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Bridging digital divides: Transforming inclusive education through technology to advance sustainable development goals

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Abstract

This qualitative study examines the lived experiences of secondary school teachers in integrating information and communication technology (ICT) in inclusive classrooms within public sector schools in Punjab, Pakistan. Grounded in a constructivist paradigm and employing a phenomenological approach, data were collected through semi-structured interviews with eight purposively selected participants. Thematic analysis, facilitated by NVivo, revealed both the transformative potential of ICT in fostering inclusive practices and significant challenges related to infrastructure, accessibility, and professional training. The findings highlight the necessity for systematic institutional support and advocate for incorporating targeted ICT training modules within teacher education programs. It addresses the challenges identified, such as resource limitations and power outages, and calls for practical solutions, including investments in infrastructure and ongoing support for teachers. It contributes to the broader discourse on inclusive education and aligns with Sustainable Development Goal 4 by promoting equitable and quality education for all.

Keywords: ICT integration, Inclusive education, Inclusive practices, Teacher education, Teacher training.

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1. Introduction

The integration of Information and Communication Technologies (ICT) in teacher education has transformed teachers' attitudes towards students with disabilities [1]. Twenty-first-century skills related to knowledge, life, and teaching have highlighted various educational functions, such as the economic function of preparing teachers for the future and the psychological role of improving teachers' self-realization and self-empowerment [2]. The use of ICT in educational settings has been identified as a critical factor in transforming the teaching and learning process, offering opportunities for innovation and inclusion [3]. In Punjab, Pakistan, incorporating ICT in teacher education is a technological upgrade and a vital step towards inclusive and effective teaching [4-6].

Educational technology, specifically in teacher training, plays a pivotal role in shaping the future of the education system [7, 8]. The use of ICT by teachers is viewed as a bridge to promote learning, regardless of learners' needs and limitations [9]. It is also evident from the literature that ICT promotes the development of a learning environment by introducing new teaching methods and strategies [10]. As highlighted in recent research, ICT not only facilitates the acquisition of digital competencies among teachers but also significantly enhances the learning experience for students [11, 12]. The importance of ICT in education has been further emphasized in the context of the COVID-19 pandemic, which has necessitated a shift to a more flexible and remote learning environment [13].

However, integrating ICT into teacher education presents challenges, especially in regions grappling with resource and infrastructural limitations [2]. Studies have pointed out that despite the potential benefits of ICT, its implementation is often hindered by factors such as a lack of training, inadequate infrastructure, and resistance to change [14, 15]. These barriers may lead to inappropriate learning for students. These challenges are particularly pronounced in developing countries, where educational institutions may require additional resources and support systems to leverage the advantages of ICT fully [16].

Furthermore, the role of ICT in promoting inclusive education (IE) has emerged as a key area of focus [17-19]. IE, defined as educating all students, including those with special educational needs (SEN), in a supportive and accommodating environment, is crucial for equitable access to education. IE is part of the UN's post-2015 agenda, notably Sustainable Development Goals (SDG 4 and SDG 5), which advocate the uniform implementation of IE worldwide [20]. ICT can be a powerful tool in facilitating IE by providing adaptable and personalized learning experiences that cater to diverse learning needs [18]. However, the effective use of ICT for IE requires not only technological resources but also a deep understanding of pedagogical approaches and the specific needs of students [21]. In Pakistan, exploring the integration of ICT in teacher education, particularly in Punjab, has become increasingly important. Understanding teachers' experiences, challenges, and perceptions in this context can provide valuable insights into how information and communication technology (ICT) can be more effectively integrated into educational practices to enhance teacher readiness and student learning outcomes. By exploring this topic, the study aims to contribute to the growing body of knowledge on educational technology in developing contexts and provide recommendations for improving the efficacy and inclusivity of ICT-based teaching and learning methods.

1.1. Research Questions

The research objective was to explore how ICT is utilized in training teachers for IE, especially for students with SEN. The following research questions guided the present research paper.

1. How does ICT contribute to the training of teachers for inclusive education?
2. How do teachers perceive the role of ICT in supporting students with special educational needs?

2. Literature Review

2.1. Integration of ICT in Education

ICT integration in education has garnered significant attention over the past few decades, Chen et al. [22] and Tabassum et al. [23]. Ngao et al. [24] argue that integrating ICT in education substantially sustains learning and teaching, even in the face of unexpected interruptions. Studies have shown that personal understanding at a deeper level is required to use ICT effectively [14, 25]. The use of ICT in education is not a recent pursuit. It can be traced back to the early days of television, when there were high hopes of revolutionizing the learning experience for students [26]. The education sector underwent a significant transformation due to the widespread influence of computers [27]. The widespread availability of inexpensive computers has made them accessible to most people, whether at home or at school [28]. Researchers have emphasized its potential to transform the teaching and learning process, making it more interactive, engaging, and tailored to individual needs. ICT in education is not just about including digital tools in teaching but also encompasses using these tools to enhance students' performance [29].

