International Journal of Advanced Engineering, Management and Science (IJAEMS)
Peer-Reviewed Journal
ISSN: 2454-1311 | Vol-12, Issue-3; May-Jun, 2026
Journal Home Page: https://ijaems.com/
DOI: https://dx.doi.org/10.22161/ijaems.123.24

Impact of Information and Communication Technology (ICT) Integration on Teaching Learning Practices in Public Schools of Gilgit Baltistan

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Received: 01 May 2026; Received in revised form: 29 May 2026; Accepted: 03 Jun 2026; Available online: 05 Jun 2026

Abstract *— The adoption of new technologies and the use of Information and Communication Technology (ICT) are now recognized as a major contributor to change in the education sector because of its capacity to improve classroom instruction, increase learners' involvement and optimize learners' learning outcomes. Giftedness can, however, be felt differently across different contexts. The effective use of ICT in schools suffers from major challenges in the form of geographical isolation, mountainous topography, unstable electricity, limited internet connectivity and socio-economic constraints in GIBALT. The focus of this research is to examine the level of integration of ICT in public schools of Gilgit-Baltistan especially in Skardu and Ghanche districts. Skardu is relatively more urbanized and well connected, whereas, Ghanche is relatively more constrained due to its isolation and rurality. This research involves both qualitative and quantitative approaches where quantitative data are obtained using survey method and qualitative data using interviews and focus group discussion methods. The research explores the influence of ICT on teaching and learning processes and factors that can either hinder or facilitate this process. The expected outcome will provide guidance for policy makers, school administration, and educational leaders in developing infrastructure, training teachers, and creating an ICT strategy based on leadership. There is currently a gap in literature concerning the role of ICTs in remote and mountainous schools and the use of ICTs in education remains debatable.*

Keywords *— **ICT integration, teaching-learning practices, Gilgit-Baltistan, digital infrastructure, education policy, student engagement.***

I. INTRODUCTION

Information and Communication Technology9 ICT) has emerged as an important instrument in the process of enhancement of the teaching and learning process in contemporary education. The use of ICT is seen as an important tool for interactive methods of teaching, provision of learning resources, and a learner-centered approach throughout the globe. However, it poses specific challenges while using ICT in remote or underdeveloped regions. Because of the difficult geographical terrain, weak power supply, uneven power distribution, lack of internet access, and socio-economic difficulties, it becomes challenging to apply ICT at public educational institutes in Gilgit Baltistan region.

The current research is focused on the impact of the adoption of ICTs in the teaching-learning process in public schools of Gilgit-Baltistan. The research highlights the role of ICT in fostering active participation of students, improving the quality of learning as well as that of instruction in spite of various constraints that might exist within such settings. The objective of the current research is to provide a general view of the adoption of ICT in the given region.

Digital learning has been extensively advocated in Pakistan, but its implementation status in the government schools of Gilgit-Baltistan remains somewhat unsatisfactory. The two different educational settings of Skardu and Ghanche are evident. Skardu represents the more developed town, while Ghanche represents the more remote areas of the region that are facing higher levels of electricity supply problems and connectivity issues. Both groups of teachers face similar problems in terms of shortage of physical materials and non-professional training for the use of ICTs in teaching and learning.

Research will thus focus on how ICT can contribute to improve classroom practice at Skardu and Ghanche schools. Emphasis will be especially placed on the involvement, achievement, and quality of teaching. Data gathering will take place using mixed methods, the purpose being that of giving a holistic overview about ICT integration, its challenges, and its opportunities.

II. LITERATURE REVIEW

ICT Integration and Educational Practices
Existing studies indicate that ICT can be used to facilitate interactive learning, to make learning materials accessible to students and to enhance students' participation. The use of digital items like multimedia presentations, online resources, and learning software correlates with better learning experiences and more effective teaching. Meanwhile, integration is dependent on certain key factors such as teacher preparedness, appropriate training opportunities, and quality infrastructure (Fisher, 2021; Davis, 2019).

ICT Infrastructure and Teacher Competence

Infrastructure is an important aspect of the effective use of ICTs. In fact, it has been noted that there can be instances where there is lack of power supply, low-speed internet connection, inadequate technical support, and lack of equipment in rural or remote schools, such as in the case of Gilgit-Baltistan (Lee & Ullah, 2024). Such problems would hamper the utilization of digital technologies in classrooms and restrict the students from accessing online resources. In addition to this, teacher competence is another significant factor since despite teachers being enthusiastic about using technology, they may not have the necessary skills for doing so (Rahim et al., 2016).

Student Engagement and Learning Outcomes
ICT can enhance student motivation, promote student involvement and assist student learning outcomes. Students can grasp complex ideas better if they are presented in multimedia made and are interactive (Patel & Singh, 2019). The impact of ICT on learning outcomes is however greatly influenced by implementation context. Access to and use of IT equipment is often unequal and limited in rural and remote schools compared to urban schools.

