Research Article

Bridging the Digital Divide: Exploring Teachers' Perspectives on Challenges and Barriers to ICT Integration in Rural Schools of Jammu Division, J&K

Harpreet Kour[1] and Tabasum Mirza[2]
[1]Senior Lecturer in Economics and [2]Lecturer in Computer Science
[1]JK SCERT, Jammu, UT of J&K
[2]DIET Rajouri, UT of J&K
[2]tabasum.mirza@gmail.com (Corresponding Author)

Manuscript Submission Date: September 22, 2025
Manuscript Acceptance Date: December 30, 2025

Abstract

The research study aims to examine the barriers to Information and Communication Technology (ICT) integration in rural schools across the four rural districts of Jammu Division, UT of Jammu and Kashmir: Ramban, Rajouri, Kathua, and Kishtwar. The study employed a survey design for research, adapted from existing studies, using both qualitative and quantitative approaches to analyse data. It utilised structured questionnaires and statistical analyses (ANOVA, T-test, Factor Analysis). The key challenges of ICT adoption identified in the study include inadequate digital infrastructure in rural schools, Internet connectivity problems, limited teacher training opportunities, and socio-economic barriers to access to digital devices and the Internet. Inferential statistics (ANOVA and independent samples t-tests) and Cohen's d to calculate effect size indicate significant differences in ICT adoption based on teachers' training, availability of technical support in schools, type of school, and gender of teacher effects ($p < .001$) with a large effect size ($d \approx 0.65$). The findings highlight that 61.7% of schools lack access to adequate ICT resources, and only 3.3% of teachers are competent to use advanced ICT tools and resources. The study emphasises the need for the development of teachers' digital competencies, improvement in the ICT infrastructure of rural schools, and targeted policy interventions to overcome the digital divide in education.

Keywords: ICT integration, quality education, Jammu and Kashmir, ICT infrastructure, challenges, teacher training, and digital divide

Introduction

Information and communication technology (ICT) is an instrumental tool in education that can transform teaching methodologies, promote student engagement, motivate learners by enabling 3D interaction with learning content, and thus improve learning outcomes. It can act as a tool for instruction and delivery of content to uplift the quality of education in India, where the pupil-teacher ratio is not appropriate. Use of ICT can help in learning outcomes, result in better methods for assessment of students and support inclusive education by using assistive technologies in classrooms. Use of technology can build 21st century skills in students and support the sharing of knowledge, enhance collaboration, and provide authentic learning opportunities by using constructivist learning approaches (Mansotra et al., 2009). Meaningful integration of technology in school education scenarios is a challenging process that needs alignment of technology, pedagogy and curriculum with learning

objectives. It also requires efforts to revise the perspectives of teachers about technology and refine educational technology policies (Mehta and Thakkar, 2024). The process needs collaboration between various stakeholders, i.e. educators, policymakers, students and the community to make adoption of technology easy for the benefit of the students (Implementation of ICT at School Scheme, 2023). Collaboration with the community to provide ICT infrastructure in remote schools, focus on digital skills of Teachers by providing in-service and pre-service ICT training, and improvements in Internet connectivity can lead to improved educational outcomes (Abykanova et al., 2024).

Although the Government of India has taken steps and initiatives for ICT integration and is focusing on strengthening digital infrastructure in schools, providing training to teachers, improving internet connectivity in the region, there are significant advancements in use of technology in the educational ecosystem but challenges and issues remain there, particularly in rural regions of Jammu and Kashmir, India, where students from rural backgrounds lack access to quality educational resources teaching aids(Mansotra et al., 2009; Kormos and Wisdom, 2021).

This study aims to highlight the challenges faced by teachers during ICT integration in the learning environments of the four districts of Jammu and Kashmir. By addressing these challenges, the tremendous potential of information and communication technology (ICT) can be utilised for meeting the demands of 21st-century education and enhancing the quality and accessibility of education in the region. This can help mitigate socio-economic issues stemming from educational inequalities.

Research Questions

This study addresses the following research questions:

RQ1. What are the perspectives of teachers regarding the use of ICT in rural schools across the Jammu Division?

RQ2. What are the challenges and barriers that hamper ICT adoption in rural schools of the Jammu Division?

RQ3. What ICT tools and technologies are used in rural schools by teachers of the Jammu Division?

The study aims at following research objectives:

a. To analyse the current scenario of the use of ICT in rural schools of Jammu Division.

b. To identify the main challenges and barriers faced by teachers in integrating ICT in rural schools of the Jammu Division.

c. To examine whether there are significant differences in ICT use and confidence levels of teachers based on gender, type of school (government/private), teacher training and availability of technical support in schools.

d. To identify the key factors influencing ICT integration in rural schools.

Literature Review

Sustainable Development Goal 4 and National Education Policy 2020

The Sustainable Development Goal 4 focuses on ensuring equitable access to good-quality education for all by 2030 (Raj and Sandasagan, 2024). The National Education Policy-2020 also aims at providing equitable learning opportunities for everyone under SDG 4 by 2030. Digital learning can help in bridging the divide and provide

affordable access to educational resources and eLearning platforms. But certain barriers hamper the ICT adoption in rural schools of India, creating a digital divide in access to technological learning resources (Bisht and Vani, 2024). This gap results from inequitable access to digital infrastructure like computers, tablets and smartphones, slow or no Internet connectivity in rural areas of India and inadequate digital skills of students (Thakur, 2014). Use of Information and Communication Technology (ICT) within the rural classrooms of Jammu Division faces different multifaceted obstacles like infrastructural limitations, socio-economic disparities, and competency factors that limit the use of technology in rural educational settings of the Jammu and Kashmir UT. Inadequate ICT infrastructure in schools, non-functional or poorly maintained digital devices and technological resources are the main constraints that limit the schools from adopting technology in effective learning and teaching (Madida et al., 2019). As rural areas lack reliable and high-speed internet access, which is important for the integration of ICT, this creates a significant barrier to adopting technology in the learning process (Mustafa and Nguyen, 2024). Moreover, the rural areas face the problems of erratic electricity, which also poses a hindrance to using technology for educational purposes (Mhlana et al., 2021). Socio-economic barriers make the availability of digital devices and internet services difficult for economically disadvantaged students in households and schools, restricting their access to quality ICT resources available online, contributing further to their digital inequity (Dzansi and Amedzo, 2014). Insufficient allocation of school funds for technological resources and digital infrastructure upgrades adds to the challenges encountered by rural schools in technology integration (Bingimlas, 2009). Teachers in rural areas often don't possess computer skills for ICT use in the teaching process (Abykanova et al., 2024; Nikolopoulou & Gialamas, 2016). They also lack access to capacity-building programs for developing the digital competencies of teachers (Singhavi,2019; Singh, 2018). Moreover, the lack of technical support in schools that is critical for providing help in the use and maintenance of ICT devices also adds to their technological anxiety, resulting in poor ICT adoption (Abykanova et al., 2024). Continuous and targeted professional development programs that focus on building digital competencies and pedagogical skills for ICT integration in education (Singhavi et al., 2019; Singh, 2018). Existing studies report that the inadequate ICT infrastructure in Govt rural schools significantly hampers the integration of technology in education (Abykanova et al., 2024). This has resulted in underdeveloped digital competencies of rural students of the Jammu Divisions (Joshi and Khatiwada, 2025). Teachers may resist the adoption of technology due to strong faith in traditional teaching methods and fear of using new techniques and tools, or less confidence in using technology (Pardede, 2020; Ndawi et al, 2014; Chauhan et al., 2025). Demographic factors like age and sex also influence teachers' use of digital tools (Peng et al., 2023; Akram et al., 2022). Institutional support and policy frameworks can also significantly impact ICT integration (Aslan and Zhu, 2016), suggesting a need for a holistic approach to enhance technology use in education (Obeng, 2025; Lawrence, 2018; Bahadur, 2022). Teachers' skills and attitudes towards ed-tech adoption are some important determining factors (Mawela and Somagaca, 2025). Other factors, like the curriculum relevance of ICT tools, rapid technological upgradation leading to continuous obsolescence, unequal access, particularly in rural areas, irrational school policies, limited access to suitable educational software, and a

