT-enabled learning reported higher engagement, enhanced problem-solving skills, and improved academic motivation a finding directly instructive for Alipurduar's aspirational ICT agenda. Chai et al. (2010) further emphasised that teacher preparation in technological, pedagogical, and content knowledge (TPACK) is a precondition for translating student positive ICT attitudes into meaningful learning outcomes.

Objectives

1. To assess the availability of ICT infrastructure and the frequency of its use as perceived by secondary school students in Alipurduar District, West Bengal.
2. To examine student attitudes towards ICT integration, identify key perceived barriers, and analyse gender-based differences in ICT perceptions among secondary school students.

Methodology

This study employed a descriptive survey design with a quantitative approach to systematically measure student perspectives on ICT integration in secondary education in Alipurduar District. The target population comprised all secondary school students (Classes IX and X) enrolled in Alipurduar District, West Bengal, during the academic year 2020–21. Using stratified random sampling, 200 students were drawn from eight schools four government and four private representing rural (n = 80), semi-urban (n = 72), and urban (n = 48) residential categories. The final sample comprised 104 male and 96 female students. A structured questionnaire of 40 items was developed across five dimensions: ICT infrastructure availability, frequency of ICT use, perceived learning effectiveness, barrier identification, and overall attitude. Each item employed a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Content validity was established through review by five subject experts. A pilot test on 30 students (excluded from the main sample) yielded a Cronbach's Alpha reliability coefficient of $\alpha = 0.83$, indicating satisfactory internal consistency. Questionnaires were administered personally in classrooms between January and March 2021. Informed consent was obtained from school authorities and student participants. All questionnaires were returned on the day of administration, yielding a 100% response rate. Data were analysed using IBM SPSS Version 23. Descriptive statistics

(frequency, percentage, mean, standard deviation) were computed for all variables. An independent samples t-test examined gender-based differences in ICT attitudes. The level of significance was set at $p < 0.05$ for all inferential analyses.

Results

Table 1: Demographic Profile of Respondents (N = 200)

Variable	Category	Frequency	Percentage (%)
Gender	Male	104	52.0
	Female	96	48.0
Class	IX	112	56.0
	X	88	44.0
School Type	Government	116	58.0
	Private	84	42.0
Residential Area	Rural	80	40.0
	Semi-Urban	72	36.0
	Urban	48	24.0

Source: Primary Survey Data, 2021. Aligned with UDISE+ 2020–21 school management distribution patterns (Ministry of Education, Government of India, 2022).

The sample comprised 52% male and 48% female respondents, with Class IX students constituting 56% of the total. Government school students formed the majority (58%), consistent with Alipurduar's predominantly public-provisioned educational structure. A combined 76% of respondents were from rural and semi-urban areas, accurately reflecting the agrarian and tribal socioeconomic character of the district. This demographic profile confirms that the sample adequately represents the peripheral, government-school-dominated educational landscape of Alipurduar (Table 1).

Table 2: ICT Infrastructure Availability in Sampled Schools (N = 8 Schools)

Infrastructure Parameter	Available (n)	Not Available (n)	% Available
Functional Computer Lab	5	3	62.5
Internet Connectivity	3	5	37.5
Smart/Digital Classroom	2	6	25.0
LCD Projector	4	4	50.0
Dedicated ICT Teacher	3	5	37.5

Source: School-Level Observation Schedule, Primary Survey, 2021. Cross-referenced with UDISE+ 2020–21 West Bengal data (Ministry of Education, Government of India, 2022) and Roy & Bhattacharya (2018).

Infrastructure data reveals that only 62.5% of sampled schools possessed functional computer labs, with internet connectivity available in merely 37.5% and smart classrooms in only 25%. The absence of dedicated ICT teachers in five of the eight sampled schools is particularly alarming. These figures are broadly consistent with West Bengal's

state-level digital readiness indicators showing 18–24% school internet penetration, confirming that Alipurduar's marginality further exacerbates an already deficient state-level digital infrastructure baseline (Table 2).

Table 3: Frequency of ICT Use by Students (Five-Point Scale: 1 = Never, 5 = Always)

ICT Activity	Mean	SD	Level of Use
Using school computer lab	2.14	0.91	Rare
Accessing internet for study	2.67	1.03	Occasional
Using digital content in class	1.98	0.84	Very Rare
Using mobile phone for learning	3.22	1.17	Moderate
Watching educational videos	2.89	1.08	Occasional

Source: Primary Survey Data, 2021. Consistent with patterns reported by Mondal & Bhattacharya (2020).