Role of Leadership and Policy Support

Sustaining the use of ICTs needs leadership and policy support. There are certain ways school leaders can encourage the use of technology which include the provision of resources, the development of a positive culture and the encouragement of the teachers to bring ICT into their teaching. However, in the context of Gilgit-Baltistan, there may be lack of adequate training, resources and institutional support among the school leaders to effectively lead the ICT initiatives. (Rahim & Bibi, 2020) Another common problem with centralized ICT policies is that they do not consider the different context of remote schools and the need for strategies that are localized and context sensitive.

Research Gaps in ICT Adoption in Gilgit-Baltistan
Despite the increased volume of literature in the domain of education and use of ICT, its utilization in remote and mountainous region of Pakistan, such as Gilgit-Baltistan, is rather minimum. Studies and publications on general perceptions and infrastructural barriers predominate, whereas competence of teachers, school leadership and student outcomes are less well developed. This research is aimed to fill these gaps by providing context based evidences regarding the public schools of Gilgit-Baltistan regarding the integration of ICT.

III. THEORETICAL FRAMEWORK

This research is guided by two main theoretical perspectives:

The TPACK (Technological Pedagogical Content Knowledge) Model: It is a model that is concerned with the relationship between the technology,

pedagogy, and content domain. It helps to get an idea of the integration of ICT tools in the effective use of the teaching methods and curriculum content in Gilgit-Baltistan schools.

Diffusion of Innovations Theory: This theory is used to describe the adoption, diffusion and sustainability of new technologies in an organization, like a school. It highlights the factors which are significant in the adoption of ICTs in public schools which include leadership support, perceived usefulness, infrastructure readiness and institutional encouragement.

Theoretical Framework Work Flow of ICT Integration

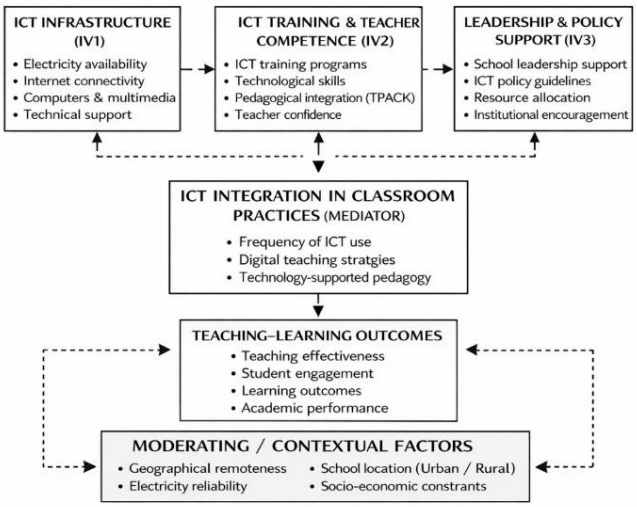

Fig.1: Theoretical Framework of ICT Integration

Research Objectives

To find out the trend of the use of ICTs, implementation challenges and perceived impact of ICTs on the teaching and learning process.

Research Design and Methodology

Teachers and students will be given questionnaires to fill out. The instruments will address the following topics: ICT infrastructure, availability of training, frequency of technology use, student engagement and learning outcomes.

Research Design

The research is of sequential explanatory mixed methods design which will investigate how the public schools of Gilgit-Baltistan have integrated ICTs in their schools in the research area of Skardu and Ghanche districts. This approach is suitable since it brings together the wide range of quantitative data and in-depth qualitative data, thus providing a holistic view of the issue of ICT integration. Two phases of research will take place:

- Quantitative Phase (First Phase)

Data Collection

Quantitative data will be collected for the availability of ICT, frequency of use and challenges in the classroom. Descriptive statistics, correlation analysis, and regression analysis of survey responses will be used to find key patterns and relationships.

- *Qualitative Phase (Second Phase)*

To account for the patterns identified in the quantitative phase and to provide greater understanding of the experiences, challenges and perceptions of teachers, students and school leaders about ICT.

Method

Teachers, school heads and students will be interviewed using a semi-structured format and also discussed in focus group discussions (FGD). These will give a detailed qualitative data on participants' perceptions of the integration of ICT in the classroom, problems encountered in the classroom and its impact on classroom teaching and learning.

Data Collection

Qualitative data will be used to explain the contextual barriers and support for ICT. Responses will be analyzed by thematic analysis to find out the themes, challenges and usable strategies for integration of ICT.

Sampling Techniques and Data Collection

- *Target Population*

The teachers and students of 50 public schools in Skardu and Ghanche. The 2 districts were chosen as they are in 2 different educational and infrastructural settings. The town of Skardu is a more urbanized and is better connected to the rest of the district while the remote rural location of Ghanche imposes more restrictions.

