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Future-Ready Classrooms: Integrating Technology in Indian Schools

Dr. K. Venu Madhavi
Associate Professor
Department of Materials Development, Testing and Evaluation
The English and Foreign Languages University,Tarnaka, Hyderabad, India
kvenumadhavi@efluniversity.ac.in

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Abstract
Technology will shift education from many perspectives. Most schools in India are integrating technology into the classroom. Many government initiatives encourage *the Digital India* framework to make learning enjoyable, enhance personalized learning, increase accessibility to e-learning tools, empower teachers with ideas on enhancing their instructional delivery, monitor student learning achievement, and give feedback. The current study focuses on the current trends and challenges to addressing the digital divide in Indian schools. The research methodology used quantitative analysis to analyze the teacher's perceptions of implementing Information and Communication Technology (ICT) in SCERT schools situated in Delhi. The study identified problems and challenges in schools implementing digital classroom facilities. We have entered the world of Artificial Intelligence (AI) and Virtual Reality (VR), showing potential growth in the educational sector. The study investigated whether Indian schools are still struggling with infrastructural requirements, quality student-teacher bases, and tailor-made professional training activities. A structured questionnaire investigated the Indian school's readiness to accept the new AI-adapted classroom environment. The data revealed progress in some aspects, but a persistent effort and an immediate solution to address the digital divide are vital in AI-driven educational settings.

Keywords: Technology, ICT implementations, SCERT, Trends, Challenges.

Introduction

Digital India Campaign is playing a significant role in changing India into a digitally empowered and knowledgeable society. Technology will also have a direct impact on the enhancement of educational processes and outcomes. The advent of artificial intelligence, machine learning, blockchains, smart boards, computing devices, and adaptive computer tests aimed at enhancing students' academic progress. According to NEP 2020, "the National Educational Technology Forum (NETF) provides a platform for free exchange of ideas on the

use of technology to enhance learning, assessment, planning, administration, for schools and higher education." NETF is constantly researching, inquiring, and analyzing the positive impacts of educational technology. NEP 2020 guidelines suggest that NETF needs to host many regional and national conferences, workshops, and seminars to get inputs from national and international educational technology researchers, entrepreneurs, and practitioners. The functions of NETF:

a. provide independent, evidence-based advice to Central and State Government agencies on technology-based interventions;
b. build intellectual and institutional capacities in educational technology;
c. envision strategic thrust areas in this domain and
d. articulate new directions for research and innovation (NEP, 2020).

The current research focused on current practices and implementation levels of ICT integration in the State Council of Educational Research and Training. The perceptions of the school teachers, SCERT, Delhi indicated potential challenges, issues, and limitations despite progressive growth in digital integration in Indian schools.

Literature Review:

ICT in Education: A Critical Literature Review and Its Implications by Jo Shan Fu (2013) presents a summary of ICT applications in education. The research review focused on the benefits of ICT implementation in schools, the difficulties and challenges, factors that determine ICT implementation, and teacher's beliefs about ICT. The research also emphasized the role of school culture in adopting ICT effectively. It directs toward identifying the gaps in the implementation of ICT in education.

The availability of breakthrough cross-cutting technologies such as smart devices, IoT, AI, AR and VR, blockchain, and software applications has enabled new ways of enhancing teaching and learning (Gaol & Prasolova-Førland, 2021; OECD, 2021). Samtani et al. (2022) suggested sufficient funding for adequate infrastructure. A strategic reformation enhancing teachers' competencies, tracking learners' experiences, and employability preparedness requires a transparent and accountable framework. Shetty et al. (2020) discussed the potential role of AI in school and educational sectors in India. The article stressing NEP 2020's vision for computer literacy, innovative thinking, and new avenues for learning and innovation emphasized the need to embrace cultural differences, address the digital divide, and design authentic tasks.

Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review by Timotheou, S., Miliou, O., Dimitriadis, Y., *et al. (2023) discussed that* information and communication technologies hold much potential for the overall transformation of schools. However, investment in ICT infrastructure and enhancing professional development in school education has to start yielding fruitful benefits.

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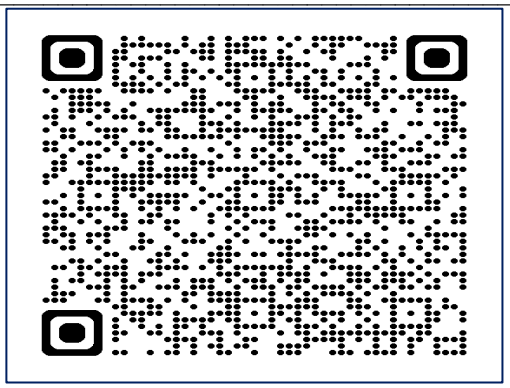

Figure 1: QR Code Linking to *Impacts of Education*

(Source: Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review by Timotheou, S., Miliou, O., Dimitriadis, Y. *et al. (2023)*

Digital transformation is a challenging process that depends on a rigorous transformation, digital readiness, and infrastructural capability. All stakeholders in the school system must have a clear vision of the use of ICT in education and work towards realizing such a vision. In addition, digital technologies are dynamic. The use of laptops, computer simulations, smart boards, learning management systems, tablets, and PCs or mobile games from 2005 to 2022's use of AR – Augmented Reality, VR – Virtual Reality, Robotics, Artificial Intelligence, and Electronic Books with features of storytelling, computer-aided and game-based instruction, hybrid learning have benefited subject-specific skills, capacity building skills, social and professional development. The research should contribute towards shaping policy decisions and promote practice and research skills for a shift towards more comprehensive methods. (Timotheou, S., Miliou, O., Dimitriadis, Y. *et al., 2023)*

Fernández-Gutiérrez et al. 2020; Lawrence & Tar, 2018; European Commission, 2019; Balyer & Öz, 2018 have addressed the impact of ICT on educational policies and emphasized the need for strategic planning and policy-making decisions for the benefit of the stakeholders, teaching-learning processes, and the development of educational systems in the context of current technological realities. However, schools have provided large amounts of investment for integrating technology, but the results have not looked attractive, and the identified goals have not been accomplished as planned (Delgado et al., 2015; Lawrence & Tar, 2018).

According to Sellar, "Data infrastructure in education is developing due to the demand for *information about student outcomes, teacher quality, school performance, and adult skills, associated with policy efforts to increase human capital and productivity practices.*" Zheng et al. (2016) concluded that when teachers used one-on-one laptop programs, the process led to positive changes in teaching and learning, which would not have been possible without the support of the technical infrastructure and support offered to teachers.

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DIKSHA (Digital Infrastructure for Knowledge Sharing) platform conceptualizes 'One Nation, One Digital Platform' for school education. The educators, students, parents, and the community can access courses and activities following the prescribed school curriculum. The guidelines on ICT interventions ((https://dsel.education.gov.in/sites/default/files/2021-06/CWSN_E-Content_guidelines.pdf) to bridge the digital divide between deprived social categories such as girls, other backward castes, SCs/ STs, minorities, Children with Special Needs (CWSN), and marginalized populations. The Ministry has provided and disseminated specific guidelines for creating e-content for CWSN on 8th June 2021.

The implementation of ICT interventions in 2024 revealed some facts and suggested immediate steps to balance traditional and digital methods in the educational sector, especially in Indian SCERT schools.

