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ICT Integration Barriers: Pre Service Science Teachers Internship Experiences

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ABSTRACT

The National Education Policy 2020 and National Curriculum Framework 2023 prioritize seamless ICT integration throughout school education, advocating not for a separate subject, but for its presence across all disciplines. Information and Communication Technologies (ICT) integration in education refers to the intentional and purposeful utilization of digital tools and resources to enhance learning experiences and teaching practices (UNESCO, 2013). It goes beyond simply placing technology in classrooms; it involves seamlessly weaving ICT into the curriculum, pedagogy, and overall school culture to achieve specific learning goals (Means et al., 2013). Critical understanding of ICT has been labelled as a crucial part of the teacher education programme and the same has been suggested by NCTE curriculum. Though ICT integration is discussed as a paper in the pre-service teacher education program, the effectiveness of its implementation in teaching learning process during the internship is of the paramount importance and the problems and challenges that come during the implementation is something that has not much touched by in research. The present study has tried to study the problems and challenges faced by pre-service teachers in ICT integration during their internship program. The results include several problems and challenges faced by pre-service teachers in ICT integration during internship that include access and infrastructure, pedagogical challenges and social and emotional challenges. As India strives for educational innovation and technological advancements, addressing these challenges becomes imperative. A holistic approach involving targeted teacher training programs, infrastructure development, and policy initiatives is crucial to empower pre-service science teachers in overcoming these obstacles. By actively working towards mitigating these challenges, the system can better prepare future science educators to utilise the potential of ICT and foster a more engaging and effective learning environment.

Key Words: ICT integration, National Education Policy 2020, National Curriculum Framework 2023, Pre-service teachers, Internship, Teacher education, Pedagogical challenges, Access and infrastructure, Digital tools.

INTRODUCTION

The National Education Policy 2020 and National Curriculum Framework 2023 prioritize seamless ICT integration throughout school education, advocating not for a separate subject, but for its woven presence across all disciplines. This aims to cultivate critical thinking, problem-solving, and digital literacy skills while leveraging tech infrastructure and emerging technologies like AI and coding. NCFSE 2023 further details learning outcomes and promotes ICT-based pedagogies for a more engaging and interactive experience. Assessment reform and comprehensive teacher training are also underscored to ensure students become not just academically sound but also future-ready digital citizens.

The National Council for Teacher Education (NCTE) updated its requirements for teacher education programmes after receiving feedback. Then the NCTE notified amended regulations, norms, and the Standards and Curriculum Framework were released for different Teacher Education Programmes. In 2015-16, all teacher training colleges in India introduced a two-year B.Ed. plan, as recommended. To enhance teacher education, the two-year B.Ed. curriculum now includes EPC (Enhancing Professional Capacities) courses and a 20-week internship programme. The EPC course is broken into four parts: EPC-(Reading and Reflecting on Texts), EPC-2 (Drama and Art in Education), EPC-3 (Critical Understanding of ICT), and EPC-4 (Understanding Oneself).

The NCTE Curriculum Framework 2014 outlines the following primary goals for the EPC course 'Critical Understanding of ICT':

1. To help instructors understand how to utilise ICT.
2. Learn about the psychological factors that influence the use of ICT assistance materials.
3. Introduce student-teachers to modern teaching-learning approaches.
4. Help student-teachers see and appreciate ICT as a valuable learning tool and functional support for instructors.

What does ICT integration mean?

Information and Communication Technologies (ICT) integration in education refers to the intentional and purposeful utilization of digital tools and resources to enhance learning experiences and teaching practices (UNESCO, 2013). It goes beyond simply placing technology in classrooms; it involves seamlessly weaving ICT into the curriculum, pedagogy, and overall school culture to achieve specific learning goals (Means et al., 2013).

ICT integration is more than just putting technology in classrooms; it is about deliberately incorporating it into the fabric of learning. This involves infusing classrooms with diverse digital tools (computers, tablets, interactive whiteboards, online platforms, educational software) (UNESCO, 2015). But it is not enough to just have the tools; teaching approaches must shift to leverage their potential. Ertmer and Gater (2010) highlight the focus on student-centered learning, collaborative activities, personalized learning pathways, and inquiry-based learning that ICT integration brings. Ultimately, the goal is to enhance learning outcomes by fostering deeper understanding, critical thinking, problem-solving skills, digital literacy, and 21st-century skills crucial for success in a technology-driven world (ISTE, 2016).

The possibilities for enriching learning with ICT extend far beyond traditional classroom walls. Imagine science lessons where students explore complex concepts through immersive simulations and virtual reality experiences, or history classes bursting with creativity as students weave digital stories to showcase their understanding. Collaboration takes on a global dimension thanks to online platforms connecting students from diverse locations for project-based learning. Even individual learning gains a personalized touch with the help of adaptive learning software that tailors paths to each student's needs and pace. These are just a glimpse of the potential for ICT integration to transform classrooms into vibrant, dynamic learning environments where every student can thrive.

