ICT Laboratory Resources in Community Schools: A Case Study of Lalbandi Municipality, Nepal

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Abstract

Information and communication technology laboratory resources in community schools including computers, software, internet access, and peripherals are essential tools for bridging the digital divide and providing equitable, hands-on digital literacy education to underserved learners. This study examined the status of ICT laboratory resources and their utilization in community schools of Lalbandi Municipality, Sarlahi District, Nepal. Using a descriptive quantitative research design, data were collected through structured questionnaires from 43 teaching and non-teaching staff members across 19 community schools. The study assessed five key dimensions: ICT infrastructure, regularity of ICT laboratory usage, human resources, maintenance and management, and institutional challenges. Findings revealed that while all surveyed schools possessed ICT laboratories with reliable electricity supply (M = 4.30), significant gaps persisted in internet reliability (M = 3.51), educational software availability (M = 3.30), and equipment maintenance (M = 3.35). Teacher training of ICT (M = 3.23)

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emerged as a critical deficiency. ICT laboratories were predominantly concentrated at the secondary level (88.4%), creating equity gaps that exclude primary-level students. Correlation analysis demonstrated strong positive relationships among infrastructure, usage, human resources, and maintenance ($r = .573$ to $.781$, $p < .01$). Despite strong agreement on ICT's positive impact on student engagement ($M = 4.33$) and teaching effectiveness ($M = 4.33$), weak correlations between ICT inputs and perceived impact suggested a belief-practice gap. The study concludes that effective ICT integration is constrained by insufficient teacher professional development, inadequate maintenance systems, and institutional challenges, requiring structured interventions for sustainable implementation.

Keywords: community schools, digital literacy, educational technology integration, ICT laboratory resources

Introduction

Information and Communication Technology (ICT) has emerged as a transformative force in contemporary education, reshaping teaching methodologies, expanding access to knowledge, and equipping learners with competencies essential for the twenty-first century. The integration of ICT into school settings is widely acknowledged as a catalyst for improved pedagogical outcomes, enhanced student engagement, and the development of digital literacy skills critical to participation in a technology-driven global economy (Antoninis et al., 2023; PISA, 2021). In developing country contexts, ICT has also been positioned as a mechanism for increases digital divide , particularly in underserved communities where traditional resources are limited (Msambwa et al., 2024; World Bank, 2020).

The Government of Nepal has recognized this potential through successive policy initiatives, including the ICT in Education Master Plan and the School Sector Development Plan 2016–2023, which mandated the establishment of ICT laboratories in community schools nationwide (Government of Nepal, 2016). The new School Education Sector Plan (SESP) 2022–2032 introduces strategic shifts toward post-pandemic institutionalization like the Sikai Chautari portal, curriculum and competency integration, inclusive and interactive digital resources, centralized federal infrastructure, lifelong learning hubs, and federalized e-governance via a strengthened IEMIS for real-time data exchange and expanded e-services (Ministry of Education, 2022). Despite these efforts, empirical evidence consistently reveals a

substantial gap between policy intent and implementation reality. Community schools which constitute the backbone of Nepal's public education system continue to face acute challenges including funding shortfalls, inadequate technical support, high teachers' turnover, and limited professional development opportunities (Acharya, 2025; Joshi & Khatiwada, 2024; Phunyal, 2024).

Lalbandi Municipality, located in Sarlahi District of Madhesh Province, exemplifies these broader national challenges within a specific local governance context. The municipality administers 43 community schools serving socio-economically diverse student populations, making it a representative case for understanding how ICT policy translates or fails to translate into effective classroom practice at the sub-national level. Previous assessments suggest considerable variability in ICT laboratory conditions, internet reliability, and teachers' digital competency across these schools (Acharya, 2025), pointing to systemic rather than isolated deficiencies.

Despite growing scholarly attention to ICT integration in education generally, there remains a relative scarcity of rigorous, institution-specific empirical studies examining the micro-level conditions of ICT laboratory resources in Nepalese community schools, particularly at the municipal level. This gap in the evidence base limits the capacity of policymakers, school administrators, and development partners to design targeted, context-appropriate interventions. This study addresses the identified gap by offering a systematic empirical assessment of ICT laboratory resources and their utilization in community schools within Lalbandi Municipality. The present study addresses this gap by providing a systematic empirical assessment of ICT laboratory resources and their utilization in Lalbandi Municipality.

Objectives

This study pursues three specific objectives:

1. To assess the availability and functional status of ICT laboratory infrastructure in community schools of Lalbandi Municipality.
2. To examine the frequency and patterns of ICT laboratory utilization for teaching and learning.
3. To identify the key institutional, human resource, and maintenance-related challenges inhibiting effective ICT integration.

Literature review

The body of literature on ICT in education shows that schools require ICT infrastructure to achieve successful teaching and learning results but this requirement does not guarantee success. The effectiveness of educational programs depends on three crucial factors teacher competency, systematic maintenance and institutional support. This review synthesizes evidence across the five dimensions of the study's conceptual framework ICT Infrastructure Regularity of ICT Lab Usage Human resources maintenance and management and institutional challenges to examine their combined effect on teaching learning effectiveness. The study evaluates developed context research by comparing its results to the actual situation of Nepal's community schools.