Research Method

The current research employs a quantitative method for analyzing and interpreting the attitudes of school teachers about the implementation of ICT in school education. A structured survey questionnaire consisted of

a. demographic information from the participants about their educational background, total number of teaching experience, name of the workplace, and the role they perform in their workplace.
b. infrastructure facilities in the school
c. ICT training methods for students and teachers
d. Impact of ICT integration on the school environment

Research Findings

25 respondents are teaching in Delhi-based SCERT schools. All the teachers have a postgraduate degree with an M.Ed. or M.A. English background. Two teachers completed their Ph.D. degrees. The teachers hail from the Directorate of Education, Sarvodaya Bal Vidyalaya, Government Boys Senior Secondary School, Rajkiya Pratibha Vikas Vidyalaya, and SCERT, Delhi. Of the 25 teachers, 5 follow the CBSE curriculum, and the rest deal with the state syllabus. There are 16 teachers with experience ranging between 2 and 5 years, three teachers with experience between 12 and 17 years, two between 22 and 27 years, and one with 33 years of experience.

Infrastructure facilities in the school

i. The data revealed that the projector is the most used ICT resource (92%), which shows there is an emphasis on ICT integration. Multimedia labs are accessible with 36%, illustrating that information communication technology is partially incorporated. Although about 60% of the population is using the internet, there is a need to expand internet availability. Similarly, personal tools such as laptops/ tablets meant for students at 25% and interactive whiteboards at 16% reveal a huge investment required for ICT resources for each student. The data reveals that schools with basic ICT support require more investment in student-centered and higher-

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end technological equipment.

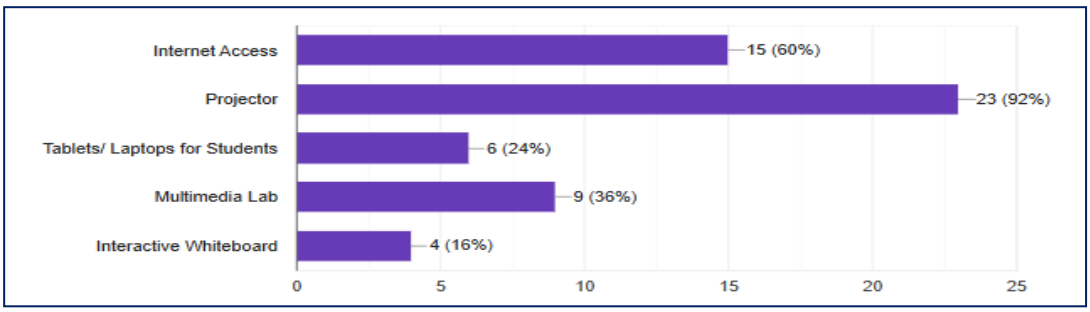

Fig 1: ICT Infrastructure in Schools

ii. The questionnaire about the availability of enough laptops/tablets and the frequency of using multimedia facilities revealed that 64% of students do not have access to personalized laptops/ tablets. The teachers mentioned that a third of students use it weekly for an hour or less. The results also indicated that 28% of students use the multimedia facilities occasionally, an irregular use suggesting either a low-frequency access rate or low interest. 24% of students report using multimedia rarely, which may reflect limited access or nonavailability. Only 12% of students use the lab daily, which proves that multimedia-based activities are minimally done. Schools with the CBSE curriculum have better infrastructure facilities, and hence, some schools and students have adopted the daily use of multimedia technology. Most students described their use of multimedia labs as weekly or occasionally, which means planned sessions for multimedia labs. There is a need to ensure easy access and adaptation to the multimedia lab to enhance the students' learning.

iii. The data regarding the use of ICT for teaching, administration, research, or assessment purposes suggests that the majority (88%) integrated ICT into teaching and learning strategies and made their teaching practices more engaging and interactive for students.