Despite the undeniable potential of ICT integration, its path is not without obstacles. The digital divide remains a crucial hurdle, as unequal access to technology, software, and reliable internet can leave some students behind (Warschauer & Ames, 2007). Equipping educators with the necessary teacher training and support is key. Effective ICT integration requires technology proficiency and pedagogical skills, making ongoing training and dedicated support crucial (UNESCO, 2020). Finally, navigating the digital world

comes with its own set of challenges. Ensuring digital safety and well-being necessitates vigilant attention to online safety, cyberbullying, and responsible digital citizenship practices (National Cyber Security Alliance, 2023). These challenges call for proactive solutions and comprehensive strategies to ensure ICT integration benefits all students while mitigating potential risks.

Despite these challenges, the opportunities presented by ICT integration are undeniable. By overcoming these hurdles and utilizing technology effectively, schools can create engaging and dynamic learning environments that prepare students for the demands of the digital age.

Review of Literature

The 21st century has witnessed a revolutionary surge in Information and Communication Technologies (ICT), transforming every facet of human interaction, including education. Integrating ICT into school curriculums has become a paramount concern, shaping both pre-COVID and post-COVID learning landscapes.

Prior to the global pandemic, the importance of ICT integration in schools was gaining significant traction. The potential benefits were multifaceted, encompassing enhanced student engagement, access to diverse learning resources, and development of crucial 21st-century skills (UNESCO, 2012).

Engaging Learning Experiences have been significantly enhanced through the integration of Information and Communication Technology (ICT) tools such as simulations, interactive games, and virtual reality, fostering deeper student engagement and active participation in learning processes (Aldrich, 2009). The potential of ICT to cater to diverse learning styles and personalize learning experiences has been underscored by studies conducted by Dede (2009). Moreover, the utilization of ICT in the educational landscape has played a pivotal role in Expanding Knowledge Horizons. Students, through ICT access, gain a gateway to boundless information and resources that extend beyond traditional textbooks. Online libraries, educational websites, and collaborative platforms like Wikipedia have facilitated knowledge exploration and peer-to-peer learning, as emphasized by Warschauer (2004). Additionally, schools have played a crucial role in Nurturing Digital Skills by integrating ICT into everyday classroom activities. This integration aligns with the mission to equip students with essential digital literacy and technology skills, covering aspects such as information retrieval, critical thinking, and problem-solving in digital environments, as advocated by the International Society for Technology in Education (ISTE, 2016) and Bawden (2008). As we navigate an increasingly technology-driven world, these skills become ever more valuable.

However, pre-COVID challenges also existed. Unequal access to technology and infrastructure, limited teacher training in ICT integration, and concerns about digital distractions and safety remained hurdles to widespread and effective ICT adoption in schools (UNESCO, 2015).

The COVID-19 pandemic acted as a powerful catalyst for ICT integration in education. With traditional classroom settings disrupted, virtual learning platforms and technology tools became indispensable for ensuring educational continuity (UNESCO, 2020).

- Emergency Remote Learning: Schools and educators relied heavily on video conferencing platforms, online learning management systems, and digital resources to deliver lessons and maintain student engagement during lockdowns and school closures (Hodges et al., 2020).
- Reimagining Pedagogy: ICT integration spurred the exploration of innovative teaching approaches, such as flipped classrooms, blended learning models, and online collaboration tools (Means et al., 2013). These approaches fostered student autonomy, critical thinking, and collaborative learning

skills.

- Bridging the Digital Divide: The pandemic highlighted the critical need for equitable access to technology and internet connectivity for all students (UNICEF, 2020). Initiatives to address the digital divide and provide students with necessary hardware and software resources gained momentum.

Despite the progress, post-COVID challenges remain. Concerns about digital equity, student well-being in online environments, and the need for effective teacher training and support for sustained ICT integration persist (UNESCO, 2021).

The increasing emphasis on ICT integration in schools demands a balanced approach that leverages the technology's potential while mitigating its challenges. Future efforts should focus on:

- Ensuring equitable access to technology and digital resources for all students.
- Providing robust teacher training and support for effective ICT integration pedagogy.
- Prioritizing student well-being and promoting responsible digital citizenship practices.
- Conducting ongoing research and evaluation to assess the impact of ICT integration on student learning and school practices.

By embracing a holistic and inclusive approach, schools can harness the transformative power of ICT to create engaging and effective learning environments, preparing students for success in the dynamic landscape of the 21st century.