restrictive curriculum, hinder effective technology use in teaching (Lawrence, 2018). Cyber safety, ethical and privacy concerns also affect teachers' trust in making use of technology (Ndawi, 2014; Goda, 2014).

The existing literature highlights several infrastructural, socio-economic, and competency-related barriers to ICT integration in rural schools; however, most studies remain broad and lack context-specific evidence from the rural schools of Jammu Division, Jammu and Kashmir. Limited research has examined these challenges from a teacher-centric perspective, particularly by exploring how institutional support, professional development, demographic factors, and classroom realities collectively influence ICT adoption. Moreover, there is insufficient empirical evidence on how national policy goals under NEP 2020 and SDG4 are operationalised at the grassroots level in rural and geographically challenging regions. This underscores the need for a focused study that systematically explores teachers' perspectives on the challenges and barriers to ICT integration in rural schools of the Jammu Division.

Methodology

The complete methodology of the research study follows a structured approach. The sample consisted of 1224 teachers and 319 schools from remote districts of Jammu Division, i.e. Ramban, Rajouri, Kathua & Kishtwar. These respondents were selected by a stratified sampling approach. The schools were selected in the first stage using a random sampling method, followed by teachers in the second stage using the purposive sampling method. The distribution of respondents is as follows (Table 1):

Table 1: Sample Size

District	Schools	Teachers
Ramban	103	208
Rajouri	46	472
Kishtwar	50	182
Kathua	120	362
Total	319	1224

The mean age of teachers participating in the research was 42.57(SD=9.72, range=27-60) years.

Research Instrument

The data was collected using structured questionnaires from the sample teachers after validation and reliability tests using Cronbach's alpha. The Cronbach α of the questionnaire was 0.74, indicating good internal consistency. The questionnaires were validated by a panel of experts having pedagogical and technological expertise. After validation, the questionnaires were pilot tested on a group of teachers in each district. The final questionnaire consisted of 22 questions divided into 06 sections with 02 open and 20 closed-ended questions.

The study uses a survey-based research design adapted from existing studies for examining the challenges and barriers to ICT integration in rural schools. This method is based on systematic collection and analysis of teachers' perspectives, experiences, and factors

that determine ICT adoption in schools (Aslan & Zhu, 2016; Bingimlas, 2009; Peng et al., 2023). This research combines qualitative and quantitative methods of research for analysis. The data collected during the research study were checked for consistency, missing values and outliers before analysis. The study employs both descriptive and inferential statistical techniques to address the research objectives. Descriptive statistics (frequencies and percentages) were used to summarise the demographic information of teachers, ICT infrastructure availability in schools, usage of ICT in the teaching process and perceived challenges to ICT adoption. Inferential statistical analyses were conducted using one-way ANOVA and independent samples t-tests to analyse the differences in ICT use across various variables linked with the teachers and schools. One-way ANOVA test analysed differences in ICT adoption conducted at $p < .05$ based on teachers' training, availability of technical support in schools, teachers' gender and type of school. Independent samples t-test was employed to compare ICT use between the government and private schools, male and female teachers, and schools with and without technical support. Effect size was calculated using Cohen's d. The Exploratory Factor Analysis method was used to identify the key factors that determine ICT integration. The qualitative data that was obtained from the responses of interviews were analysed by content analysis methods.

Results

The results were tabulated, and the descriptive analysis of the results was performed using the percentage method in Table 2. The study examined responses from teachers teaching in rural schools of the Jammu Division to investigate the challenges faced by them in adopting ICT in classrooms.

Table 2: Survey Results

Items and Variables	Percentage (%)
Demographic Information	
Gender	
Male	56.5
Female	43.5
Education	
10+2	3.6
Graduation	15.3
Post graduation	78.6
Professional	2.5
Age	
27-45 years	67.3
45-60 years	31.7
Length of Service	
<10 years	33.3
10-20 years	38.0

Items and Variables	Percentage (%)
>20 years	29.7
Subject	
Science	37.4
Humanities	39.2
Languages	23.4
Type of School	
Government	72.1
Private	27.9
Teacher Perceptions about Technology	
Do you agree that the use of technology can increase the effectiveness of education?	
Strongly Agree	65
Agree	12.1
Slightly agree	8.5
Doesn't agree	3.0
Strongly Disagree	5.5
School Infrastructure	
PC	13
Laptop	5
Projector	11
PDA	43
Interactive board	15
Others	7
Electric Supply	
Yes	89.8
No	10.2
Internet Access	
Yes	55
No	45
Technological Support	
Yes	49
No	51
Rate your Computer Skills	
No skills	28.9

Items and Variables	Percentage (%)
Little skills	18.3
Good skills	12.3
Very good skills	15.9
Teachers' confidence in using ICT	
Low	13.6
Little	29.7
Good	34.8
Verry good	21.9
Can create content	
Yes	39.3
No	60.7
Can use content	
Yes	82.8
No	17.2
Can search for relevant content	
Yes	89.2
No	10.8
Can find Local Language Content	
Yes	57.1
No	42.9
Can use common Web portals	
Yes	93
No	7
Awareness about Intellectual Property Rights	
Yes	53.5
No	46.5
Frequency of use for ICT tools in teaching	
PC	
Never	3.2
Few times in a year	15.1
Once a month	13.6
Once a week	9.3
Everyday	4.0
Interactive Board	

Items and Variables	Percentage (%)
Never	53.5
Few times in a year	7.5
Once a month	12.5
Once a week	7.6
Everyday	11.5
PDA	18
Everyday	21.3
Few times in a year	21.4
Once a month	15.7
Once a week	20.2
Projection Devices	
Never	64.1
Few times in a year	11.3
Once a month	9.6
Once a week	3.4
Video Conferencing Systems	
Never	58.8
Few times in a year	22.9
Once a month	13.2
Once a week	3.8
Everyday	1.3
Other devices	
Never	69.9
Few times in a year	7.6
Once a month	13.8
Once a week	5.5
Everyday	3.2
Difficulty in using ICT	
Very difficult	18.7
Difficult	15.1
Slightly difficult	31.8
Easy	14.2
Very easy	20.2