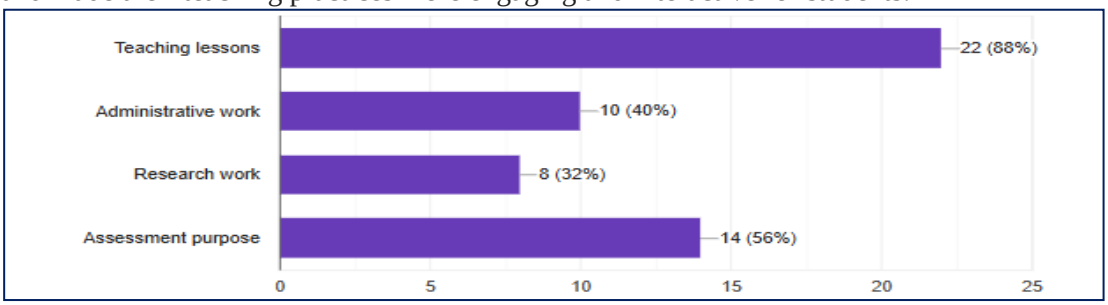

Fig 2: Adoption of ICT for various Activities in Schools

40% of teachers use ICT for administrative purposes to enhance the administration process in teaching learning interface; 32% of them apply ICT in the research activities, indicating that

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although they use it for scholarly purposes, it is not as common as teaching or administrative uses. Data revealed that teachers frequently apply digital devices to assess students' performance, designing quizzes, exams, and other test-related items. The integration of ICT with teaching and assessment among teachers has received welcoming participation, implying the advanced role of ICT in teaching practices. Yet, there are opportunities to enhance the integration of ICT in administrative and research activities.

iv. Accessibility to internet facilities for students shows that a majority (40% of 'always' and 'often') have internet access. A subset of the population has limited internet usage, with 28% and 36% in the 'rarely' and 'never' categories. There is rising concern regarding internet connectivity and addressing the digital divide situation.

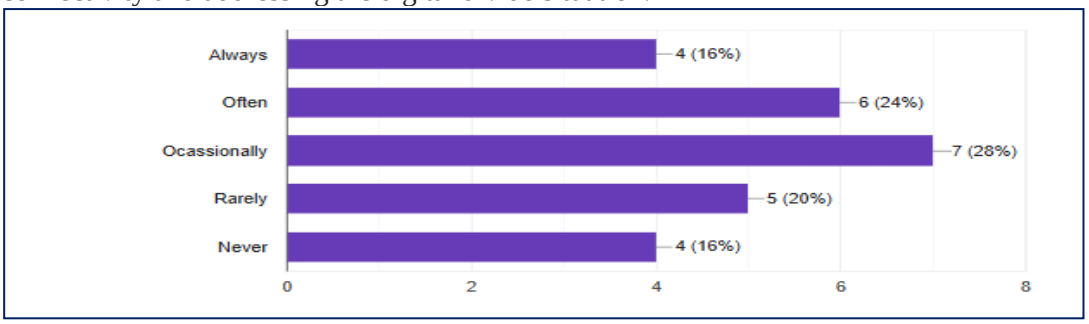

Fig 3: Internet Accessibility to Students

ICT Training for students and teachers

v. The data about the learners' comfort while using ICT tools and web resources revealed that 68% of the students wish to engage in multimedia teaching and learning environments. 32% opted for a conventional approach due to insufficient ICT-embedded academic schedules, lack of hands-on approach, and no special attention for slow learners. Most of the learners do not have access to personal desktops at home, leading them to boredom, lack of motivation, and increased anxiety.

vi. Student's involvement in developing or utilizing media-related tasks is encouraging. More than half of the students (56%) are creating content with PowerPoint or video compilations, indicating their development of digital literacy and communication skills. Most students (64%) actively engage in online quizzes and assessments. Kahoot!, Quizlet, Google Forms, and institutional LMS platforms engaged the learners with immediate feedback and review mechanisms from the teachers. The data revealed that 48% of the students attend computer-aided tasks and solve digital worksheets and exercises. Nevertheless, only 32% engage in collaborative project work. There is a need to enhance teamwork, communication competencies, and successful collaboration in the AV technology