Post-pandemic ICT integration in Indian classrooms offers immense potential, but navigating its path demands addressing distinct challenges. Bridging the digital divide remains paramount, as disparities in access to hardware, software, and reliable internet persist within geographical regions and socioeconomic groups (Kumar et al., 2020). Studies by Joshi and Krishna (2023) further highlight the need for context-specific training programs for Indian teachers, emphasizing culturally relevant pedagogical approaches that leverage ICT effectively. Concerns about digital safety and well-being resonate strongly in the Indian context, where studies by Singh et al. (2022) emphasize the need for robust cyber-safety awareness programs and regulations alongside promoting responsible digital citizenship practices. Additionally, developing effective assessment strategies for ICT-enhanced learning environments remains a crucial area of exploration, with Indian researchers like Pandey and Dash (2021) advocating for a blend of traditional and technology-integrated methods to capture the holistic picture of student learning. Addressing these unique challenges in tandem with global best practices holds the key to unlocking the transformative potential of ICT for all students in the Indian education landscape.

The researchers were unable to find reviews on problems and challenges faced by pre-service teachers in ICT integration and hence found the **GAP** in research and hence chose the topic for the study.

Need and Significance of the study

The digital age demands a revolution in education, and ICT integration rises to the challenge. Engaging tools, personalized learning, and global connections empower students with essential skills for the future workforce, all while bridging geographical gaps and fostering responsible digital citizenship. Beyond adding technology, ICT integration transforms learning experiences, preparing students to thrive in a world where knowledge and connection know no bounds. Many research studies have been carried out with respect to different aspects related to ICT integration and have brought out findings regarding ICT integration such as how to integrate ICT in classroom, how integration takes place in teaching and learning, advantages of ICT integration etc. Teaching of ICT integration is important but how has the ICT integration played out in the real-life classroom becomes equally important. Hence, there was a need to

study the problems and challenges faced in ICT integration during internship among pre-service teachers. By understanding these problems better interventions can be given to the pre-service teachers before and during the internship. Hence the study Problems and Challenges faced by pre-service science teachers in ICT integration during Internship.

Objectives of the study

1. To find out the problems and challenges faced by pre-service science teachers with respect to Access and Infrastructure for ICT integration during internship.
2. To find out the pedagogical challenges faced by pre-service science teachers with respect to ICT integration during internship.
3. To find out the Social and Emotional challenges faced by pre-service science teachers with respect to integration during internship.

Methodology

For the study, the researchers followed Descriptive Survey method to find out the problems and challenges faced by the problems and challenges faced by pre-service science teachers in ICT integration during Internship. A rating scale was prepared and google forms was used to find out the Problems and Challenges faced by pre-service teachers in ICT integration during Internship. The rating scale consisted of 25 items which covered the areas of access and infrastructure, pedagogical challenges, content and resource challenges and social and emotional challenges. An interview schedule was also prepared and students were interviewed on the similar questions asked in the interview to know in-depth about the Problems and Challenges faced by pre-service teachers in ICT integration during Internship. Qualitative analysis was done for the study under which the data collected were analysed.

Final year pre-service science teachers who have completed their internship were given the tool and a total of 73 pre-service teachers from various institutions participated in the study. Further interview was conducted from participants studying in Regional Institute of Education (NCERT), Mysuru, who attended the tool randomly to understand the problems and challenges faced by pre-service teachers further.

Results and Findings

The following are the findings of the study. This chapter has been divided into sections based on the research objectives chosen for the study.

Problems and challenges faced by pre-service teachers with respect to Access and Infrastructure for ICT integration during internship.

Pre-service teachers faced several problems and challenges with respect to access and infrastructure for ICT integration that included:

1. **Access to reliable internet in the classroom.**

Insufficient connectivity and inadequate technological infrastructure in schools hinder students' ability to explore a diverse range of online educational materials, engage in collaborative learning, and develop digital literacy skills (Chakraborty & Nair, 2019). 33% of pre-service teachers did not have access to internet facilities in their school, whereas, 23% of pre-service teachers had interrupted internet facility in their school and 34% of pre-service teachers had an uninterrupted internet access in their schools during internship.

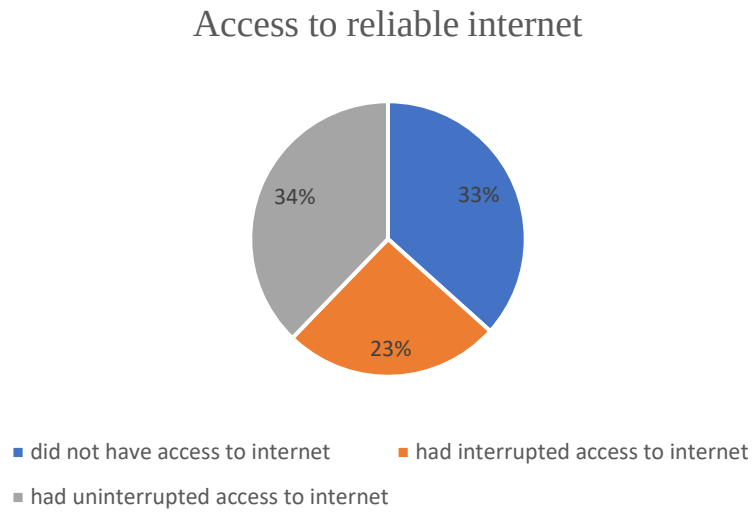

Figure 1: Access to reliable internet

2. Availability of ICT resources in school

27% of pre-service teachers did not have proper Technological resources for ICT integration in their internship schools, 28% of pre-service teachers had few ICT resources available at their school and 46% of pre-service teachers had all the technological resources present in their schools during internship.