ICT Infrastructure: Availability, Functionality, and Equity

A substantial body of global evidence documents the persistence of ICT infrastructure deficits in schools, particularly in developing country contexts. The UNESCO Global Education Monitoring Report, revealed that only 42% of schools in lower-income country contexts had access to computers and 22% to internet connectivity figures that situate Nepal's community school challenges within a broader structural pattern (Antoninis et al., 2023).(Tamayo, 2024) examined ICT resource status in Philippine public schools and found that the majority of facilities suffered from poorly functioning computers, unstable internet, and absent maintenance personnel, rendering nominally available infrastructure functionally inadequate. Similarly, Host et al. (2025) identified unreliable electricity, insufficient laboratory space, and limited networking infrastructure as persistent structural barriers across primary schools in East African contexts.

In the Nepalese context, Acharya (2025) documented wide variation in ICT lab conditions across community schools in Surkhet District, finding that while most schools possessed laboratories, the operational status of equipment, reliability of power supply, and availability of internet access varied substantially. Phunyal (2024) corroborated these findings, reporting that even schools with nominally complete ICT facilities frequently experienced system downtime due to hardware failures and unreliable electricity. These findings are consistent with Kira (2025) observation in Tanzanian secondary schools, where limited computer-to-student ratios created scheduling inequities that denied many students meaningful ICT exposure.

Critically, the literature underscores that infrastructure metrics alone counts of computers or laboratories are poor proxies for actual educational utility. Msambwa et al. (2024) , in a systematic review spanning 47 studies across secondary education systems, concluded that functionality, connectivity reliability, and student-to-device ratios are the infrastructure dimensions most strongly associated with learning outcomes, not mere laboratory presence. This insight directly informs the present study's approach of assessing infrastructure quality across multiple indicators rather than treating laboratory availability as a binary measure.

Regularity of ICT Lab Usage: From Availability to Practice

The transition from ICT availability to regular, pedagogically purposeful use represents a critical and frequently underachieved step in the integration process. Phunyal (2024) found that ICT resources in Nepalese community schools are frequently present but chronically underutilized, attributing this gap to unstable connectivity, power interruptions, scheduling conflicts, and the absence of administrative encouragement for ICT-integrated teaching. These structural barriers produce what Karunakaran et al. (2023) describe as 'resource-practice discontinuity' a condition in which teachers are aware of available tools but face sufficient practical obstacles to discourage consistent use.

Kira (2025) reported that in public secondary schools in Tanzania, many students interacted with ICT tools only a few times per term due to limited computer availability and rigid laboratory scheduling, far below levels required for meaningful skill development. Al Muuti et al. (2025) similarly noted that ICT utilization frequency in community school settings is strongly mediated by teacher digital confidence and the organizational culture surrounding technology adoption. Siena et al. (2023) established empirically that schools with structured ICT usage policies including mandatory curriculum integration and regular teacher accountability achieved significantly higher utilization rates and correspondingly better student outcomes than those relying on voluntary teacher adoption.

The distinction between scheduled ICT access and genuine pedagogical integration is equally important. Mustafa et al. (2024), reviewing technology integration in rural schools across 30 countries, found that even where scheduled lab access was regular, depth of integration varied enormously based on teacher preparedness and curriculum alignment. These findings establish that regularity

of use cannot be treated as equivalent to effectiveness of use a distinction with significant implications for both measurement and policy.

Human Resources: Teacher Competency, Confidence, and Continuous Development

Teacher competency is consistently identified across the literature as the single most influential factor determining the quality of ICT integration in schools (Mustafa et al., 2024; Shikomera et al., 2023). Mustafa et al. (2024)conducted a study of ICT integration in Kenyan public primary schools and found a direct, statistically significant relationship between the extent of teacher ICT training and the frequency and pedagogical quality of classroom ICT use. Their core finding that untrained teachers default to non-use regardless of infrastructure quality establishes teacher development as a prerequisite rather than a complement to infrastructure investment.

Phunyal (2024) confirmed this pattern in the Nepalese context, documenting that the absence of structured ICT professional development was the most commonly cited barrier to effective technology use among community school teachers. Kira (2025) added that training programmes in community school contexts tend to be episodic and generically designed, failing to build the subject-specific pedagogical competencies teachers need to integrate ICT meaningfully into subject instruction.

Al Muuti et al. (2025) synthesized evidence across multiple contexts to argue that ICT's educational potential can only be harnessed through concurrent investment in both physical infrastructure and comprehensive, sustained, pedagogically-aligned teacher training. Karunakaran et al. (2023) further documented that teacher confidence a psychological dimension of competence plays a significant mediating role: teachers who lack confidence in ICT tools actively avoid their use even when training has been provided, suggesting that professional development must address attitudinal as well as technical dimensions. These insights collectively position human resource development at the centre of any viable ICT integration strategy.

Maintenance and Management: Sustaining Operational Effectiveness

The maintenance of ICT equipment and the management of laboratory resources constitute a dimension of ICT integration that receives comparatively less scholarly attention yet emerges repeatedly as a critical determinant of sustained utility.Msambwa et al. (2024) identified inadequate maintenance as one of the three most commonly cited barriers to effective ICT integration across their systematic review, noting that the absence of dedicated technical support staff and maintenance

budgets created a pattern of progressive equipment degradation that eventually rendered laboratories unusable. Tamayo (2024) documented this trajectory in Philippine public schools, where the absence of technicians meant that hardware failures accumulated over time until functional computer availability fell below minimum thresholds for practical use.