Items and Variables	Percentage (%)
Present scenario of ICT use in the classroom	
Always	15.1
Never	32.9
Sometimes	52.0
Issues/Barriers in the use of ICT	
Infrastructure	14.8
Insufficient support of School administration	10.2
Lack of training	10.2
Absence of technical support	10
Time constraints	14.6
Unable to use ICT tools	33.8
Curriculum doesn't support integration of ICT	9.9
Teacher Training	
Need Training	
Yes	79.5
No	20.5
Attended in-service Training	
Yes	30.1
No	69.9
Training agency	
DIET Rajouri	46.5
School Education Dept, other than DIET	40.5
Others	13
Training was useful	
Yes	55.4
Nos	19.7
To some extent	24.9
How Teachers learn to use ICT	
In Service Trainings	38.4
From Colleagues	11.8
Trial and Error	35.6
Other sources	14.2

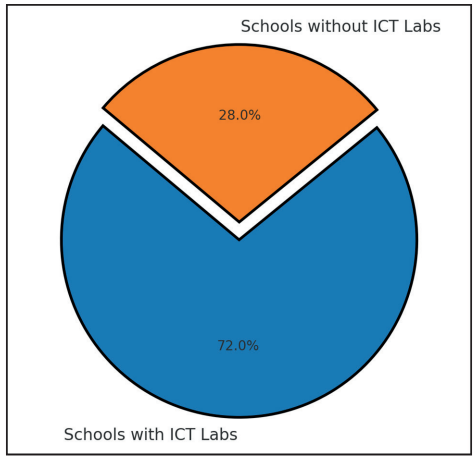

Fig. 1: Availability of ICT Infrastructure

Figure 1 indicates that 72% of secondary schools in the districts of Jammu Division have ICT labs, but not all the labs are properly functional for use by teachers.

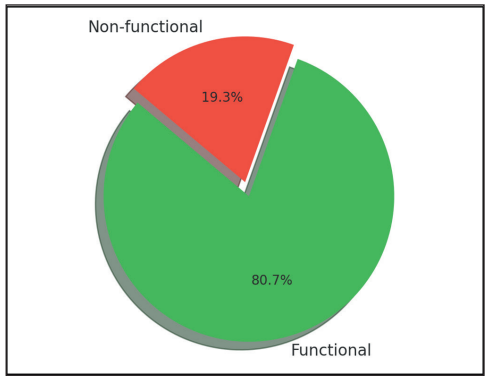

Fig. 2: Functionality of ICT infrastructure

Figure 2 indicates that a significant number of ICT labs, 19.3%, are non-functional or underutilised due to poor maintenance and lack of resources. 80.7% ICT labs are functional.

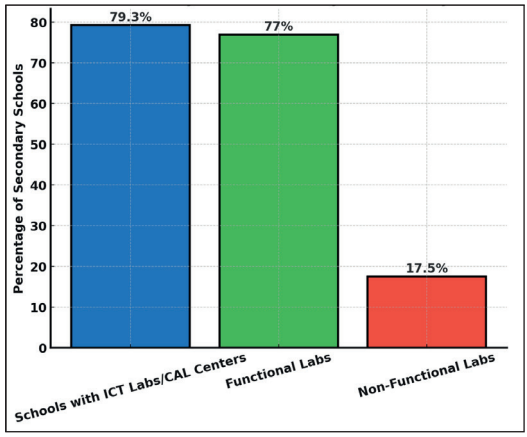

Fig. 3: Status of ICT Labs/CAL centres

Figure 3 reveals that although the majority of the secondary schools have ICT labs or computer-aided learning centres (79.3%) that can help in using digital resources to support learning, only 77% of them have maintained functional labs. A significant percentage (17.5%) remains under utilised due to poor functionality and maintenance. The disparity between functional and non-functional labs limits ICT accessibility. This limits the reach of ICT-based education and highlights gaps in infrastructure development. A total of 43% of teachers report that they have adequate ICT infrastructure in their schools to support digital learning.

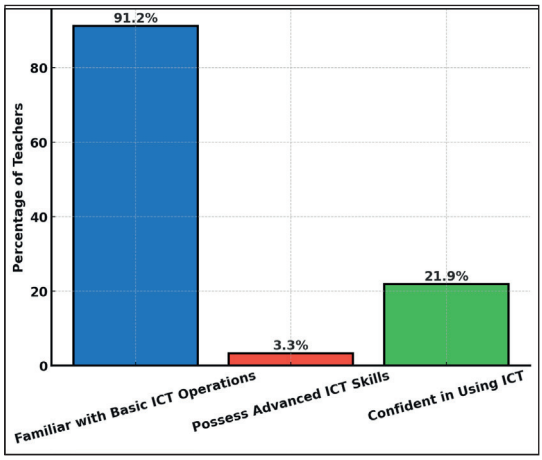

Fig. 4 Teacher ICT skills and Confidence in using Technology

Figure 4 indicates that 91.2% of teachers are familiar with basic ICT tools and operations, yet only 3.3% of teachers reported having advanced ICT skills. Only 21.9% of teachers are confident while using ICT tools; this stresses on developing the digital skills of educators. Senior teachers even show lesser confidence and interest in using technology while teaching. Teachers lack confidence and training in handling ICT tools, especially having the age more than 45 years or more than 17 years of experience, in comparison to the teachers who are less than 45 years of age. Thus there is a huge gap in acceptance levels of technology dependent on age of teachers. Young teachers having more exposure to technology and skills, show more interest in using ICT for teaching. On the other hand, senior teachers have lesser exposure to technology have lesser acceptance towards technology.

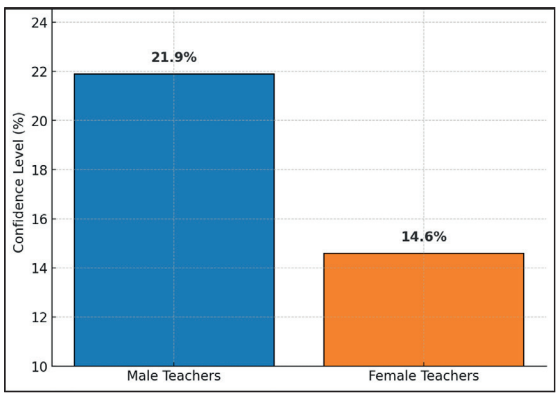

Fig. 5: Gender Disparity in ICT adoption

Figure 5 indicates the Gender disparities in ICT adoption, with male teachers exhibiting 7.3% higher confidence levels than their female teachers, suggesting a need for special support for female educators that can help them in ICT adoption.