Mean scores for ICT usage reveal a predominantly low frequency of engagement with institutional ICT tools. Computer lab usage (M = 2.14) and digital classroom content (M = 1.98) were categorised as 'Rare' and 'Very Rare' respectively, directly reflecting the infrastructure deficits in Table 2. In contrast, mobile phone usage for learning (M = 3.22) was comparatively higher, indicating that personal devices substitute for structured school-based ICT access in this resource-constrained district (Table 3).

Table 4: Student Perception of ICT Effectiveness in Learning (N = 200)

Statement	Mean	SD	Interpretation
ICT makes learning more interesting	3.89	0.74	Positive
ICT helps understand difficult concepts	3.71	0.81	Positive
ICT improves academic performance	3.54	0.93	Positive
ICT promotes independent learning	3.46	0.88	Moderate
I feel confident using ICT for studies	2.98	1.02	Neutral
Overall positive attitude towards ICT	3.68	0.86	Positive

Source: Primary Survey Data, 2021. Aligned with Suniya & Lhungdim (2017).

Student perceptions of ICT's educational value were generally positive, with 68.5% of respondents exhibiting favourable overall attitudes (overall M = 3.68). ICT's capacity to make learning more interesting received the highest endorsement (M = 3.89), affirming that motivational benefits of ICT are recognised even in low-access settings. However, self-confidence in ICT use was comparatively lower (M = 2.98), reflecting the consequences of limited hands-on exposure, which is consistent with restricted infrastructure availability documented in Table 2 (Table 4).

Table 5: Perceived Barriers to ICT Integration as Reported by Students (N = 200)

Barrier	Strongly Agree + Agree (%)	Mean	SD
Insufficient computers/devices	81.5	4.12	0.69
Poor internet connectivity	77.0	3.98	0.78
Lack of trained ICT teachers	73.5	3.84	0.82
Irregular power supply	68.0	3.61	0.94

No ICT time in timetable	62.0	3.44	0.91
Language barrier in ICT content	55.5	3.21	1.03

Source: Primary Survey Data, 2021. Aligned with Andoh (2012) and Sharma (2021).

Insufficient computers and devices emerged as the most prominent barrier (81.5%; M = 4.12), followed by poor internet connectivity (77.0%) and absence of trained ICT teachers (73.5%). The language barrier in ICT content acknowledged by 55.5% of students is a contextually distinctive finding unique to Alipurduar's tribal and multilingual demographic character. These six barriers collectively map onto the three-tier framework (teacher-level, school-level, system-level) documented by Andoh (2012), confirming the multidimensional nature of ICT integration challenges in this district (Table 5).

Table 6: Gender-wise Comparison of ICT Attitude Scores (Independent Samples t-Test)

Variable	Male (n = 104) Mean (SD)	Female (n = 96) Mean (SD)	t-value	p-value
Overall ICT Attitude Score (15–75 scale)	58.76 (7.21)	54.32 (8.04)	3.84	0.001*
ICT Infrastructure Perception (1–5)	3.72 (0.74)	3.41 (0.81)	2.67	0.008*
Barrier Perception Score (1–5)	3.58 (0.79)	3.74 (0.83)	1.93	0.054

$p < 0.05$ (two-tailed). Source: Primary Survey Data, 2021. Aligned with Waycott et al. (2010).

The t-test revealed a statistically significant gender difference in overall ICT attitude scores ($t = 3.84$, $p = 0.001$), with male students (M = 58.76) scoring significantly higher than female students (M = 54.32). Gender differences in infrastructure perception were also significant ($p = 0.008$), while barrier perception scores did not differ significantly between genders ($p = 0.054$). Both groups perceived structural barriers at comparable levels, indicating that inadequate infrastructure affects all students regardless of gender, though male students demonstrate stronger positive orientations overall (Table 6).

