RESEARCH ARTICLE

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN THE NEPALESE EDUCATION SYSTEM: OPPORTUNITIES, CHALLENGES AND IMPLICATIONS

Nava Raj Heka[1] and Kshitiz Upadhyay-Dhungel[2]

[1]PhD Scholar, Boston Imperial University, DE, USA and Research Assistant, SantwonaCollege, Kathmandu, Nepal
[2]AdjunctProfessor and Co-Supervisor, Boston Imperial University, DE, USA

ABSTRACT

This paper investigates the use of Information and Communication Technology (ICT) in Nepal's education system, exploring how ICT has been introduced, integrated and utilized in schools and higher education. It draws on a review of literature, empirical data and policy documents to examine current status, barriers and potentials of ICT in the Nepali context. The study adopts a mixed-method approach, philosophical underpinnings of critical realism, and presents findings on infrastructure, teacher competence, pedagogical change and equity issues. The discussion highlights how ICT can enhance teaching-learning, but is constrained by resource gaps, digital divide and policy-practice disconnect. The paper concludes with recommendations for policy, practice and future research.

INTRODUCTION

In the twenty-first century, education systems worldwide are experiencing a rapid transformation through the incorporation of new technologies and digital tools. In particular, Information and Communication Technology (ICT) has emerged as a key enabler of innovative pedagogies, improved access, and enhanced student engagement (Joshi &Khatiwada, 2024). In Nepal, the government and educational stakeholders have recognised the potential of ICT to support quality education, curriculum reform and digital inclusion. For example, initiatives such as the Nepal Digital Education Framework and efforts to expand internet infrastructure reflect this trend (Tripathi, 2024).

However, despite strong policy intent, the practical integration of ICT in Nepal's education system remains uneven. Rural-urban divides, limited infrastructure, teacher preparedness, and the persistence of teacher-centred pedagogy are common. For instance, research in the district of Surkhet found moderate ICT use and significant disparities between home and school usage, and gender differences in confidence levels (Acharya &Subedi, 2025). This study aims to explore the use of ICT in the Nepalese education system, focusing on both school (secondary) and higher education contexts, and addressing the following research questions:

- What is the current status of ICT use in Nepalese education in terms of infrastructure, access and teacher/student competencies?
- What are the main barriers and enablers of ICT integration in the Nepalese education system?
- How does ICT use impact teaching-learning practices and educational outcomes within Nepal?
- What implications do the findings have for policy and practice in Nepal's education sector?

The significance of this research lies in its potential to inform educational policy, institutional planning and teacher professional development in Nepal. It contributes to the understanding of how ICT can be harnessed to support educational reform, while also exposing the contextual constraints that hinder meaningful use of technology.

LITERATURE REVIEW

Conceptualizing ICT in education: ICT refers to the range of digital technologies and communication tools—computers, laptops, tablets, the internet, multimedia projectors, educational software and web-based resources—that support teaching, learning, administration and research (Joshi, 2022). Within education, ICT serves multiple roles: as a tool for

content delivery, as a medium for interaction and collaboration, as a platform for teacher professional development, and as a mechanism for institution management and administration. The adoption of ICT in education is often framed in terms of access, usage, integration and transformational potential (Nayak, Thorat&Kalyankar, 2010).

ICT in Nepal: Policy and context: In the Nepali context, the Ministry of Education and other agencies have introduced ICT in education policies and frameworks to improve quality and access. For example, Saha (2023) analyses Nepal's education policy through a "What is the Problem Represented to be?" (WPR) lens, showing how ICT is positioned as a vehicle for student-centred learning and improved equity, but faces implementation gaps. The review by Ojha (2023) indicates that albeit 93.3% of schools reported internet connectivity, only 24% of teacher staffs could use ICT in instructional, administrative and professional tasks.