Singun (2025), examining barriers to digital transformation in educational institutions, concluded that organizational planning deficits including inadequate scheduling, unclear accountability for equipment care, and absence of replacement cycles were as damaging as financial constraints in explaining maintenance failures. Host et al. (2025) reinforced this point by finding that schools with dedicated ICT coordinators and explicit laboratory management protocols maintained significantly higher levels of equipment functionality than those relying on informal, ad hoc arrangements. Phunyal (2024) observed that in Nepalese community schools, maintenance responsibilities were frequently assigned to ICT teachers as an informal addition to teaching duties, without allocated time or resources a practice that systematically underinvests in the maintenance function.

The relationship between maintenance quality and utilization frequency is bidirectional: poorly maintained equipment discourages teacher and student use, while low utilization reduces the visibility of maintenance needs and the political justification for maintenance investment. This feedback loop, documented by Msambwa et al. (2024) and consistent with the World Bank (2020) analysis of technology sustainability in low-income school systems, suggests that maintenance must be treated as a continuous programmatic commitment rather than an incidental expense.

Institutional Challenges: Policy, Funding, and Administrative Governance

Institutional factors encompassing policy frameworks, funding mechanisms, administrative leadership, and equity dynamics shape the macro-environment within which individual school-level ICT integration efforts succeed or fail. Joshi and Khatiwada (2024), in a systematic review of ICT integration barriers across South Asian educational systems, identified policy implementation gaps specifically, the absence of clear operational guidelines, monitoring frameworks, and accountability mechanisms as the most pervasive institutional barrier. They found that even well-intentioned national ICT policies frequently failed to translate into school-level change due to weak implementation structures and insufficient resourcing.

Phunyal (2024) documented that community school administrators in Nepal frequently reported receiving policy directives without accompanying financial support or technical guidance, creating mandates without means. Mustafa et al. (2024) similarly found that in rural school contexts across multiple countries, the absence of administrative champions school leaders who actively prioritized and modelled ICT use was a consistent predictor of low integration levels. Singun (2025) argued that institutional leadership commitment is non-negotiable: without it, even well-resourced schools struggle to sustain ICT integration beyond initial implementation phases.

The equity dimension of institutional challenges is particularly salient in the Lalbandi context. Mustafa et al. (2024) demonstrated that socio-economic disparities within school communities translate into unequal ICT access even within the same institution, as students from disadvantaged households are less able to supplement limited school-based ICT exposure with home access. The World Bank (2020) emphasized that sustainable ICT integration requires dedicated maintenance funding streams, monitoring and evaluation mechanisms, and equitable resource distribution protocols none of which can function without robust institutional governance frameworks. Scherer et al. (2019) further identified organizational readiness, including shared vision, leadership support, and collaborative culture, as a prerequisite for technology integration success, underscoring that institutional conditions function as the enabling environment within which all other variables operate.

ICT Impact on Teaching-Learning Effectiveness

Despite the multifaceted barriers documented above, the literature strongly and consistently affirms that effective ICT integration produces measurable improvements in teaching and learning outcomes. Al Muuti et al. (2025) found that ICT-integrated instruction significantly enhanced student interaction, knowledge retention, and motivation compared to traditional teaching methods when supported by adequate infrastructure and teacher training. (PISA, 2021) reported that students in schools with high-quality ICT access and frequent, purposeful use demonstrated stronger reading comprehension and digital literacy skills than peers in low-access schools, although the relationship was moderated by teaching quality and implementation strategy.

A critical tension identified across the literature is what Karunakaran et al. (2023) term the 'belief-practice gap': educators' strong positive attitudes toward ICT

frequently coexist with low actual utilization rates, suggesting that attitudinal readiness is necessary but insufficient for implementation. Scherer et al. (2019) identify this gap as a key target for professional development interventions, arguing that closing it requires building not only technical skills but pedagogical confidence and structural support. This paradox high perceived value, moderate actual use emerges as a central finding in the present study and is theorized within the conceptual framework as an implementation gap requiring holistic systemic responses.

Critical Synthesis: Toward an Integrated Framework

The reviewed literature reveals a clear pattern of systemic interdependency among the five dimensions of ICT integration. Infrastructure without trained teachers yields low utilization; trained teachers without maintained equipment cannot sustain practice; functional systems without institutional support lack sustainability; and even well-supported schools can be undermined by broader socio-economic inequities. No single factor is independently sufficient effective ICT integration is an emergent property of the interaction among infrastructure, human capacity, maintenance quality, and institutional (Msambwa et al., 2024; Mustafa et al., 2024).

This synthesis provides the theoretical foundation for the present study's conceptual framework. By operationalizing each of these dimensions as distinct but interrelated independent variables, the framework enables a nuanced empirical assessment of ICT integration conditions in Lalbandi Municipality's community schools one that moves beyond binary presence/absence measures toward a multi-dimensional understanding of what it takes to achieve effective, sustainable ICT-enabled teaching and learning. Crucially, the literature suggests that the relationship between these variables and ICT impact may be non-linear and context-dependent, a possibility that the correlation-based analysis in this study partially addresses, and that future longitudinal research should examine more rigorously.