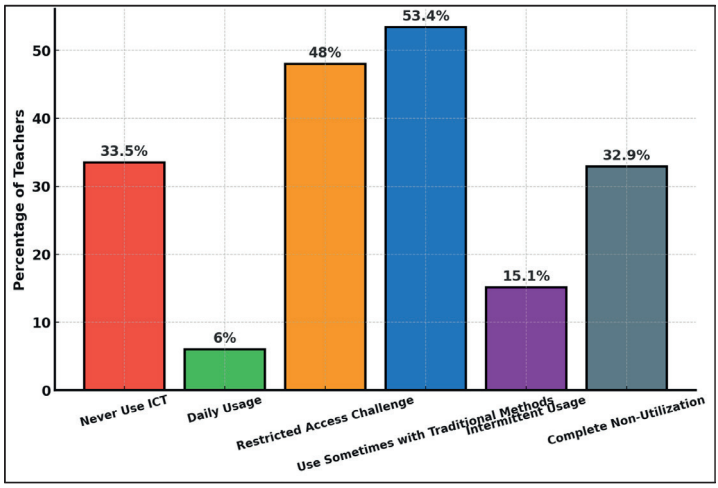

Fig. 6: ICT Usage in Schools

Figure 6 indicates that 33.5% of teachers have never used ICT tools in their schools. Daily use of ICT tools is limited to only 6% of teachers. 53% of teachers reported use of ICT for assessments and teaching in addition to traditional teaching methods using chalkboards. One-sixth of teachers reported intermittent ICT use, and 32.9% reported not using ICT for teaching, indicating a significant gap in ICT adoption in rural schools.

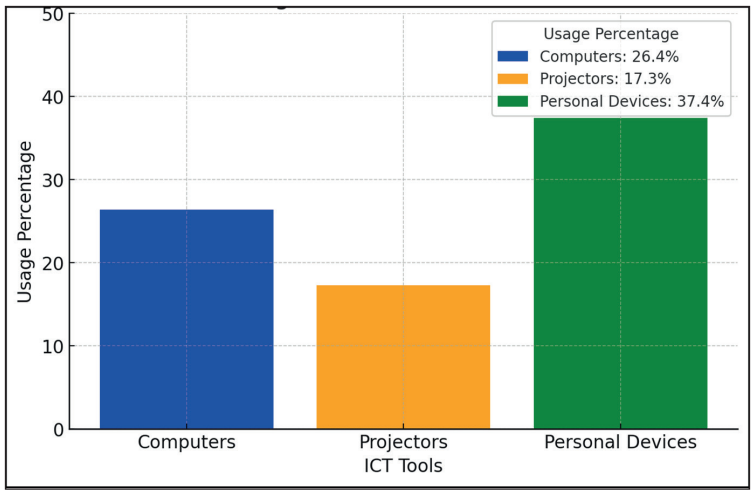

Fig. 7: ICT Tools used in schools

As Figure 7 indicates, the most often used ICT tools and resources in schools include computers (26.4%), projectors (17.3%), and personal devices like laptops and smartphones (37.4%).

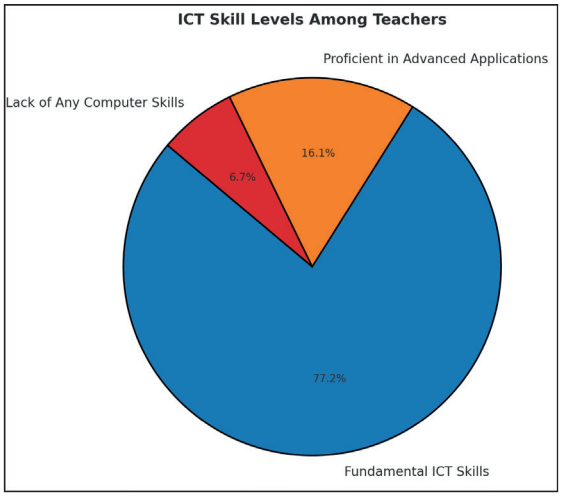

Fig. 8: ICT Skills of Teachers

As per Figure 8, 63.6% of teachers have fundamental ICT skills (typing, handling smartphones), and only 13.3% are proficient in more advanced applications. A significant portion (5.5%) lacks any computer skills.

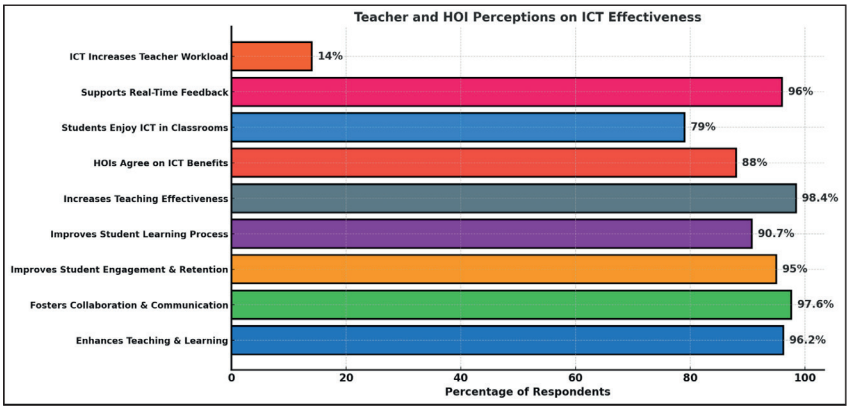

Fig. 9: Perspective of HOIs & teachers regarding the effectiveness of ICT

ICT has significantly improved teaching effectiveness, with teachers acknowledging better engagement and learning outcomes, and ICT's role in improving education quality, with an emphasis on enhancing student motivation. Teachers believe it enhances engagement, retention, and the quality of the teaching-learning process. There is visible improvement in student academic performance with the use of ICT. Teacher respondents believe ICT improves the student learning process. ICT tools were found to improve engagement, retention, and teaching quality, increase teaching effectiveness, and enhance teaching and learning quality. Teachers also said that students enjoyed ICT in classrooms, improving engagement and retention. Teachers recognised ICT's role in assessing learning outcomes through real-time feedback mechanisms, but some teachers viewed ICT as increasing teacher workload without measurable benefits.

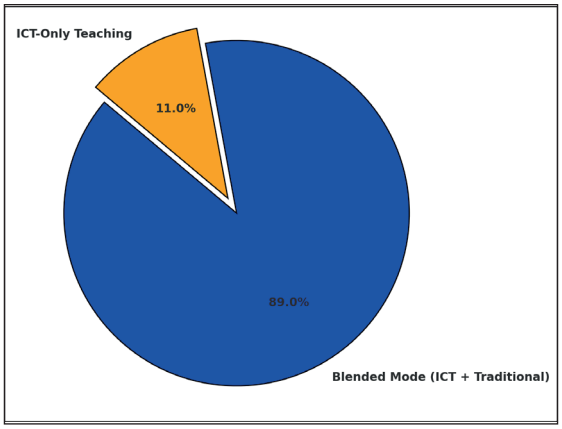

Fig. 10: Teachers' preference for ICT and Blended Mode

Figure 10 indicates that a major percentage of teachers (89%) advocate for using a blended mode of teaching that strategically combines ICT tools with other teaching methods, emphasising the role of using technology for effective instruction. In contrast, only 11% teachers support exclusive ICT-based teaching, suggesting that although the use of technology is important, face-to-face teacher-student interaction is important for effective learning.