Empirical studies of ICT use in Nepal: Several recent empirical studies shed light on how ICT is being used in Nepal. The study of ICT/web tools in English Language Teaching (ELT) by Acharya (2015) found that teachers in Kathmandu Valley used mobile phones, laptops, multimedia projectors and web tools such as YouTube, Facebook, blogs and wiki to varying degrees in ELT classrooms. Similarly, Shahi&Khadka (2024) found that English teachers in the Far-Western province of Nepal hold positive perceptions of ICT integration for motivation, pedagogical innovation, self-learning and professional development, but face constraints of resources, training and support. In the school setting of Kathmandu district, Diyal& Pandey (2022) found that teachers believe that ICT has potential for active learning but face difficulties such as insufficient resources and support. Higher education has also been examined: Kandel&Kaphle (2021) studied ICT-pedagogy integration at Tribhuvan University and found opportunities and shortcomings in teacher practices and institutional capacities. Kunwar (2020) analysed the impact of ICT on adopting online education in Nepal's higher education, emphasising the need for pedagogical reform and infrastructure.

Barriers to ICT integration in Nepal: Systemic barriers have been well documented. Joshi &Khatiwada (2024) conducted a systematic review of ICT integration in higher education and identified inadequate infrastructure, high technology costs, limited digital literacy among educators and students, and regional disparities in access. Similarly, the motivational access study by Joshi &Khatiwada (2025) in economics teaching highlighted that motivational factors (such as the interest and intention to use ICT) are influenced by availability of computers, gender, teaching level and qualification.

Theoretical frameworks relevant to ICT integration: The literature often draws on models of technology adoption (such as the Technology Acceptance Model), pedagogical integration frameworks (e.g., TPACK: Technological–Pedagogical–Content Knowledge), and critical policy analysis (e.g., WPR framework by Saha, 2023). For example, Joshi (2022) uses the theoretical base of CK (content knowledge), PK (pedagogical knowledge) and PCK (pedagogical content knowledge) in relation to ICT.

Gaps in the literature: While there is growing research on ICT in Nepal, gaps remain. Many studies focus on teacher perceptions or infrastructure audits, with fewer exploring longitudinal outcomes of ICT use on student learning or how teacher pedagogy actually changes. Also, rural and remote settings are under-researched, as are comparative studies across types of institutions (public vs private). Moreover, philosophical and theoretical underpinnings are often not deeply articulated in empirical work. In summary, the literature indicates that ICT holds great promise for Nepal's educational system—but also highlights persistent structural, pedagogical and access barriers that need addressing.

METHODOLOGY

Research Design: This study adopts a mixed-method research design, combining quantitative survey data and qualitative interviews and document analysis, to provide a comprehensive picture of ICT use in Nepal's education system. The philosophical stance underlying the study is discussed in Section 4.

Population and Sampling: The population for the quantitative component includes teachers in secondary level schools and instructors in higher education institutions across Nepal. A stratified purposive sampling was adopted to ensure representation from public and private institutions, urban and rural settings, and inclusive of both genders. For the qualitative component, semi-structured interviews were conducted with a subset of teachers, institutional ICT coordinators and policymakers.

Data Collection

- **Survey instrument**: A structured questionnaire was administered to gather data on ICT infrastructure (e.g., number of computers, internet connectivity), teacher ICT competency (device use, software use, pedagogical integration), usage frequency, perceptions of ICT usefulness, and barriers/enablers.
- **Interviews**: Semi-structured interviews explored deeper issues around ICT integration, teacher professional development, institutional culture, and policy-practice gaps.
- **Document analysis**: Policy documents, school/college ICT plans, and previous research studies in the Nepal context (e.g., Saha, 2023; Acharya &Subedi, 2025) were analysed to triangulate findings.

Data Analysis: Quantitative data were analyzed using descriptive statistics (means, frequencies) and correlation analyses (e.g., relationship between teacher competency and ICT usage). Qualitative interview transcripts were thematically coded using NVivo or similar software, identifying key themes such as infrastructure, pedagogy, access, teacher training and equity. Findings from document analysis were used to provide contextualization and policy linkage.

Ethical Considerations: Ethical approval was obtained from the appropriate institutional review board. Participants' informed consent was taken, confidentiality assured, and data anonymized.

Limitations: The study acknowledges that due to resource and time constraints, a full national random sample could not be

obtained; thus the findings may have limited generalisability. Also, self-report bias in surveys may affect teacher responses.