Conceptual Framework

The conceptual framework of this study is grounded in the theoretical and empirical evidence synthesized in the literature review and is informed by established frameworks in educational technology integration research. Drawing on the Technology Integration Framework proposed by Scherer et al. (2019)Ronny</author><author>Siddiq, Fazilat</author><author>Tondeur, Jo %J Computers</author><author>education</author></authors></contributors><titles><title>The

technology acceptance model (TAM and the multi-level implementation model articulated by Msambwa et al. (2024), the framework organizes the determinants of ICT integration effectiveness into five interrelated independent variables that collectively influence the dependent variable: Teaching-Learning Effectiveness Using ICT.

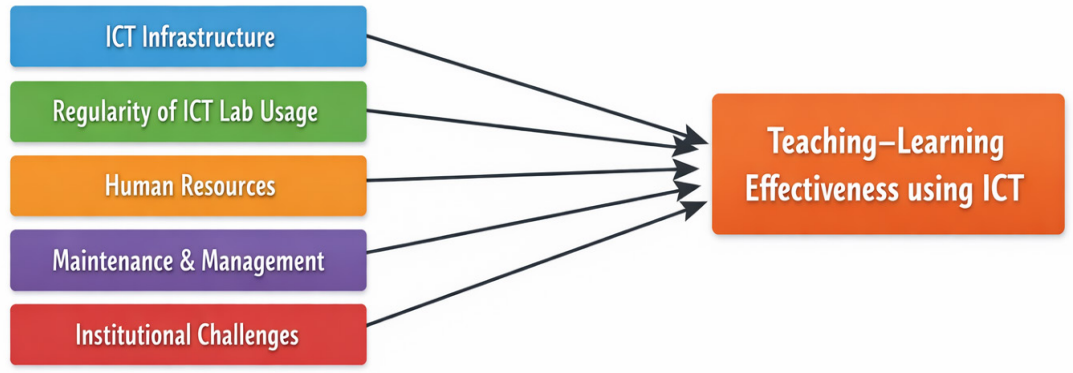

Figure 1: Conceptual framework

Method

This study adopted a descriptive quantitative research design to systematically examine the current situation of ICT laboratory resources in community schools of Lalbandi Municipality, Sarlahi, Nepal. A quantitative approach was selected because the study aims to measure, describe, and establish statistical relationships among defined variables across a specified population objectives well served by structured survey instruments and descriptive and inferential statistical analysis (Creswell & Creswell, 2017). The descriptive component characterizes the status of ICT infrastructure, usage patterns, and challenges; the analytical component employs Pearson correlation to examine relationships among framework variables.

The target population comprised all teaching and non-teaching staff directly engaged with ICT laboratory management and use in the 45 community schools of Lalbandi Municipality. From this population, 25 schools were selected using simple random sampling a probability-based method that ensures each school in the population has an equal probability of selection and minimizes selection bias (Kothari, 2004). From each selected school, all staff members directly involved with ICT laboratory management including head teachers, ICT teachers, lab assistants,

and administrative personnel were identified as eligible respondents, constituting purposive sampling within each school (Creswell & Creswell, 2017).

A total of 70 staff members across the 25 schools were identified as eligible. Seventy structured questionnaires were distributed; 43 completed questionnaires were returned from 19 schools within the data collection period from February 13 to March 11, 2026.

A structured questionnaire comprising 42 items was developed to assess the five independent variables and the dependent variable identified in the conceptual framework. Items were scored on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The questionnaire was developed through a review of validated instruments from comparable ICT integration studies (Msambwa et al., 2024; Tamayo, 2024) and adapted to the Nepalese community school context. Content validity was established through expert review by two ICT education specialists prior to administration.

Table 1

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.949	.951	33

Source: Field Survey, 2026

The Cronbach's Alpha reliability coefficient for the 33 analytical items was $\alpha = 0.949$ (Table 1), indicating a high level of internal consistency (Nunnally, 1978).

Data were entered and processed using IBM SPSS Statistics Ver. 27 . Descriptive statistics viz. frequency counts, percentages, means, and standard deviations were computed for all Likert-scale items to characterize ICT laboratory conditions across the five framework dimensions. Means were interpreted using the scale: 1.00–1.80 (Strongly Disagree), 1.81–2.60 (Disagree), 2.61–3.40 (Neutral), 3.41–4.20 (Agree), and 4.21–5.00 (Strongly Agree).

Pearson's product-moment correlation coefficients were computed to examine relationships among the five composite variable scores. Pearson correlation is appropriate when variables are measured at the interval level and relationships are expected to be linear conditions met by summed Likert-scale composite scores

(Field, 2024). Given the exploratory nature of the study and the small sample size, correlation results are interpreted conservatively and are used to identify patterns and generate hypotheses rather than to establish causal claims (Pallant, 2020). Composite variable scores were constructed by averaging the item scores within each framework dimension to enable cross-variable comparison.Results and Analysis

The following section presents findings organized by the five dimensions of the conceptual framework, drawing on frequency distributions, descriptive statistics, and correlation analysis.