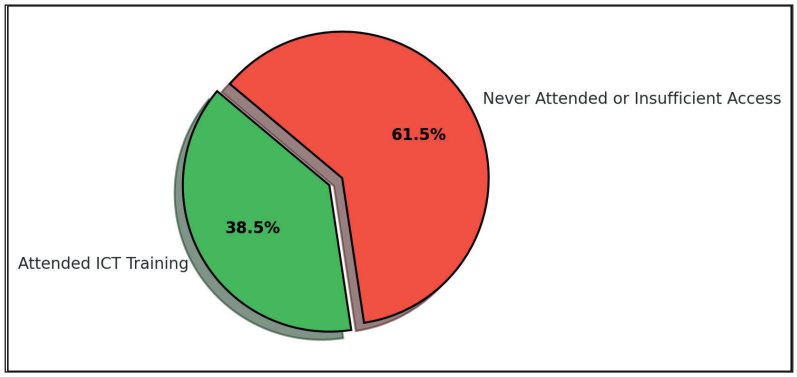

Fig. 11: Participation in ICT Training Programs

Figure 11 shows that 38.5% of teachers reported they have participated in ICT training programs, while the majority of teachers have never attended ICT training. Although capacity building programs and training sessions are conducted by SCERT J&K and DIETs in a phased manner for developing ICT skills in teachers, only a small percentage of teachers have been trained yet. The reason that all teachers don't get the opportunity to acquire training from DIETs and SCERT is due to the financial constraints of DIETs and SCERT. As the prime focus of teachers remains on academic activities in school, this contributes to time constraints for attending training programs. Teachers emphasised that there is a need for improving access to professional development opportunities for teachers in the successful integration of ICT in classrooms.

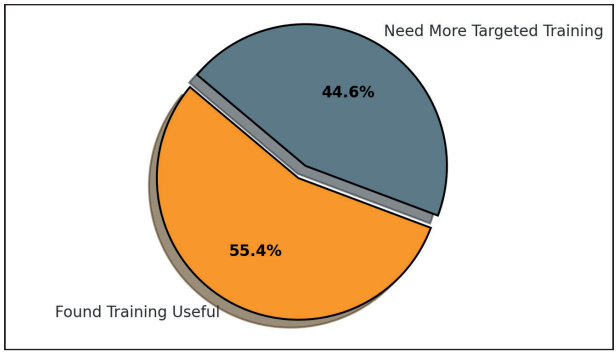

Fig. 12: Teacher Perceptions of Training Programs

Figure 12 indicates that teachers found training programs useful for building ICT competencies and increasing confidence in using ICT tools, but the need for more targeted and hands-on approaches for ICT use was highlighted by teacher respondents.

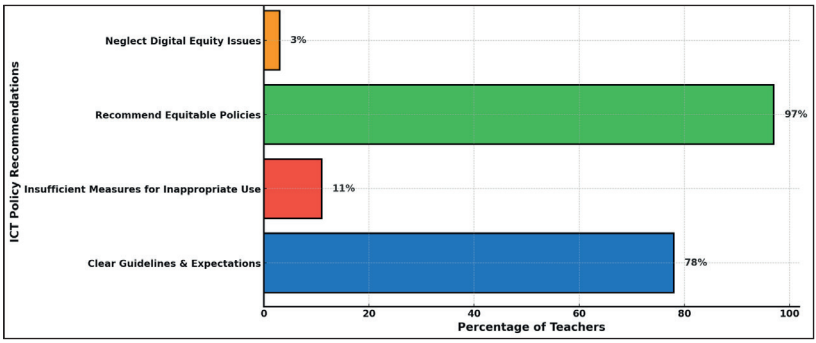

Fig. 13: Teachers' perspectives about existing policies for Digital Equity

Figure 13 indicates that 78% of teachers advocated the need for clear guidelines and expectations for ICT use among students.11% teachers indicated there are insufficient measures in place to manage inappropriate ICT use in schools.97% teachers recommended execution of policies for equitable ICT access to support the use of technology in rural schools.3% teachers admitted to neglecting digital equity issues due to a lack of reinforcement or awareness, highlighting the need for strong measures for the implementation of policies meant to bridge the digital divide between rural and urban schools.

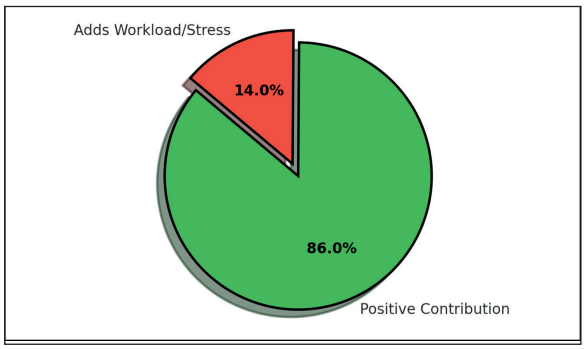

Fig. 14: Teachers' perspectives about Community and Parents' involvement

Figure 14 indicates that 86% of teachers believe that parental or community support can contribute positively towards effective ICT integration, but 14% teachers said that such involvement will add to the existing workload or burden of teachers. This calls for a need for support and collaboration between stakeholders, i.e. teachers, parents, and the community, to help with ICT integration.

Key Challenges for ICT Integration in Rural Schools of Jammu Division

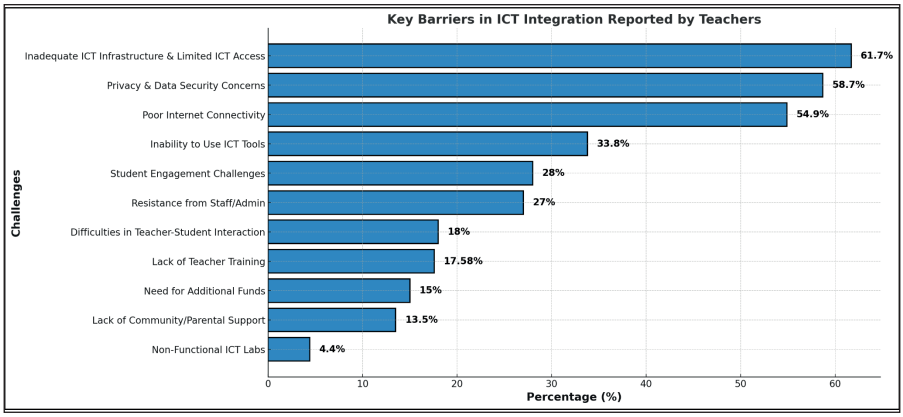

Fig. 15: Key Challenges in ICT Integration

As indicated in Graph 13, the key challenges faced by teachers in the integration of technology for teaching and learning are as follows:

- Inadequate ICT Infrastructure & Limited Access (61.7%) – Schools lack sufficient computers, projectors, and digital tools.
- Privacy and Data Security Concerns (58.7%) – Teachers worry about data breaches and online safety risks.
- Poor Internet Connectivity (54.9%) – Unreliable internet disrupts digital learning and online collaboration.
- Inability to Use ICT Tools (33.8%) – Many teachers struggle with digital literacy and effective ICT usage.
- Student Engagement Challenges (28%) – Keeping students actively engaged through ICT remains difficult.
- Resistance from Staff/Admin (27%) – Some educators and administrators hesitate to adopt ICT tools.
- Difficulties in Teacher-Student Interaction (18%)– ICT can sometimes hinder personal engagement in teaching.
- Lack of Teacher Training (17.58%) – Insufficient training prevents teachers from integrating ICT effectively.
- Need for more Financial Support (15%)– Schools require more funding to maintain and upgrade ICT resources.
- Lack of Community Support (13.5%) – Parents and communities are not cooperating in ICT adoption.
- Non-Functional ICT Labs (4.4%) – Some schools have ICT labs that remain inoperative due to poor maintenance.

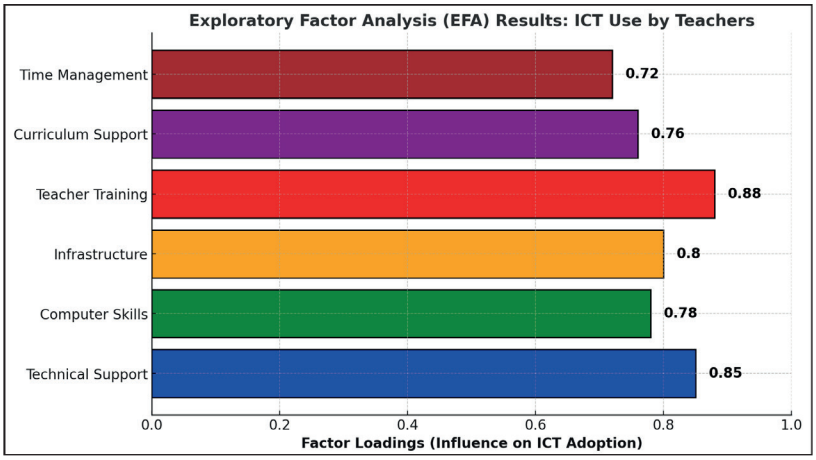

Fig. 16: EFA Result

Exploratory Factor Analysis (EFA) (See Figure 16) was performed on research data to identify key factors influencing ICT adoption in teachers, having significant factor loadings include technical support, computer skills, infrastructure, teacher training, curriculum support, and time management. Among these, teacher training and technical support showed the highest influence, emphasising their critical role in ICT integration. The findings suggest that focusing on these factors can enhance ICT adoption, making digital tools more accessible and effective in the classroom. One-Way ANOVA (Analysis of Variance) was conducted to check if there is a significant difference in ICT adoption across different groups of teachers on the basis of training, type of school, i.e. govt or private, teacher gender, i.e. male and female, and schools with and without technical support.

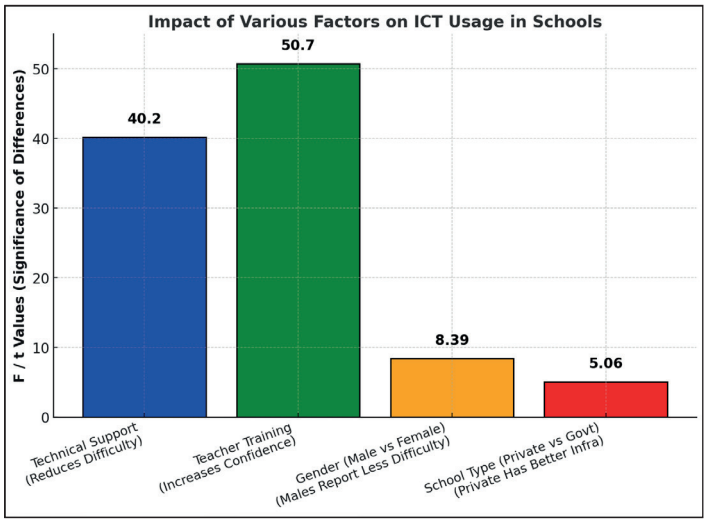

Fig. 17: ANOVA Test Results

The ANOVA results reveal that technical support significantly reduces ICT difficulty, while teacher training greatly enhances ICT confidence. Gender disparities exist, with male teachers reporting fewer ICT challenges than

female teachers. Additionally, private schools demonstrate superior ICT infrastructure compared to government schools.

These findings emphasise the need for stronger technical support, targeted training programs, and equitable ICT resource distribution across schools to enhance digital learning adoption. The non-availability of dedicated technical support teams or staff in Govt schools who can scaffold teachers in the use of technology and tools in teaching practices ($F = 40.2$, $p < .001$) also leads to difficulty in the use of technology. Teacher training was found to improve ICT confidence significantly ($F = 50.7$, $p < .001$).

The results also indicate towards gender disparity in adopting technology where male teachers face lesser difficulty in use of ICT compared to female teachers ($F = 8.39$, $p = .004$). This may be due to less exposure and negative attitude of female teachers towards educational technology. As female teachers had limited opportunities to try new technologies in their daily life and have to balance the work and domestic responsibilities limiting their learning opportunities. While as male teachers have more time, access to social circles and digital learning communities as compared to female teachers adding to their learning advantage.

More focus should be laid on Capacity building of female teachers, user-friendly, easy-to-use tools for female teachers, free computer courses for teachers, and provision of hands-on sessions in collaboration with local IT experts.

Another issue hampering the adoption of technology is the lack of initiatives and efforts taken by school administrators. Capacity building of teachers is one of the key contributing factors in technology use. Although SCERT and DIETs are providing training to teachers, there is a need for effective impact analysis, monitoring and evaluation at the grassroots levels.

Private schools have good ICT infrastructure, availability and direct access to funds, collaborate with NGOs, and autonomy of school administrators to make decisions regarding edTech use. They have to maintain their teaching standards to sustain in the educational market. Their recruitment policies and criteria for the selection of young teachers having computer skills.

The age factor of teachers in government schools also contributes to the disparity in the use of ICT tools. Whereas, no preference is given to computer skills during recruitment and promotion of teachers ($t = 5.06$, $p < .001$).

An Independent Samples T-Test was used to compare differences between private and government schools, male and female teachers, in terms of ICT adoption. Cohen's d was calculated to assess the effect size.

- Independent samples t-test showed that private schools had significantly better ICT infrastructure than government schools ($t = 5.06$, $p < .001$)with a large effect size ($d \approx 0.65$).
- Teachers in schools with technical support perceived ICT use as less difficult than those without support ($t = 6.77$, $p < .001$), demonstrating a large effect ($d \approx 0.78$).
- Male teachers exhibited significantly higher ICT confidence compared to female teachers ($t = 8.32$, $p < .001$), indicating a moderate-to-large effect size ($d \approx 0.70$).