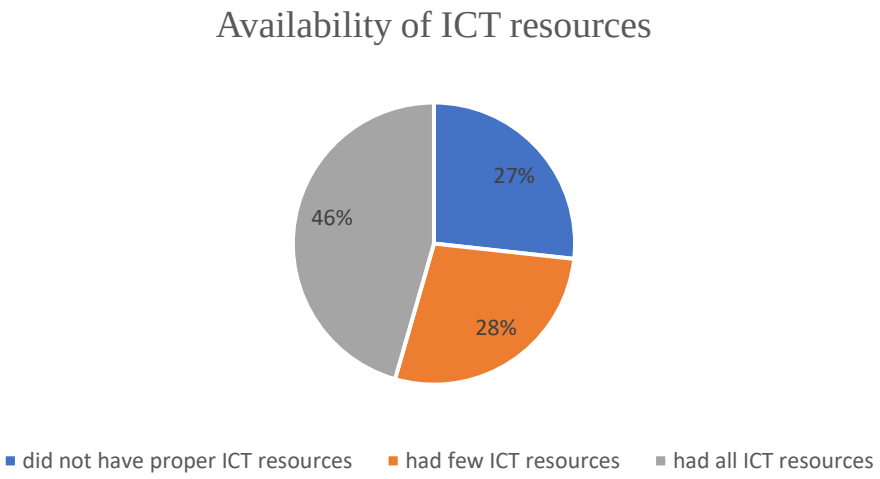

Figure 2: Availability of ICT resources

3. Classroom layout

Classroom layout was one other problem that posed challenges in seamless ICT integration during internship for pre-service teachers. 32% of pre-service teachers opined that classroom layout was not well equipped and friendly for ICT integration, 25% of the pre-service teachers opined that classroom layout was sometimes a problem in ICT integration and 43% of student teachers opined that classroom layout did not pose and problems or challenges in ICT integration in their school during internship.

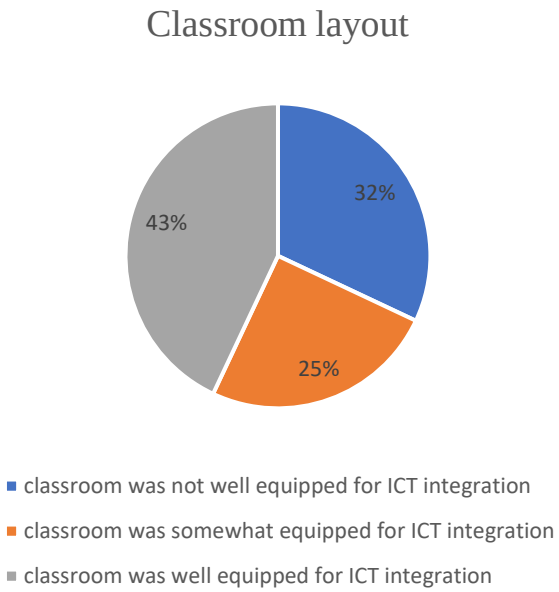

Figure 3: Classroom layout

4. Access to digital resources

Access to digital resources in Indian schools has been a persistent challenge, impacting educational opportunities and hindering the integration of technology into the learning environment. Despite the increasing importance of online resources for education, many schools in India face limitations in internet access. This digital divide is particularly pronounced in rural and economically disadvantaged areas, where infrastructure development is slower (Singh & Bansal, 2018). The present study found that 41% of pre-service teachers had access to digital resources in their internship schools, 34% of pre-service teachers faced difficulties in accessing digital resources and 25% of pre-service teachers had no access to digital resources in their internship schools.