Table 2

Respondent Role

	Frequency	Percent	Valid Percent	Cumulative Percent
Head Teacher	17	39.5	39.5	39.5
ICT Teacher	20	46.5	46.5	86.0
Lab Assistant	3	7.0	7.0	93.0
Administrator	3	7.0	7.0	100.0
Total	43	100.0	100.0	

Source: Field Survey , 2026

The table 2, data indicates that 46.5 % of respondents are ICT teachers, which represents the largest group in the study. Head teachers present 39.9 %, administrators represent 7.0 %, and lab assistants make up 7.0 % of respondents. This distribution shows that the study includes participants from different roles related to ICT laboratory management and use.

Table 3

Educational Qualification of Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Intermediate	1	2.3	2.3	2.3
Bachelor	18	41.9	41.9	44.2
Master	23	53.5	53.5	97.7
Others	1	2.3	2.3	100.0
Total	43	100.0	100.0	

Source: Field Survey , 2026

The table 3, indicates that the majority of respondents hold a Master's degree 53.5%, followed by those with a Bachelor's degree 41.9%. Only a small number of respondents have Intermediate and Other qualifications, each representing 2.3%. Overall, the data shows that most participants are highly educated, with more than half having postgraduate qualifications.

Table 4

Teaching Level

	Frequency	Percent	Valid Percent	Cumulative Percent
Primary	11	25.6	25.6	25.6
Secondary	32	74.4	74.4	100.0
Total	43	100.0	100.0	

Source: Field Survey , 2026

The table 4, shows that the majority of respondents teach at the secondary level, accounting for 32 participants 74.4%, while 11 respondents 25.6% are from the basic level. This indicates that most of the data is influenced by secondary-level teachers, with comparatively fewer participants from the basic level.

Table 5

ICT Laboratory Availability

	Frequency	Percent	Valid Percent	Cumulative Percent
Primary	5	11.6	11.6	11.6
Secondary	38	88.4	88.4	100.0
Total	43	100.0	100.0	

Source: Field Survey , 2026

The table 5, shows that ICT laboratory availability is reported to be much higher at the secondary level, with 38 respondents 88.4% indicating its presence, compared to only 5 respondents 11.6% at the primary level. This suggests that ICT infrastructure is predominantly concentrated in secondary schools, with limited availability in primary-level institutions.

The findings indicate that all surveyed schools 100% reported having an ICT laboratory. This suggests that ICT laboratory facilities are available in the sampled schools; however, the effectiveness, accessibility, and utilization of these laboratories may vary among institutions.

Table 6

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
School has well-equipped ICT lab	43	2	5	3.95	.785
Computers are sufficient for students	43	2	5	3.60	1.027
Computers are functional.	43	2	5	3.63	.926
Internet available in lab	43	1	5	3.91	1.042
Internet works reliably	43	1	5	3.51	1.099
Electricity supply is reliable	43	2	5	4.30	.773
Projector or smart board available	43	1	5	3.91	.921
Educational software available	43	1	5	3.30	1.013
ICT lab is regularly used	43	2	5	3.65	.997
Students get practical ICT classes	43	1	5	3.58	1.029
Teachers use ICT in teaching	43	2	5	3.74	.790
All classes access ICT lab	43	1	5	3.51	1.099
Lab timetable is managed properly.	43	1	5	3.81	1.029
Qualified ICT teacher available.	43	1	5	3.77	1.130
Teachers are ICT trained.	43	1	5	3.23	1.109
Teachers confidently use ICT	43	2	5	3.60	.877
Technical support staff available	43	1	5	3.33	1.063
Teachers receive regular ICT training.	43	1	5	3.19	1.200
ICT equipment regularly maintained	43	1	5	3.35	.897
Broken equipment repaired quickly	43	1	5	3.35	1.021
Lab resources well managed	43	1	5	3.44	1.098
Maintenance budget allocated	43	1	5	3.44	1.098
Equipment safety maintained	43	2	5	3.53	.855
Budget limits ICT development	43	2	5	3.91	.921
Administrative support insufficient	43	1	5	3.53	1.032
Heavy workload prevents ICT use	43	1	5	3.53	.984
Lack of technical support affects use	43	2	5	3.51	.935
Students lack lab access time	43	1	5	3.65	.997
ICT increases student engagement	43	2	5	4.33	.715
ICT improves teaching effectiveness	43	2	5	4.33	.680
Students understand better using ICT	43	2	5	4.28	.734
ICT improves digital skills	43	2	5	4.26	.848
ICT makes learning interactive	42	2	5	4.29	.708
Valid N (listwise)	42				

Source: Field Survey , 2026

Table 6, presents the descriptive statistics of respondents' perceptions regarding the current status of ICT laboratories in schools. The findings indicate that respondents generally agreed that ICT facilities are available, although some challenges remain.

Regarding ICT infrastructure, respondents reported that schools had relatively well-equipped ICT laboratories (M = 3.95, SD = 0.79). Internet availability (M = 3.91, SD = 1.04) and the presence of projectors or smart boards (M = 3.91, SD = 0.92) were also rated positively. Electricity supply was found to be highly reliable (M = 4.30, SD = 0.77), suggesting that the basic infrastructure necessary for ICT integration is largely available.

In terms of ICT resources and usage, respondents moderately agreed that computers were sufficient (M = 3.60, SD = 1.03) and functional (M = 3.63, SD = 0.93). Teachers' use of ICT in teaching (M = 3.74, SD = 0.79) and regular use of ICT laboratories (M = 3.65, SD = 1.00) were also reported. However, access to ICT labs for all classes (M = 3.51, SD = 1.10) and the availability of educational software (M = 3.30, SD = 1.01) were rated at a moderate level.