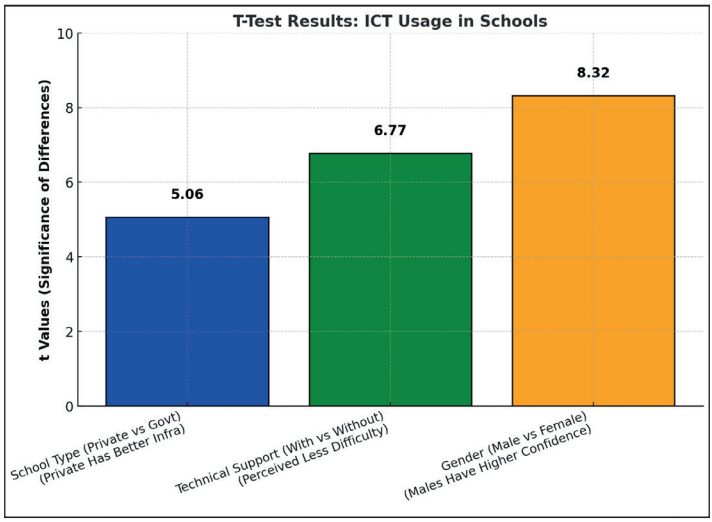

Fig. 18: Independent samples t-test

The independent samples t-test results (See Figure 18) indicate that private schools have significantly better ICT infrastructure than government schools. Teachers of schools where technical support reports ICT use as less difficult than their counterparts. Moreover, gender disparity in adopting technology reveals that male teachers exhibit higher confidence than female teachers in using ICT, suggesting gender disparities in the digital skills of teachers. These findings suggest the need for technical support in schools and targeted teacher training programs to build their digital competencies.

Qualitative data from open-ended questions were analysed using the content analysis method. The data was coded and categorised into different themes like ICT infrastructure, teacher confidence in ICT use, teacher training, lack of technical support in schools, etc. The qualitative data findings complement the results obtained from statistical tests.

Discussion

Although educational technology has strong potential to achieve the learning outcomes and help in improving access to effective learning resources and content by rural students of Jammu and Kashmir UT, there are significant barriers and challenges to be addressed collaboratively by teachers, community, policymakers and other organizations like DIETs and SCERT. To promote digital access to disadvantaged students, adequate ICT infrastructure in schools, teacher training, and improved connectivity access are essential, along with strong administrative support. ICT adoption between Government and Private Schools also shows disparities, indicating that Private owned schools have better ICT infrastructure, but encounter challenges in ICT adoption due to larger class sizes. However, Government schools face barriers in ICT infrastructure, internet access and trained teachers. Remote and hilly areas of Jammu Division, like Rajouri, Poonch, Ramban, Kishtwar, etc, face significant challenges in ICT adoption, like limited internet connectivity, unreliable electricity, etc. Teachers' resistance to ICT adoption and less interest of aged teachers or teachers who lack digital skills in learning and adopting ICT training also act as barriers to edTech adoption in classrooms. Training and

capacity building programs of teachers should be designed effectively so that they equip teachers with the skills to use technology as per their pedagogical needs by linking their learning objectives with the help of TPACK approach. Moreover, setting up of community based approaches among teachers to reuse and refine learning resources can help. Teachers must be encouraged to try new tools in teaching process by handholding them at all levels. There must be opportunities like online training, short term courses, diploma courses to support continous learning of teachers. There is need to engage the teachers in the process of developing e-content relevant to their local context and learning needs of students. Additionally the development and dissemination of content in local languages in collaboration with educators and institutions like DIETs, SCERTs, and NCERT is essential to adopt ICT in the local context. It has become important to address emerging Cyber Safety and Security concerns by creating awareness regarding safe and secure use of technology by students and teachers. The study indicates there are limited partnerships or collaborations with NGOs, tech companies or any other organisations to provide ICT resources in schools. There is a lack of in-depth research studies for systematic assessments regarding ICT's impact on educational outcomes.

The main implications of this study for ICT Integration in rural classrooms of Jammu Division are summarised below:

- There is a need for high-quality professional development of teachers to equip them with computer skills.
- Focused initiatives should be implemented with priority to equip the rural schools with ICT resources and infrastructure, and ensure equitable access of children belonging to SEDGs to quality education.
- The remote schools of Jammu Division should be provided with high-speed broadband Internet facilities to harness the potential of eLearning and improve access to quality educational resources available online.
- There is a need to align the curriculum, technology and pedagogy to achieve learning objectives effectively.
- Cybersecurity awareness should be provided to teachers and students to promote digital citizenship, and the enforcement of strict guidelines to address ethical and safety concerns while using ICT should be ensured.
- There is a need for using a blended approach in addition to traditional classroom instruction to keep students engaged and motivated during the learning process with the help of technology.
- Parents and the community should be mobilised to support ICT Integration to prioritise investments in ICT infrastructure, particularly in rural schools.
- There is dire need to address time constraints and workload issues of teachers to facilitate ICT adoption.
- Teachers need enhanced support from school administrators and the availability of technical support personnel in schools to help use ICT in classrooms.

Conclusion

To eliminate the digital divide in use of ICT between the schools of rural and urban areas of Jammu and Kashmir, the administration must focus on upgradation of ICT infrastructure in the rural schools, SCERT and DIETs need to provide effective hands-on trainings to

teachers and continuous upgradation of skills using platforms like DIKSHA, promoting gender equity in developing ICT skills by subsidising costs of digital devices for girls, free Internet hotspots in school libraries, and promoting solar based ICT labs for areas lacking reliable access to electricity. Moreover, establishing robust ICT policies can help in improving access to technology when implemented with the help of all stakeholders, i.e. teachers, students, administrators and the community, by establishing community learning hubs. Use of technological pedagogical models like Technological Pedagogical Content Knowledge framework (TPACK) and Substitution, Augmentation, Modification and Redefinition (SAMR) models to adopt technology can improve motivation of learners, engage them in learning process and help in knowledge retention, and achievement of learning outcomes.

Acknowledgements

This research paper is made possible through the help and support provided by DIET faculty and teachers of Districts Ramban, Rajouri, Kathua and Kisthwar, who have collected and provided the primary data for this research.

References

Abas, M. A., Arumugam, S. E., Yunus, M. M., & Rafiq, K. R. M. (2023). ChatGPT and personalized learning: Opportunities and challenges in higher education. *International Journal of Academic Research in Business and Social Sciences, 13*(12), Article 20240. https://doi.org/10.6007/IJARBSS/v13-i12/20240

Abykanova, B., Kussainov, G., Tautenbayeva, A. A., Zheldybayeva, B., Kochshanova, G., & Shuakbayeva, R. (2024). Teaching the teachers: Technological proficiency and professional growth in rural education. *Evolutionary Studies in Imaginative Culture*, 989–1003. https://doi.org/10.70082/esiculture.vi.931

Akram, H., Abdelrady, A. H., Al-Adwan, A. S., & Ramzan, M. (2022). Teachers' perceptions of technology integration in teaching-learning practices: A systematic review. *Frontiers in Psychology, 13*. https://doi.org/10.3389/fpsyg.2022.920317

Aslan, A., & Zhu, C. (2016). Influencing factors and integration of ICT into teaching practices of pre-service and starting teachers. *International Journal of Research in Education and Science, 2*(2), 359–370. https://doi.org/10.21890/IJRES.81048

Bahadur, P. (2022). Integration of ICT in classroom: Perception of university teachers and students. *Molung Educational Frontier, 5*(1), 11–23. https://doi.org/10.3126/mg.v5i1.70617

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science and Technology Education, 5*(3), 235–245.