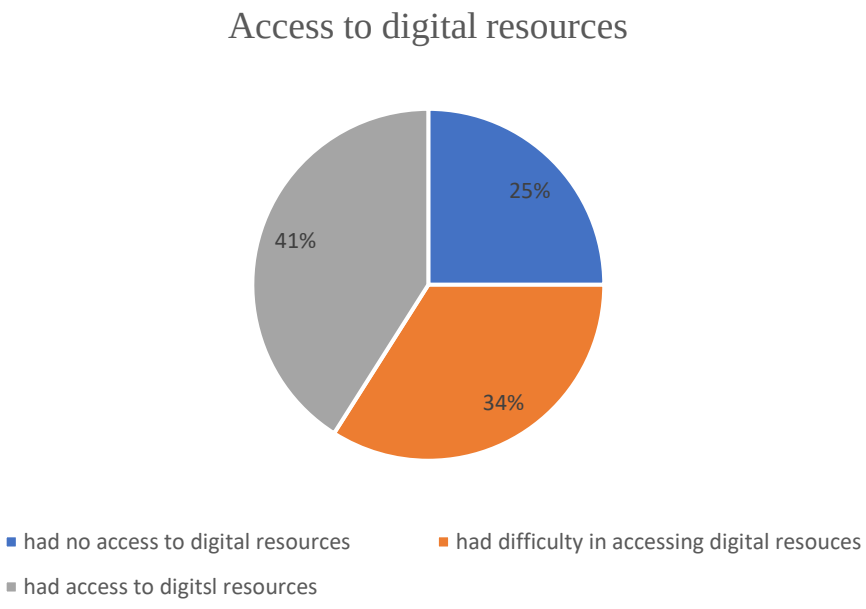

Figure 4: Access to digital resources

Based on the achieved results the researchers further wanted to know in depth about the problems and challenges with respect to access and infrastructure for ICT integration, for which interview was conducted randomly for the pre-service teachers who attended the survey and it was found that many schools, especially in rural areas lacked sufficient access to modern technology, such as limited availability of computers, projectors and other ICT devices. If present, these devices often had outdated hardware or software. Pre-service teachers also expressed their concerns regarding unreliable internet connectivity or slow internet speeds in the classrooms or computer labs and frequent power outages. Another major issue was the lack of infrastructural modifications in the classrooms, as most classrooms did not have the necessary facilities for implementing ICT based lessons within the classroom and the class had to be shifted to a separate computer lab, causing inconvenience.

Problems and challenges faced by pre-service teachers with respect to Pedagogical Challenges for ICT integration during internship.

The integration of ICT in schools presents various pedagogical challenges that impact the effective utilization of technology for educational purposes. One key challenge is the need for teachers to adapt their pedagogical approaches to incorporate technology seamlessly into the curriculum (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Teachers often face difficulties in aligning ICT tools with instructional objectives and integrating them cohesively into existing teaching methods (Mishra & Koehler, 2006). The pre-service teachers faced pedagogical challenges that included

1. Aligning ICT tools with specific learning objectives

53% of pre-service teachers were confident in aligning ICT tools with specific learning objectives, 27% were somewhat confident and 20% of pre-service teachers were not at all confident in aligning ICT tools with specific learning objectives for their classes during internship.

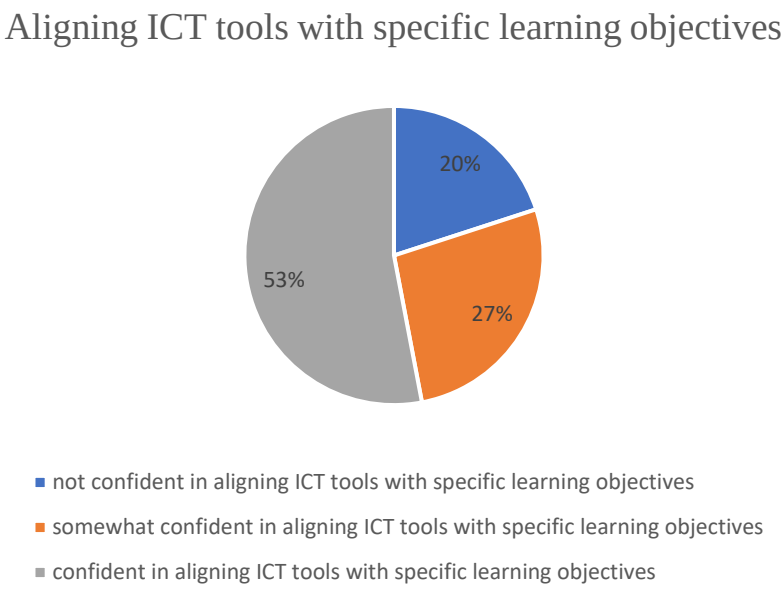

Figure 5: Aligning ICT tools with specific learning objectives

2. Designing engaging and effective ICT-based activities

Designing engaging and effective Information and Communication Technology (ICT)-based activities

for integration into school curricula presents several challenges. One primary difficulty lies in the need to align ICT activities with pedagogical goals while maintaining student interest and participation (Ertmer, 2005). Teachers often encounter challenges in crafting activities that not only leverage the capabilities of technology but also enhance the overall learning experience (Voogt, Fisser, Pareja Roblin, Tondeur, & van Braak, 2013).