With regard to human resources, the availability of qualified ICT teachers was moderately rated (M = 3.77, SD = 1.13). However, teachers' ICT training (M = 3.23, SD = 1.11) and regular training opportunities (M = 3.19, SD = 1.20) were comparatively lower, indicating a need for professional development. Technical support staff availability was also moderate (M = 3.33, SD = 1.06).

In terms of management and maintenance, ICT equipment maintenance (M = 3.35, SD = 0.90), resource management (M = 3.44, SD = 1.10), and maintenance budget allocation (M = 3.44, SD = 1.10) were rated moderately. Similarly, the repair of broken equipment (M = 3.35, SD = 1.02) suggests room for improvement.

Regarding challenges, respondents agreed that budget limitations (M = 3.91, SD = 0.92), administrative support issues (M = 3.53, SD = 1.03), heavy workload (M = 3.53, SD = 0.98), lack of technical support (M = 3.51, SD = 0.94), and limited student access time (M = 3.65, SD = 1.00) affect ICT utilization.

Finally, respondents strongly agreed on the positive impact of ICT on teaching and learning. ICT was found to increase student engagement (M = 4.33, SD = 0.72), improve teaching effectiveness (M = 4.33, SD = 0.68), enhance students' understanding (M = 4.28, SD = 0.73), develop digital skills (M = 4.26, SD = 0.85), and make learning more interactive (M = 4.29, SD = 0.71).

Table 7

Pearson's Correlation Matrix

Variable	1. Infra.	2. Usage	3. HR	4. Maint.	5. Inst.Ch.	6. Impact
1. ICT Infrastructure	—	.594**	.573**	.574**	-.282	.092
2. ICT Lab Usage	.594**	—	.781**	.704**	-.438*	.233
3. Human Resources	.573**	.781**	—	.691**	-.480*	.064
4. Maintenance & Mgmt.	.574**	.704**	.691**	—	-.222	.181
5. Institutional Challenges	-.282	-.438*	-.480*	-.222	—	.177
6. ICT Impact	.092	.233	.064	.181	.177	—

Source: Field Survey , 2026

The Table 7, shows the relationships among ICT infrastructure, ICT lab usage, human resources, maintenance and management, institutional challenges, and ICT impact. The results indicate strong positive correlations among ICT infrastructure, usage, human resources, and maintenance. ICT infrastructure is significantly and positively correlated with ICT lab usage ($r = .594$, $p < .01$), human resources ($r = .573$, $p < .01$), and maintenance ($r = .574$, $p < .01$). Similarly, ICT lab usage has a strong positive relationship with human resources ($r = .781$, $p < .01$) and maintenance ($r = .704$, $p < .01$), suggesting that better staffing and management contribute to increased ICT utilization.

Human resources also show a significant positive correlation with maintenance ($r = .691$, $p < .01$), indicating that the availability of skilled personnel is associated with better management of ICT resources. In contrast, institutional challenges are negatively correlated with ICT lab usage ($r = -.438$, $p < .05$) and human resources ($r = -.480$, $p < .05$), implying that higher challenges hinder effective ICT use and staffing.

However, ICT impact shows weak and non-significant correlations with most variables, including infrastructure ($r = .092$), usage ($r = .233$), human resources ($r = .064$), and maintenance ($r = .181$). This suggests that although ICT resources and practices are interrelated, their direct impact on teaching and learning outcomes may not be strongly evident in this dataset. Overall, the findings highlight strong interconnections among ICT-related factors, while institutional challenges act as a limiting factor.

Discussion

The findings of this study provide a nuanced empirical portrait of ICT laboratory conditions in community schools of Lalbandi Municipality, Sarlahi, Nepal, and invite interpretation against the backdrop of the broader literature on ICT integration in developing country educational systems. The discussion addresses each of the three research questions in turn before examining cross-cutting themes and theoretical implications.

ICT Infrastructure: Mixed Adequacy with Systemic Gaps

The first research question concerned the current status of ICT laboratory infrastructure. Results indicate that all surveyed schools reported the presence of an ICT laboratory, with electricity reliability receiving the highest infrastructure rating (M = 4.30). This finding partially reflects the success of Nepal's ICT in Education Master Plan in establishing baseline laboratory infrastructure (Government of Nepal, 2016). However, the relatively lower ratings for educational software availability (M = 3.30) and internet reliability (M = 3.51) suggest that laboratory presence does not equate to functional quality, echoing the well-documented distinction between nominal and operational availability documented across comparable developing country contexts (Msambwa et al., 2024; Tamayo, 2024).

The pronounced concentration of ICT laboratories at the secondary level (88.4%) compared to the primary level (11.6%) is a particularly significant finding. This disparity implies that younger learners in Lalbandi Municipality's community schools are systematically excluded from early digital literacy experiences, a structural inequity that may compound over time.Kira (2025) reported analogous equity gaps in Tanzanian secondary schools, where limited computer-to-student ratios created scheduling inequities that denied many students meaningful ICT exposure. The Lalbandi Municipality schools data suggest a vertical equity dimension that the existing literature has not fully theorized: namely, the tendency for ICT resource concentration to favour upper educational levels even within the same institutional system. This aligns with the World Bank (2020) warning that sustainable ICT integration requires equitable resource distribution protocols across all levels of schooling.