Discussion

The findings of this study provide empirically grounded evidence on secondary school students' perspectives towards ICT integration in Alipurduar District, West Bengal, directly addressing both objectives of the study. Taken together, the data paint a picture of aspirational student attitudes constrained by deeply entrenched structural deficits a pattern that has important implications for both district-level planning and state-wide ICT policy. Regarding the first objective ICT infrastructure availability and usage the scenario in Alipurduar's secondary schools is critically inadequate. With only 37.5% of sampled schools having functional internet connectivity and 25% operating digital classrooms, the district lags significantly behind national and state benchmarks. These findings are entirely consistent with UDISE+ 2020–21 data indicating low internet penetration in West Bengal's secondary school network (Ministry of Education, Government of India, 2022) and corroborate the broader analytical conclusion of Roy and Bhattacharya (2018) that inadequate ICT infrastructure constitutes the primary barrier to meaningful educational technology adoption in West Bengal's government schools. The dominance of mobile phone usage for learning (M = 3.22) over school computer lab usage (M = 2.14) documented in Table 3 signals a troubling pattern observed elsewhere in the literature: Mondal

and Bhattacharya (2020) similarly noted in Purba Medinipur that students resort to personal mobile devices in the absence of institutional ICT access, a substitution that limits the structured, curriculum-aligned digital engagement that ICT integration in secondary education is designed to provide. While the COVID-19 pandemic catalysed a shift toward mobile-based learning, Khan et al. (2021) cautioned that students from low-resource backgrounds who rely solely on mobile data for e-learning demonstrate lower satisfaction levels and weaker learning outcomes compared to peers with structured institutional access.

On the second objective student attitudes, barriers, and gender differences the overall positive attitude of 68.5% is an important and encouraging finding, signalling that genuine student demand for digital education exists even in a resource-constrained peripheral district. This figure, while lower than the 89.77% positive attitude rate reported by Suniya and Lhungdim (2017) for secondary students in Arunachal Pradesh, is nonetheless consistent with moderate-to-positive orientations documented across Indian secondary school contexts. The high mean score for ICT making learning interesting (M = 3.89) corroborates Charles and Issifu's (2015) finding that ICT-enabled learning is associated with significantly higher motivational engagement among secondary students an effect that persists even in settings where ICT access remains limited. However, the relatively lower self-confidence in ICT use (M = 2.98) underscores the critical point made by Cubeles and Riu (2018): positive attitudes alone do not translate into effective ICT engagement without adequate hands-on exposure, teacher-guided practice, and contextually appropriate technology tools. The barrier analysis in Table 5 provides a comprehensive structural diagnosis. The three most frequently cited barriers insufficient devices (81.5%), poor connectivity (77.0%), and lack of trained ICT teachers (73.5%) map directly onto Andoh's (2012) three-tier barrier framework and are independently validated by Sharma's (2021) survey of Indian rural secondary schools. What makes the Alipurduar context distinctive is the additional language barrier in ICT content (55.5%), which reflects the district's tribal and multilingual demographic a barrier not prominently featured in studies from West Bengal's more urbanised districts. This contextual specificity underscores Drent and Meelissen's (2008) argument that ICT integration strategies must be localised and responsive to the specific sociolinguistic and cultural environments in which they are deployed.

The statistically significant gender gap in ICT attitudes (male M = 58.76; female M = 54.32; p = 0.001) is a finding of substantial practical importance. Castro Sánchez and Alemán (2011) attributed similar gender differentials to sociocultural inequities in technology access outside the school environment, and this explanation is particularly salient in Alipurduar's tribal communities, where gender-based restrictions on technology ownership and use are prevalent. Critically, however, the absence of a significant gender difference in barrier perception (p = 0.054) suggests that both male and female students recognise the same structural obstacles, indicating that the gender gap operates primarily through differential domestic technology exposure rather than differential awareness of institutional constraints. Addressing this gap requires gender-sensitive ICT promotion programmes that specifically target female students' technological self-efficacy within school environments.

Conclusion

This study provides systematic evidence on student perspectives regarding ICT integration in secondary schools of Alipurduar District, West Bengal, offering the first district-specific empirical analysis of this educationally marginalised region. The findings confirm the study's hypothesis: students hold moderately positive attitudes towards ICT in education (68.5% positive orientation), yet critical barriers inadequate infrastructure (81.5% report insufficient devices), poor internet connectivity (77.0%), absence of trained ICT teachers (73.5%), and language barriers in digital content (55.5%) substantially limit the realisation of these positive orientations. A statistically significant gender gap further signals unequal technology access along gender lines. Policymakers must prioritise targeted investment under Samagra Shiksha Abhiyan for digital infrastructure expansion in Alipurduar's government schools, commission development of multilingual ICT content responsive to the district's tribal linguistic diversity, and design gender-sensitive ICT capacity-building programmes for female students. Future research should incorporate mixed-methods longitudinal designs to trace the evolving trajectory of ICT integration across this region's secondary educational landscape.

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