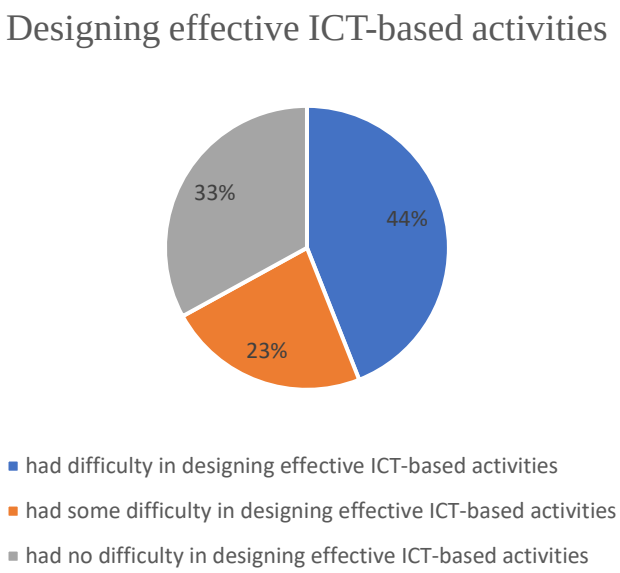

Figure 6: Designing effective ICT-based activities

3. Specific pedagogical approaches particularly effective for ICT integration in the classroom

From the study it was found that 30% of pre-service teachers never used specific pedagogical approaches for ICT integration in their internship schools, 43% of pre-service were able to use effective pedagogical approaches sometimes in their classrooms and only 27% were effectively able to use specific pedagogical approaches for ICT integration in their classrooms.

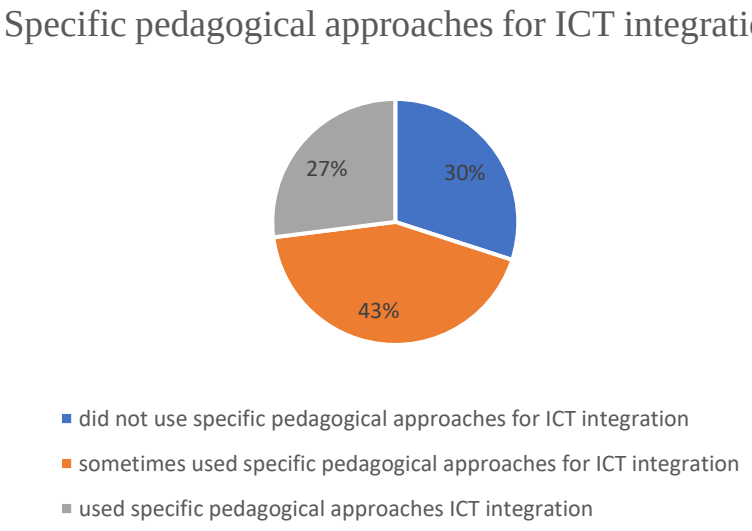

Figure 7: Specific pedagogical approaches for ICT integration

4. Modifying existing lesson plans to incorporate ICT integration during the internship

Only 24% of pre-service teachers were able to modify their existing lesson plans to incorporate ICT integration, whereas, 44% of pre-service teachers faced difficulties in modifying existing lesson plans and, 32% of pre-service teachers failed to modify the existing lesson plans into ICT integrated ones during their internship.

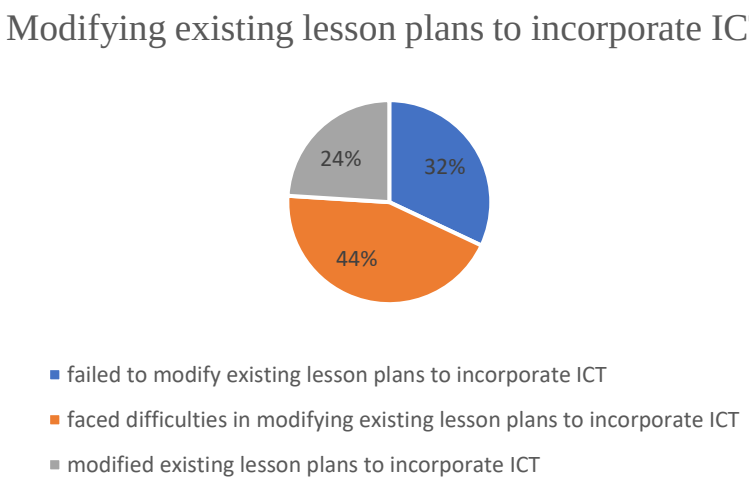

Figure 8: Modifying existing lesson plans to incorporate ICT

5. Support from cooperating teachers and institute supervisors.

Getting constant feedback regarding ICT integration is an important part of the internship process. From the study it was found that 34% of pre-service teachers never received feedback from the cooperative teachers regarding ICT integration during their internship, 36% pre-service teachers received feedback sometimes and, only 30% of pre-service teachers received constant support and feedback form their cooperative teachers during their internship. When it came to the institute supervisors, a whopping 48% of pre-service teachers received no support and feedback from the institute supervisors regarding ICT integration during their internship. 26% of pre-service teachers received the feedback sometimes and only 24% received constant support and feedback from their institute supervisors on ICT integration during their internship.