ICT Laboratory Utilization: The Resource-Practice Discontinuity

The second research question addressed the frequency and effectiveness of ICT laboratory utilization. The moderate mean scores for ICT lab regularity of

use (M = 3.65), student practical ICT classes (M = 3.58), and all-class access to the laboratory (M = 3.51) confirm the "resource-practice discontinuity" described by Karunakaran et al. (2023), whereby available resources are not systematically translated into consistent pedagogical practice. This pattern is well established in the literature: Phunyal (2024) documented similar underutilization in Nepalese community schools, attributing it to unstable connectivity, power interruptions, scheduling conflicts, and the absence of administrative encouragement for ICT-integrated teaching.

The strong positive correlation between ICT lab usage and human resources ($r = .781$, $p < .01$) is among the most significant findings of this study. It confirms the centrality of teacher competency a relationship strongly established in the literature (Mustafa et al., 2024; Shikomera et al., 2023) and suggests that utilization rates in Lalbandi schools are primarily constrained by human resource deficits rather than infrastructure absence per se. This interpretation is reinforced by the comparatively lower ratings for teacher ICT training (M = 3.23) and regular training opportunities (M = 3.19), which represent the two lowest-scoring human resource items.

Institutional Challenges and the Belief-Practice Gap

The third research question addressed the primary challenges constraining effective ICT laboratory utilization. Budget limitations (M = 3.91) emerged as the foremost institutional obstacle, consistent with Joshi and Khatiwada (2024) systematic review finding that financial insufficiency is the most pervasive institutional barrier to ICT integration across South Asian educational systems. The negative and statistically significant correlations between institutional challenges and both ICT lab usage ($r = -.438$, $p < .05$) and human resources ($r = -.480$, $p < .05$) provide empirical confirmation of the inhibiting role of institutional factors, aligning with Singun (2025) argument that organizational planning deficits are as damaging as financial constraints in explaining ICT implementation failures.

Perhaps the most theoretically important finding is the paradox of high perceived ICT impact alongside weak statistical correlation between ICT-related variables and actual impact scores. Respondents strongly affirmed that ICT increases student engagement (M = 4.33), improves teaching effectiveness (M = 4.33), and enhances digital skills (M = 4.26); yet none of the infrastructure, usage, human resource, or maintenance variables correlated significantly with the ICT impact composite. This pattern is precisely what Karunakaran et al. (2023) describe as

the "belief-practice gap": educators hold strong positive attitudes toward ICT yet translate these beliefs into practice only partially.(Scherer et al., 2019) identify this gap as a key target for professional development interventions, arguing that closing it requires building not only technical skills but pedagogical confidence and structural support. The Lalbandi municipality schools provide recent contextual evidence for this theoretical construct in a Nepalese municipal school setting, suggesting that attitudinal readiness is necessary but insufficient to drive measurable impact.

Systemic Interdependency: Evidence for the Integrated Framework

The overall pattern of intercorrelations in Table 7 substantiates the conceptual framework's core proposition of systemic interdependency among ICT integration dimensions. The strong positive correlations among infrastructure, usage, human resources, and maintenance ranging from r = .573 to r = .781 confirm the integrated nature of the ICT ecosystem in community schools, where deficits in any one dimension tend to be associated with deficits in others. This is consistent with Msambwa et al. (2024) systematic review conclusion that effective ICT integration is an emergent property of the interaction among infrastructure, human capacity, maintenance quality, and institutional governance, rather than the product of any single factor. The maintenance dimension warrants particular attention: its moderate mean scores across all items (M = 3.35 to 3.53) and its significant positive correlations with both infrastructure and usage suggest that maintenance represents the weakest link in Lalbandi municipality community schools' ICT integration chain a finding consistent with Msambwa et al. (2024) identification of inadequate maintenance as one of the three most commonly cited barriers to effective ICT integration globally.

Conclusion

This study set out to provide a systematic empirical assessment of ICT laboratory resources and their utilization in community schools of Lalbandi Municipality, Sarlahi, Nepal. Drawing on structured survey data from 43 staff members across 19 schools, it examined three research questions concerning infrastructure status, utilization patterns, and constraining challenges, organized within a five-dimension conceptual framework informed by established educational technology integration theory (Msambwa et al., 2024; Scherer et al., 2019).

The study yields four principal conclusions. First, while universal laboratory availability has been achieved in the sampled schools, reflecting the partial

success of Nepal's national ICT education policy (Government of Nepal, 2016), significant quality gaps persist across internet reliability, educational software, and equipment maintenance particularly in primary-level institutions. Second, ICT laboratory utilization remains moderate and uneven, constrained by insufficient teacher training, scheduling limitations, and inadequate technical support, confirming patterns identified across comparable developing country contexts (Kira, 2025; Phunyal, 2024). Third, the correlation analysis reveals strong systemic interdependency among infrastructure, usage, human resources, and maintenance dimensions, while institutional challenges function as a significant inhibitor of both utilization and human resource development. Fourth, the paradoxically weak statistical relationship between ICT-related input variables and perceived impact despite respondents' strongly positive attitudes toward ICT in teaching and learning points to a structural belief-practice gap requiring targeted professional development and institutional reform (Karunakaran et al., 2023; Scherer et al., 2019)Ronny</author><author>Siddiq, Fazilat</author><author>Tondeur, Jo %J Computers</author><author>education</author></authors></contributors><titles><title>The technology acceptance model (TAM.