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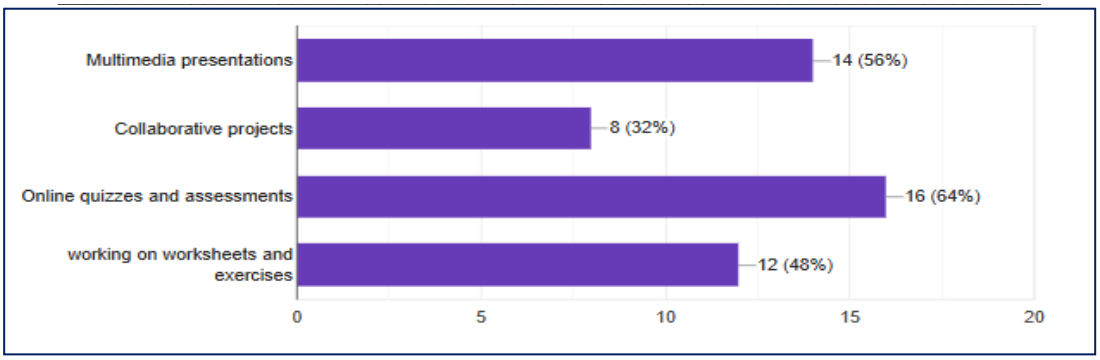

Fig 4: Students engaging in Media related Tasks

vii. It is interesting that 52% of teachers feel competent and confident working on ICT-enabled platforms, while 48% mentioned being 'poor' in engaging in digital pedagogy. When asked about their ICT training, 68% of the teachers found it comfortable to access multimedia and digital resources. Further, 40% of the teachers attend professional workshops and hands-on practice sessions. Among the respondents, 52% have formally attended online courses in ICT training. This represents that more teachers are embracing online learning platforms. 48% of the teachers practice Self-directed learning. This proves that most teachers are proactively seeking ways and means to learn ICT on their own. Among the respondents, 8% have not attended any ICT-related training.

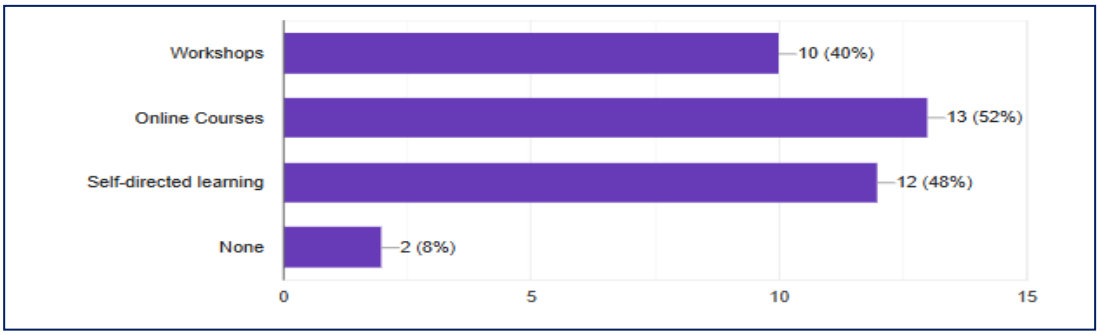

Fig 5: Teachers attending ICT-enabled Training

This is a challenge for school teachers who have no time or interest in undertaking ICT training for their classroom practices; 4% of them are not using ICT training and development. The reasons for poor performance need immediate attention and action to make such teaching platforms interesting and motivating to the teachers. However, many teachers participate in various kinds of ICT training.

Impact of ICT integration on the school environment

viii. The information presented in the data points to the favorable effects of ICT on different aspects of the educational process. 68% of respondents confirmed that ICT has enhanced

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student's regularity, participation, and motivation. Multimedia and other interactive content assist in fun and interactive learning. 60% of the respondents support ICT as it offers better access to learning resources. These include online resources, educational websites, e-books, and gamification content. 56% of teachers said that ICT has improved teaching skills. This implies that teaching practices that result in the use of ICT enhance instructional practices and techniques. 48% of the respondents view ICT as a time-saving tool for administrative work, particularly for grading assignments and tests, record-keeping, creation of lesson plans, and collaborative projects. 48% of the respondents viewed ICT as enhancing the learner's independence and autonomy. A learner can personalize his learning needs, thus allowing for self-paced learning.