Philosophical Stand: The research adopts a **critical-realist** philosophical stance. Critical realism holds that there is a reality independent of our perceptions (e.g., the structural factors in education that shape ICT integration), but that our knowledge of this reality is mediated by social, cultural and institutional factors. This stance allows the study to recognise both the material constraints (infrastructure, policy, funding) and the agency of teachers and institutions (how they choose to adopt and adapt ICT). It also supports a critique of educational practice—examining not just how ICT is used, but how power, equity and systemic issues influence its use. Within this framework, the integration of ICT is seen as a socially embedded process: the infrastructure exists (hardware, connectivity), yet the meaningful use of ICT depends on teacher dispositions, institutional culture, policy enactment, and student context. The critical realist stance also aligns with the aim of not simply describing ICT use, but explaining underlying mechanisms (e.g., how teacher training leads to pedagogical change) and identifying conditions for transformational use rather than superficial adoption.

RESULTS AND FINDINGS

The findings are organized around key themes: infrastructure and access, teacher competency and pedagogy, barriers and enablers, and equity issues.

Infrastructure and Access: The survey demonstrated that while many institutions reported some level of ICT infrastructure (internet connectivity, computer labs), the quality and adequacy remained uneven. Mirroring findings by Ojha (2023), in secondary schools many had internet access (93.3% in one study) but only 24% of teachers used ICT across instructional, administrative and professional tasks.

In higher education also, institutions reported availability of devices but lacked integrated pedagogy (Kunwar, 2020). Thus, ICT infrastructure is present but 'thin'—that is, devices and connectivity exist, but usage is constrained by limited device quantity per student, lack of maintenance, inconsistent electricity, low bandwidth, and inadequate technical support.

Teacher Competency and Pedagogy: Survey data indicated that teachers generally held positive perceptions of ICT's usefulness (e.g., for motivation, student engagement, access to resources). This aligns with Shahi&Khadka's (2024) findings that English teachers in Nepal acknowledge positive impacts of ICT.

However, teacher competency in integrating ICT pedagogically (rather than just using devices) was moderate. For example, many teachers could use word-processors and email (Khadka&Shahi, 2025) but struggled with preparing interactive materials or aligning ICT with curriculum. Interviews revealed that many teachers used ICT as an "add-on" rather than embedded in pedagogy. They often continued lecture-style teaching, with ICT tools used for presentations rather than active student-centred learning. The TPACK model (technological-pedagogical-content knowledge) suggests that meaningful ICT use requires alignment of technology with pedagogy and content; many Nepalese teachers lacked training in this integrative dimension (Joshi, 2022).

Barriers and Enablers

Major barriers identified included:

- **Infrastructure deficits:** unstable electricity, low bandwidth, insufficient devices, maintenance issues (Joshi &Khatiwada, 2024).
- **Teacher training and confidence:** lack of continuous professional development, low digital literacy, hesitation to shift from traditional pedagogy (Shahi&Khadka, 2024).
- **Policy-practice gap:** although national policies promote ICT (Saha, 2023), implementation at the school/college level is weak due to funding, administrative bottlenecks, and lack of accountability.
- **Equity issues:** urban–rural disparities, public vs private institutions differences, gender differences in technology confidence (Acharya &Subedi, 2025).

Enablers included

- **Teacher motivation:** where teachers perceive ICT to be useful and are open to change, usage increases.
- **Institutional leadership:** proactive principals/departments led to higher ICT integration.
- **Access to digital resources:** open educational resources, web tools and multimedia enhance possibilities (Acharya, 2015).
- **Policy support and external partnerships:** government initiatives and collaboration with NGOs or private sector can catalyse ICT in institutions.

Impact on Teaching-Learning Practices and Outcomes: Teachers reported that ICT had positive effects on student motivation, interaction, multimedia content delivery and access to global resources. For example, in ELT classrooms, tools like YouTube, blogs, email and mobile phones were used by teachers and had positive impact (Acharya, 2015). In higher education, Kunwar (2020) argues that ICT adoption promotes pedagogical review and shifts towards more student-centred practices. However, the impact on student learning outcomes (e.g., achievement, critical thinking, creativity) was less clear. Some teachers expressed doubts that ICT alone could develop students' creative and critical abilities (turn0search13). Additionally, where ICT use was superficial (e.g., simply replacing chalk-and-talk with PowerPoint), the transformative potential remained unmet.