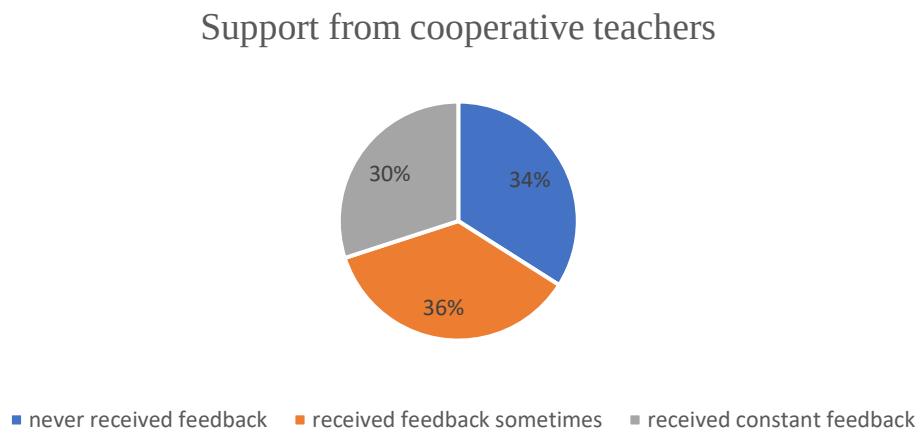

Figure 9: Support from cooperative teachers

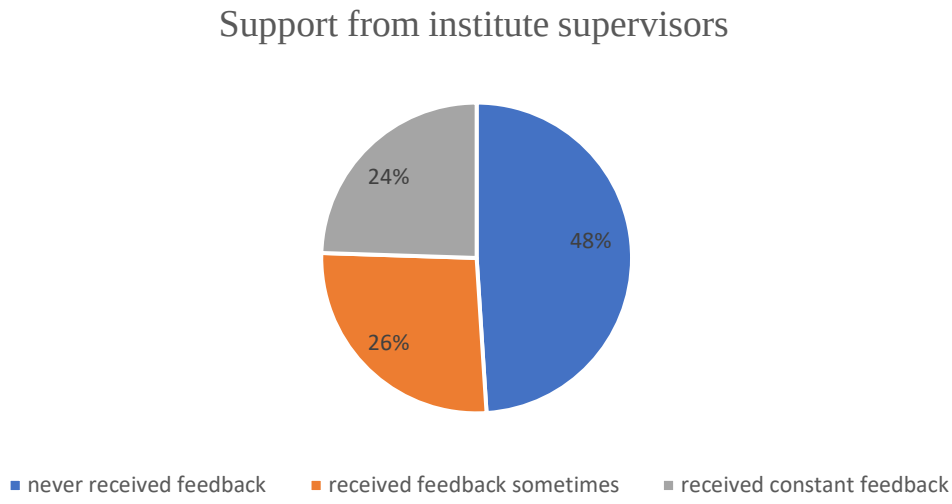

Figure 10: Support from institute supervisors

Based on the achieved results the researchers further wanted to know in depth about the pedagogical challenges in ICT integration for which interview was conducted randomly for the pre-service teachers who attended the survey and it was found that the pre-service teachers faced difficulties in implementing specific pedagogic approaches that were effective for ICT integration in the classrooms, hence hindering the effectiveness of the ICT tool itself. This often led to them incorporating ICT tools in their 5E lesson plans without modifying the lesson plan to truly integrate ICT. The major concern posed by the pre-service teachers was the lack of feedback from the cooperative teachers and institute supervisors, which, if given, could have helped the teachers to reflect on the effectiveness of the ICT tool and improve upon areas that needed improvement. Many of the pre-service teachers mentioned that the cooperative teachers did not have sound knowledge about ICT integration and because of that the doubts of pre-service teachers were not properly attended to during the internship.

I. Social and Emotional challenges faced by pre-service teachers with respect to ICT integration during internship.

Pre-service teachers encounter various social and emotional challenges when integrating Information and Communication Technology (ICT) into schools. The pressure to adapt to rapidly evolving technological landscapes and the expectation to seamlessly incorporate digital tools into teaching practices can lead to feelings of anxiety and self-doubt (Mishra & Koehler, 2006). The fear of technology failure or lack of proficiency may hinder pre-service teachers' confidence in utilizing ICT effectively (Selwyn, 2016). The social and emotional challenges faced by per-service in ICT integration during their internship include:

1. Student resistance or distraction when using technology in the classroom

27% of pre-service teachers encountered resistance or distraction when using technology in the classroom. 39% of pre-service teachers encountered resistance or distraction sometimes and 34% of pre-service teachers encountered no resistance or distraction when using technology in the classroom.