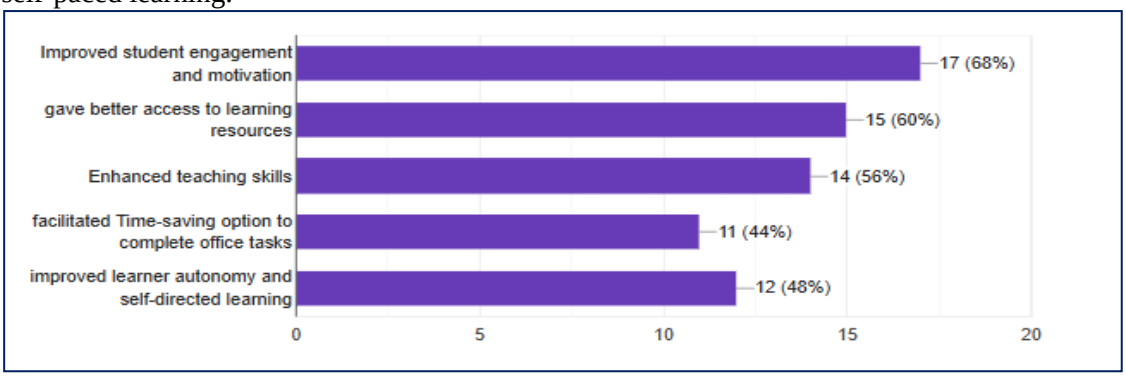

Fig 6: Impact of ICT integration in the school environment

ix. ICT has shown a tremendous impact on the school environment. However, the respondents raised common concerns and challenges to implementing ICT-enabled instruction:

- 72% lack of infrastructure facilities
- 52% insufficient training for students and teachers;
- 40% poor internet connectivity
- 28% expensive ICT tools
- 12% resistance to change

x. The study also highlighted the lack of funds and financial stability to furnish schools with the required facilities. Another important finding reveals the need to upgrade ICT infrastructure. 24% of teachers said that ICT upgrading happens annually, 28% said in 2-3 years, and 48% said it is 'very rare.' This indicates that there should be a proper mechanism and schedule for updating the infrastructure. Regular checks and immediate solutions will not hamper the continuity of the ICT facilities.

There are critical issues, including inadequate access to computers, tablets, and other requisite gadgets; poor internet connectivity, especially in rural learning institutions; insufficient technical support to sustain and repair ICT equipment; lack of appropriate

digital tools to address learner needs and improve education quality; lack of proper orientation and training for students and teachers. The facilities in CBSE schools are better compared to state boards. There is a Learning Management System (LMS) called KYAN, which provides customized services for teachers and students. Hence, there should be uniformity among the school boards for accessibility and inclusivity of education for all kinds of learners.

Limitation

The study is limited to SCERT teachers in Delhi. Further research input from different parts of India will provide present conditions and ICT practices for classroom teaching and learning.

Conclusion

India's Viksit Bharat 47 slogan," transforming India into a $30 trillion economy by 2047 from its current $3.4 trillion GDP," included many key indicators, including a technology-integrated knowledge society. The present data collected in 2024 reminds us of the continuing problems and challenges in the educational field, although there is a significant awareness about ICT among the stakeholders. There is a need for continuous monitoring, regular checking and addressing the issues, reviewing feedback about the implementation of ICT, acting on the feedback, and providing adequate support towards digital educational renovations. NETF guidelines released in 2021 need further investigation, survey, and appropriate remedies to make the Digital India Campaign successful.

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