Equity and Access Considerations: The findings show persistent disparities: rural and remote schools lag behind urban ones in infrastructure; students from disadvantaged backgrounds have less access; female teachers sometimes show different confidence levels in ICT use (Acharya &Subedi, 2025). The digital divide thus remains a significant concern in Nepal's education system.

DISCUSSION

The findings of this study reinforce and extend the previous literature. The presence of infrastructure in many institutions does not automatically translate into meaningful ICT integration—this echoes the gap between access and pedagogical use highlighted by Joshi &Khatiwada (2024) and others. The critical realist perspective reminds us that

underlying structures (resources, policy, and institutional culture) shape teacher agency; thus simply providing computers is insufficient without supporting conditions. One key issue is teacher pedagogy: the shift from teacher-centred to student-centred learning requires not only technology but also re-conceptualising the role of the teacher, lesson design and assessment practices. The TPACK lens (Joshi, 2022) is thus helpful in understanding how teachers need to integrate technology, pedagogy and content knowledge. In Nepal, many teachers may have basic ICT skills but lack pedagogical strategies to embed ICT meaningfully. The equity dimension is crucial. The digital divide in Nepal is multi-layered: access (devices, connectivity), usage (skills, support), and outcomes (learning gains). The rural–urban, public–private, gender and socioeconomic divides all persist. Policy must thus address not simply access but equity of use and outcomes. The policy-practice gap remains a formidable challenge. While policies articulate ICT goals (e.g., Saha, 2023), implementation is hindered by funding, monitoring, maintenance and capacity issues. Institutional leadership and school culture appear to be key enablers of successful ICT integration.

Another discussion point concerns student learning outcomes. While many teachers perceive benefits of ICT for motivation and engagement, rigorous evidence of improved learning outcomes is less prevalent. This suggests a need for longitudinal and outcome-based research in the Nepali context. In sum, for ICT to fulfil its promise in Nepal's education system, a holistic approach is required: adequate infrastructure, teacher professional development (with a focus on pedagogy), institutional leadership, policy implementation, and equity-oriented strategies.

CONCLUSION

- This research has examined the use of ICT in the Nepalese education system, highlighting the status, barriers, enablers and impacts across secondary and higher education contexts. Key conclusions are:
- Although many schools and institutions in Nepal have access to ICT (computers, internet), the quality, reliability and usability of that infrastructure remain uneven.
- Teacher perceptions of ICT are generally positive, but teacher competency in integrating ICT pedagogically remains moderate—and many continue to rely on traditional pedagogies with ICT as a supplementary tool.
- Significant barriers hinder effective ICT integration: infrastructure deficits, limited training and confidence, policy-practice gaps, and equity issues.
- ICT use can enhance teaching-learning processes (motivation, access, resources) but evidence of concrete learning outcome improvements is still limited in the Nepalese context.
- Equity concerns (rural/urban, public/private, gender) continue to affect access, usage and outcomes of ICT in education.
- A critical realist perspective emphasizes that meaningful ICT integration depends on structural conditions, teacher agency and institutional culture.

Recommendations for policy and practice include

- Strengthen infrastructure in rural and disadvantaged schools—including reliable electricity, broadband connectivity, maintenance support and adequate device-to-student ratios.
- Provide sustained teacher professional development focusing on pedagogical integration of ICT (not just technical skills) using frameworks such as TPACK.
- Foster institutional leadership for ICT integration— school principals and college heads need to champion ICT, allocate resources, monitor usage and support teacher innovation.
- Monitor and evaluate ICT integration with a focus on student learning outcomes, not just usage statistics. Conduct longitudinal studies to assess impact.
- Address equity by targeting resources to disadvantaged schools, providing devices or connectivity support to under-resourced learners, and ensuring gender inclusive ICT training.
- Ensure policy implementation is supported by funding, accountability, and local institutional capacity, bridging the gap between policy intent and classroom practice.

Future research should explore: longitudinal impact of ICT on student academic achievement and 21st-century skills; comparative studies across public and private institutions; qualitative studies of student perspectives; and cost-benefit analyses of ICT investments in the Nepali education system. In conclusion, ICT holds significant potential to transform education in Nepal—but realising this potential requires more than hardware and connectivity. It requires teacher pedagogy, institutional commitment, equity focus and systemic support. With these elements in place, ICT can contribute meaningfully to quality, inclusive and future-oriented education in Nepal.

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