- *Sampling*

Stratified random sampling will be applied in the quantitative phase, and purposive sampling in the qualitative phase by selecting schools that vary in terms of their use of ICTs.

Quantitative Phase

During the quantitative phase, stratified random sampling will be applied to get a sample of teachers and students representative of the population. The schools will be segmented into Urban and Rural schools and then the participants will be randomly selected from each category. This will enable the comparison of use of ICTs and related challenges in various school contexts.

Qualitative Phase

The qualitative phase will involve purposive sampling of schools and participants based on the level of ICT use, for example, high use schools and low use schools. The intent is to have a diversity of implementation experiences. Interviews and FGDs will be done in the selected schools with teachers, school heads and students who are engaged in ICT related activities to capture a variety of perspectives.

Research Tools and Instruments

- *Teacher Questionnaire*

The questionnaire will explore issues concerning teachers' views on ICT usage, teacher development/training, technology use in classrooms, and the involvement of the school leader in ICT implementation. This questionnaire will include closed and open-ended questions with Likert Scales that will yield quantitative and qualitative responses to each question.

- *Student Questionnaire*

A student questionnaire will be used to gather data on access to ICT, the use of digital tools in classroom, student engagement, perceived impact on learning outcomes. It will also have quantitative and qualitative questions which will help to surface students' needs and learning experiences.

- *Interviews/Focus Groups*

These tools will be utilized in conjunction with teachers, school leaders and students to gather qualitative information. Semi-structured interviews will be used to gain insight into the experience of the school leaders and teachers with the integration of ICTs, the leadership support, and implementation challenges. Students will be included in focus group discussions with them about their use of the ICT in their classrooms, and their perceptions of what impact it is having on their learning.

Data Analysis Plan

- *Quantitative Analysis*

To summarize the data, descriptive statistics will be used: frequencies and means will be calculated for quantitative responses. Descriptive statistics will be used to summarize the data: frequencies and means will be calculated for quantitative responses. Relationships between variables (e.g., ICT infrastructure and ICT usage) will be analyzed using correlation analysis. The influences of the ICT infrastructure, teacher training, and leadership support on student engagement and student outcomes will be assessed through regression analysis.

- *Qualitative Analysis*

The qualitative information from the interviews and Focus Group Discussions will be subjected to thematic analysis. The process will include recognizing recurring themes, categories, and patterns, as well as gaining a deeper understanding of barriers and opportunities to using ICT in public schools in Gilgit-Baltistan.

Ethical Considerations

The research will adhere to established ethical principles throughout the research process. Prior to data collection, informed consent will be obtained from all participants, including teachers, students, and principals. Participants will be fully informed about the purpose of the research, the nature of their involvement, and the procedures for ensuring confidentiality before their consent is sought. Confidentiality will be strictly maintained by anonymizing the identities of all participants, and all collected data will be treated anonymously. The findings will be reported only in aggregated and general terms to prevent the identification of any individual respondent. Furthermore, participation in the research will be entirely voluntary. Participants will be assured that their decision to participate or decline participation will have no effect on their employment, academic standing, studies, performance evaluations, or any other professional or educational outcomes.

IV. RESULTS

Quantitative Findings

Table1: Teachers' Perceptions of ICT Integration by District (n=200)

Variable	Skardu Mean	Ghanche Mean	Overall Mean
ICT Infrastructure Adequacy	2.45	1.85	2.15
ICT Training Availability	2.60	2.10	2.35
Frequency of ICT Use	3.05	2.55	2.80
Impact on Teaching Effectiveness	3.85	3.65	3.75
Leadership & Policy Support	2.55	2.25	2.40

Interpretation: Teachers in Skardu report comparatively better access to ICT and more frequent use than teachers in Ghanche, although both districts continue to face serious infrastructure and policy-related constraints.

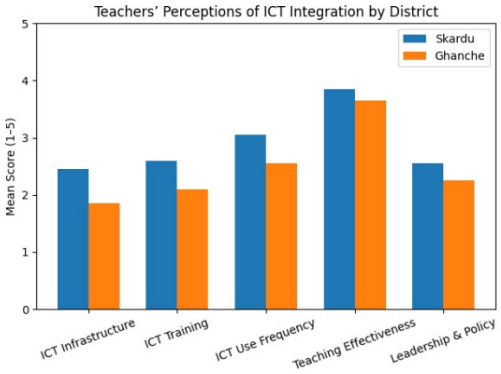

Fig.2: Comparative bi-bar chart of teacher's opinion about the infrastructure for ICT

Table 2: Students' Perceptions of ICT Use by District (n=500)

Variable	Skardu Mean	Ghanche Mean	Overall Mean
Access to ICT Facilities	2.50	2.00	2.25
ICT Use in Classroom	3.20	2.70	2.95
Student Engagement	3.75	3.45	3.60
Improvement in Learning Outcomes	3.65	3.45	3.55

Interpretation: The table presents students' perceptions of ICT access, classroom use, engagement, and learning outcomes by district (n = 500).