Based on these conclusions, this study recommends: (1) the development of a structured, sustained ICT professional development programme for teachers in Lalbandi Municipality's community schools, grounded in pedagogically-aligned, subject-specific competency frameworks; (2) the establishment of dedicated ICT laboratory management roles with clearly defined accountability structures and allocated maintenance budgets; (3) a targeted policy intervention to extend ICT infrastructure to primary-level institutions, addressing the observed secondary-primary equity gap; and (4) the integration of ICT usage requirements into school accountability frameworks to translate high perceived value into consistent pedagogical practice. These recommendations are consistent with best-practice evidence from comparable educational contexts and are designed to address the specific interdependencies identified in the municipality community schools empirical data (Al Muuti et al., 2025; Host et al., 2025; Mustafa et al., 2024).

Further Limitations and Implications

Methodological Limitations

Several methodological limitations must be acknowledged to appropriately bound the scope of interpretation. First, the relatively small effective sample size

(n = 43 across 19 schools) limits the statistical power of the Pearson's correlation analysis and may account for the non-significant correlations observed between input variables and ICT impact. As Pallant (2020) notes, small sample studies require conservative interpretation of correlation findings; the relationships identified here should therefore be treated as hypothesis-generating rather than hypothesis-confirming. Field (2024) further cautions that Pearson's correlations computed from Likert-composite scores may underestimate the strength of nonlinear relationships, particularly in small samples where skewness can distort correlation estimates.

Second, the exclusive reliance on self-reported perceptual data introduces social desirability bias: staff respondents may have rated their schools' ICT conditions more favourably than objective observation would confirm. Future research should triangulate survey findings with direct laboratory observation protocols, equipment audits, and student performance data to provide a more complete picture of ICT integration quality (Creswell & Creswell, 2017). Third, the cross-sectional design precludes causal inference; the correlations reported here establish associations among variables at a single point in time and cannot demonstrate the direction or mechanism of causal influence. This is a recognized limitation of descriptive quantitative research in educational technology contexts (Kothari, 2004).

Fourth, the scope of the study is limited to a single municipality within Madhesh Province, and findings should not be uncritically generalized to other districts, provinces, or national-level policy contexts. Lalbandi Municipality presents a specific socio-economic, administrative, and geographic profile that may differ from mountainous, hill, or urban school contexts within Nepal. The relatively high proportion of secondary-level respondents (74.4%) also means that the study's findings disproportionately reflect secondary-level conditions, and primary-level ICT challenges may be more severe than the aggregate data suggest. Sampling was further limited to schools returning completed questionnaires within the data collection window, introducing potential non-response bias if schools with poorer ICT conditions were less likely to participate.

Implications for Policy and Practice

Despite these limitations, the study carries several important implications for policy and practice at the municipal, provincial, and national levels. For the Lalbandi Municipality Education section and the District education office, the findings underscore the need to shift policy focus from infrastructure provisioning

largely accomplished to quality assurance, maintenance sustainability, and teacher professional development. The municipality's local governance mandate, strengthened by Nepal's federal restructuring under the 2015 Constitution, provides a governance vehicle through which targeted, context-sensitive ICT integration strategies can be designed and monitored at scale (Government of Nepal, 2016). Singun (2025) argues that local-level institutional leadership commitment is non-negotiable for sustaining ICT integration beyond initial implementation; Lalbandi's administration is thus positioned to exercise precisely this function.

At the national policy level, the findings reinforce the growing consensus that Nepal's successive ICT in education plans must be accompanied by dedicated sub-national implementation frameworks that allocate maintenance budgets, establish teacher training pipelines, and create accountability mechanisms for ICT integration at the school level (Acharya, 2025; Joshi & Khatiwada, 2024). The (PISA, 2021) evidence that students in high-quality ICT access schools demonstrate stronger digital literacy outcomes mediated by teaching quality provides an external benchmark against which Nepal's community school ICT conditions can be evaluated and improved.

Directions for the Future Research

The study points to several productive directions for the future research. First, a longitudinal investigation tracking changes in ICT infrastructure quality, utilization frequency, and student digital literacy outcomes over two or more academic years would substantially strengthen the causal claims that the present cross-sectional design cannot support. Second, a mixed-methods follow-up incorporating classroom observation, in-depth teacher interviews, and student focus groups would provide the contextual depth needed to explain the belief-practice gap identified here, particularly the mechanisms through which institutional challenges translate into reduced ICT usage. Third, comparative studies across multiple municipalities in Madhesh Province or across Nepal's diverse ecological and administrative zones would enable the identification of contextual moderators of ICT integration effectiveness, generating more generalizable theoretical insights (Creswell & Creswell, 2017). Finally, intervention research testing specific professional development models such as mentored peer learning, subject-specific ICT integration modules, or school-based ICT coordinator programmes would contribute directly actionable evidence to the field (Al Muuti et al., 2025; Mustafa et al., 2024).

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