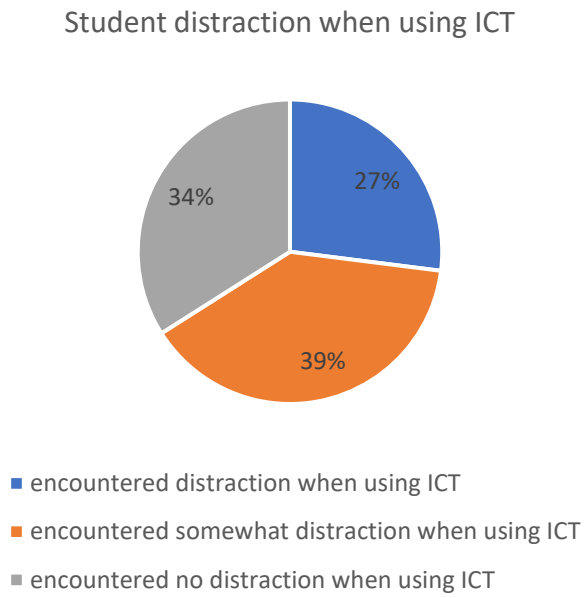

Figure 11: Student distraction when using ICT

2. Comfort while addressing student concerns or problems related to technology use in the classroom

59% of pre-service teachers were comfortable in addressing student concerns or problems related to technology use in the classroom, whereas, 33% were neither comfortable for uncomfortable and 8% of teachers were not comfortable addressing student concerns or problems related to technology use in the classroom.

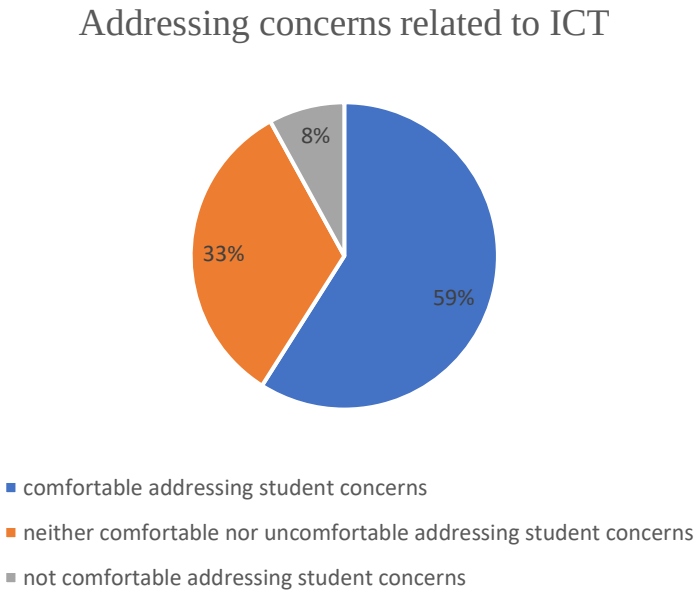

Figure 12: Addressing concerns related to ICT

3. Personal challenges (e.g., anxiety, discomfort) regarding using technology for teaching during internship

In the present study the researchers found that only 8% of pre-service faced personal challenges (e.g., anxiety, discomfort) regarding using technology for teaching during internship, where as 29% of pre-service teachers sometimes faced personal challenges and 63% of pre-service teachers rarely or never faced personal challenges (e.g., anxiety, discomfort) regarding using technology for teaching during internship.

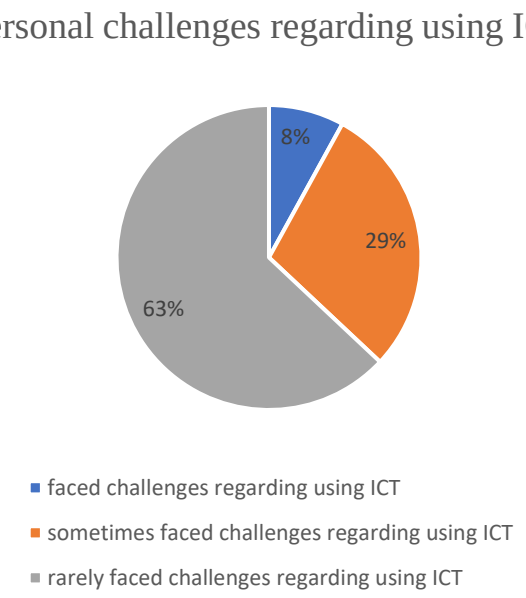

Figure 13: Personal challenges regarding using ICT

Personal challenges can be highly specific to individuals. So, in order to understand the different personal challenges pre-service teachers faced while integrating ICT in their school during internship, interviews were conducted where pre-service teachers were asked to explain their problems in detail and it was found there was some discomfort in using ICT in classrooms due to challenges such as distraction of students away from the content due to the use of ICT, difficulty in making and finding inclusive ICT tools by taking into account the cultural and ethnic diversity of the classroom while ensuring that the digital material was accessible to different type of learners and learners with different abilities.

Conclusion

In conclusion, the research aims to highlight the many challenges and problems in ICT integration faced by pre-service science teachers in India. From limited access to technology and inadequate training to infrastructure issues and resistance to change, these impediments collectively hinder the seamless integration of ICT into science education.

As India strives for educational innovation and technological advancements,, addressing these challenges becomes imperative. A holistic approach involving targeted teacher training programs, infrastructure development, and policy initiatives is crucial to empower pre-service science teachers in overcoming these obstacles. By actively working towards mitigating these challenges, the system can better prepare future science educators to utilise the potential of ICT and foster a more engaging and effective learning

environment.

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