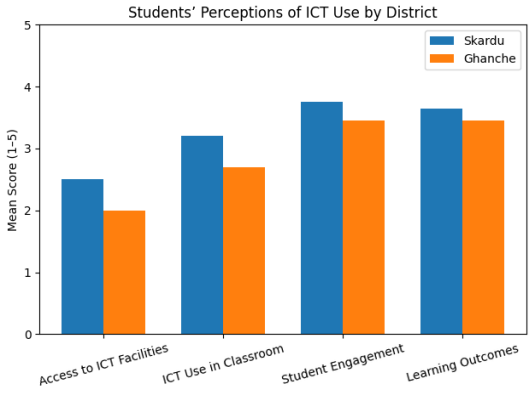

Fig.2: Students' perception of access to ICT facilities

Inferential Analysis

The ICT training has a significant positive correlation with the use of ICT ($r=0.62$, $p=0.001$). According to the results, regression analysis revealed that the infrastructure of ICT ($\beta=0.54$) and training ($\beta=0.61$) had significant influence in the integration of ICT in education ($p<0.001$).

Qualitative Findings

Several factors influence the effective integration of ICT in schools. Infrastructure remains a significant challenge, as frequent power outages hinder the consistent use of ICT resources in teaching and learning activities. In terms of professional development, ICT training programs are often theoretical in nature and are not adequately aligned with the practical classroom needs of local schools. Despite these challenges, school leadership plays a positive role, with principals generally demonstrating support for teachers' use of ICT in instructional practices. Additionally, the use of multimedia technologies has been found to enhance student motivation and engagement, contributing to improved learning and understanding of lessons.

V. DISCUSSION

The research will contribute to the policy-making process by providing policy-relevant suggestions for enhancing the ICT infrastructure, creating the need-based and relevant teacher training, and strengthening the leadership support for effective utilization of ICT in schools of Gilgit-Baltistan.

To improve ICT integration in remote schools, it is important to enhance ICT infrastructure by ensuring

quality electricity, reliable internet connectivity, and adequate ICT equipment. Continuous and locally relevant teacher development should also be provided, focusing on practical ICT integration, pedagogical approaches, and the TPACK framework. In addition, leadership support should be strengthened by encouraging school leaders to promote, sustain, and actively lead ICT initiatives within their institutions. Furthermore, localized policies should be developed by adapting national ICT policies to reflect the specific conditions of remote areas, with particular attention to equity in resource distribution and long-term sustainability.

Key Barriers

Low quality infrastructure, inadequate teacher training and inadequate leadership to support the use of ICTs, especially in remote schools.

Successful Strategies

How some schools with more resources and more active leadership have adapted effective use of ICT in their school to enhance teaching and learning. The impact of ICT on student engagement, motivation and success in learning, especially in remote and under-resourced schools.

VI. CONCLUSION

The research finally stresses essentialities for successful integration of ICT in Gilgit Baltistan are the enhancement in infrastructure, teacher training and leadership. The recommendations highlight local policies which have a direct impact on school issues in remote areas as being important. The research finds that: ICT Integration is a must: Improving the ICT capacity building and improvement of teachers is necessary for improving the educational outcomes in GB. One “same” policy won't do; ICT strategies must be local in order to meet the needs of remote schools.

REFERENCES

[1] Ali, M. (2011). The role of ICT in enhancing educational outcomes in Gilgit-Baltistan. Journal of Educational Technology & Society, 14(3), 79–88.

[2] Hussain, I., Angaiz, D., & Jan, S. (2016). Relationship between prospective teachers’ attitude towards ICT and its use for educational purposes in Gilgit-Baltistan. Pakistan Journal of Social Research, 3(4), 398–411.

[3] Iqbal, M. (2017). Barriers to successful integration of ICT in education in Baltistan region. NICE Research Journal, Special Issue, 1–12.

[4] Lee, C., & Ullah, E. (2024). Innovation in education: Teachers’ and students’ perceptions of implementing ICT in learning in higher secondary schools of Gilgit-Baltistan. Journal of Asian Development Studies, 13(3), 528–541.

[5] Rahim, S., & Bibi, T. (2020). ICT policy formulation and integration at mountainous rural schools of Gilgit-Baltistan: A case research. Journal of Educational Research, 41(2), 189–201.

[6] Rahim, S., Bibi, T., & Qutoshi, S. (2016). Challenges and opportunities to formulate and integrate an effective ICT policy at mountainous rural schools of Gilgit-Baltistan. International Journal of Educational Development, 48, 62–7