Bisht, R. K., & Vani, B. M. M. (2024). Challenges and opportunities: The role of ICT in enhancing educational access in rural Telangana. *International Journal for Multidisciplinary Research, 6*(6). https://doi.org/10.36948/ijfmr.2024.v06i06.33118

Chauhan, T., Visnu, S., & Kumar, S. (2025). Bridging the digital divide: A review on digital literacy, e-learning, and LMS solutions for rural communities. *Preprints*. https://doi.org/10.20944/preprints202504.0411.v1

Dzansi, D. Y., & Amedzo, K. (2014). Integrating ICT into rural South African schools: Possible solutions for challenges. *International Journal of Embedded Systems, 6*(2), 341–348. https://doi.org/10.1080/09751122.2014.11890145

Ghavifekr, S., Kunjappan, T., & Ramasamy, L. (2006). Teaching and learning with ICT tools: Issues and challenges from teachers' perceptions. *Malaysian Online Journal of Educational Technology, 4*(2), 38–57.

Goktas, Y., Gedik, N., & Baydas, O. (2013). Enablers and barriers to the use of ICT in primary schools in Turkey: A comparative study of 2005–2011. *Computers & Education, 68*, 211–222. https://doi.org/10.1016/j.compedu.2013.05.002

Hassan, M. M., & Mirza, T. (2021). Digital literacy among teachers in schools of Rajouri (J&K), India: Teachers' perspective. *International Journal of Education and Management Engineering, 11*(1), 28–40. https://doi.org/10.5815/ijeme.2021.01.04

Implementation of ICT at school scheme: A case study. (2023). *International Journal for Multidisciplinary Research*. https://doi.org/10.36948/ijfmr.2023.v05i04.4852

Joshi, B. M., & Khatiwada, S. P. (2025). Teachers' characteristics, ICT use and educational outcomes. *Tribhuvan University Journal, 17*(1), 63–81. https://doi.org/10.3126/thj.v17i1.77840

Kormos, E., & Wisdom, K. (2021). Rural schools and the digital divide: Technology in the learning experience. *Theory & Practice in Rural Education, 11*(1). https://doi.org/10.3776/TPRE.2021.V11N1P25-39

Lawrence, J. E. (2018). Factors influencing teachers' integration of ICT in teaching and learning. *International Journal of Adult Vocational Education and Technology, 9*(2), 48–63.

Madida, M., Naidoo, G. M., & Rugbeer, H. (2019). Barriers to effective digital teaching in rural schools. *Gender and Behaviour, 17*(4), 14101–14115. https://doi.org/10.4314/gab.v17i4

Makhlouf, K., & Bensafi, Z. (2021). An exploration of factors influencing teachers' attitudes toward the use of ICT in classroom practice: A case study of secondary school EFL teachers in Algeria. *Advances in Language and Literary Studies, 12*(2), 37. https://doi.org/10.7575/aiac.alls.v.12n.2.p.37

Mansotra, V., Sharma, V., & Sambyal, G. S. (2009). IT initiatives in education: A case study for J&K State. In *Proceedings of the IEEE International Conference on Computer Science and Information Technology* (pp. 182–186). https://doi.org/10.1109/ICCSIT.2009.5234382

Mawela, T., & Somagaca, U. (2025). Factors influencing the integration of ICT in teaching and learning. *Artha Journal of Social Sciences, 24*(2), 1–42. https://doi.org/10.12724/ajss.73.1

Mehta, S., & Thakkar, K. (2024). ICT (information and communications technology) in education: Change brings challenges. *Indian Scientific Journal of Research in Engineering and Management, 8*(7), 1–3. https://doi.org/10.55041/ijsrem36371

Mhlana, S., Chipangura, B., & Twinomurinzi, H. (2021). Conceptualising factors that influence learners' intention to adopt ICT for learning in rural schools in developing countries. In *Communications in Computer and Information Science* (Vol. 236, pp. 391–401). https://doi.org/10.1007/978-981-16-2380-6_34

Mwei, P. K. (2020). Teachers' perception of factors affecting integration of information and communication technology for instructional purposes in secondary schools in Kenya. *Journal on Educational Technology, 8*(1), 25–37.

Ndawi, V. E., Thomas, K. A., & Nyaruwata, T. L. (2014). Barriers to effective integration of information and communication technology in Harare secondary schools. *International Journal of Science and Research*. http://www.ijsr.net

Nikolopoulou, K., & Gialamas, V. (2016). Barriers to ICT use in high schools: Greek teachers' perceptions. *Journal of Computers in Education, 3*(1), 59–75. https://doi.org/10.1007/s40692-015-0052-z

Obeng, P. (2025). Influence of teacher perceptions, attitudes, and policy on ICT integration in basic schools in Ho Municipality, Ghana. *Journal of Education, 9*(4), 15–30. https://doi.org/10.53819/81018102t4357

Osaï, J. A., Amponsah, K. D., Ampadu, E., & Commey-Mintah, P. (2021). Teachers' experiences with overcrowded classrooms in a basic school in Ghana. *International Online Journal of Primary Education, 10*(1), 73–88.

Pardede, P. (2020). Secondary school students' perception of ICT use in EFL classrooms. *Journal of English Teaching, 6*(3), 246–259. https://doi.org/10.33541/jet.v6i3.2215

Peng, R., Razak, R. A., & Halili, S. H. (2023). Investigating the factors affecting ICT integration of in-service teachers in Henan Province, China: Structural equation modeling. *Humanities & Social Sciences Communications, 10*(1), 1–11. https://doi.org/10.1057/s41599-023-01871-z

Raj, S. S., & Sandasagan, K. (2024). Accessibility of technology affecting pupils' learning in rural schools. *International Journal of Science and Advanced Technology, 15*(4). https://doi.org/10.71097/ijsat.v15.i4.1254

Singh, S. (2018). Digital divide in India: Measurement, determinants and policy for addressing the challenges. *Journal of Information and Digital Economy*. https://doi.org/10.4018/jide.2010040101

Singhavi, C., Basargekar, P., & Somaiya, K. J. (2019). Barriers perceived by teachers for use of information and communication technology (ICT) in the classroom in Maharashtra, India. *ASER Centre*.

Thakur, G. K. (2014). ICT and digital divide in Indian school system. *International Journal of Information Management Systems*. http://www.ijims.com/uploads/f90404702bff04fca837D6.pdf