In developing countries, the integration of ICT in education presents opportunities and challenges [30, 31]. While ICT can provide access to vast resources and learning materials, infrastructural limitations and the digital divide often hinder its effective utilization [32]. ICT is fundamental in providing educational opportunities to people from remote geography [33]. Researchers also found an uneven spread of ICT access in diverse populations, with the changing role of networks [34]. Furthermore, it has also been found that a critical understanding of how ICT is implemented in different socio-economic and cultural contexts suggests that technology alone cannot solve deep-rooted educational challenges [35]. As a strategic tool, it can significantly contribute to students' development and effectiveness in the classroom [36].

2.2. Teacher Training and ICT

The role of teacher training is for teachers to utilize ICT to enhance students' learning effectively. Professional training is paramount to them [37]. In the future, the increasing use of ICT will pose a challenge to developing digital teaching skills [38, 39]. The training sessions for pre-service and in-service teachers should align with ICT's educational requirements and training syllabus [40]. In addition to professional development initiatives, teachers require adequate financial and technological resources, as well as technical assistance, to effectively employ ICT in the classroom [33, 41]. According to a study by Francom et al. [42], the most common challenge to integrating technology into education is the limited availability of ICT resources. However, recent research has shown that improving accessibility to technology does not automatically lead to increased or improved technology use [43]. Thus, teacher training is more important in this context.

Studies focusing on teacher education in ICT have identified several key factors related to infrastructure, management, teaching, and educational materials for students' success [44]. Additionally, factors such as teachers' teaching skills in tech classrooms and the social support provided are also paramount [45]. Teachers' beliefs and attitudes towards technology significantly influence ICT integration, which is also the area to focus on for the successful implementation of ICT in the classroom [46, 47]. Similarly, it was also found that the role of teachers' self-efficacy in technology is vital, suggesting that teachers who feel confident in their ability to use ICT are more likely to incorporate it effectively into their teaching [48].

2.3. ICT in Inclusive Education

The potential of ICT in fostering inclusive education has been increasingly recognized. ICT can provide unique opportunities for learners with SEN, offering customizable and adaptable learning experiences [17, 18]. ICT can help create more inclusive classrooms by providing different learning materials and accessible content. Thus, teaching with ICT tools in IE becomes more challenging if teachers are not adequately prepared to use pedagogical approaches [49]. Hence, we can understand that implementing ICT in IE is challenging [50]. The effective use of ICT for inclusion requires a thorough understanding of diverse learning needs and the pedagogical approaches that best address these needs [51]. Teacher training becomes pertinent in the technical use of ICT and its application to support diverse learners [25].

2.4. ICT Integration in Developing Countries

In the context of developing countries, integrating ICT in education presents specific challenges Cha et al. [30]. Afawubo and Noglo [16] argued that ICT could decrease the expenses associated with transportation costs, enhance the efficiency of organizational processes, and improve connections with teachers and students. However, in the literature, we found that challenges such as limited access to technology, unreliable infrastructure, and lack of teacher training often impede the effective use of ICT [45, 52]. It was also found that cultural factors and resistance to change can significantly impact the adoption of ICT in educational settings [53]. Despite these challenges, there are examples of successful ICT integration in developing countries [33]. It has been found that initiatives focusing on teacher training, infrastructure development, and contextualized ICT solutions can lead to positive outcomes [54].

2.5. ICT in the Pakistani Context

In Pakistan, the integration of ICT in education is an area of growing interest [55]. Pakistan faces significant challenges regarding resource allocation, teacher training, and infrastructure development for effective ICT integration [56]. However, according to Shair et al. [57], ICT has the potential to significantly improve educational outcomes and can play a crucial role in enhancing teaching quality and student learning experiences in any context, including Pakistan, a developing country [57]. There is a growing awareness of the importance of IE, and the use of ICT to support this goal is still in its nascent stages. They suggest that focused efforts on teacher training and infrastructure development are necessary to leverage ICT for IE effectively. Aligned with Pakistan's commitment to the United Nations Sustainable Development Goal 4 (SDG4), which emphasizes inclusive and equitable quality education and lifelong learning opportunities for all, recent educational policies have highlighted the role of ICT in achieving national educational objectives. Pakistan's National Education Policy recognizes the significance of ICT in promoting inclusive and quality education, particularly for marginalized and differently-abled learners. Therefore, integrating ICT to support IE is a pedagogical initiative and a strategic move to fulfill global and national commitments.

3. Methodology

3.1. Research Design

The researchers designed the present study to gain insights into how secondary school teachers perceive, interpret, and understand the role of ICT in their professional development to address diversity in the classroom. The focus was on understanding the lived experiences regarding the phenomenon of training and its implications afterward. In similar studies, Memiş et al. [58] and Ngao et al. [24] used a phenomenological research design to understand teachers' experiences, perceptions, and practices regarding the integration of ICT in teacher training. Thus, we also followed the phenomenological research design to understand the role of ICT in teacher training and accommodating students with SEN in IE.

3.2. Participants

The participants involved in the present study were secondary school teachers working with boys and girls in public secondary schools in the Kasur district of Punjab. There are 233 secondary and 16 higher secondary schools in the four

tehsils (administrative units) of Kasur (Kasur, Chunian, Patoki, Kot Radha Kishan), and 1,179 secondary school teachers are working in these boys' and girls' secondary and higher secondary schools [59]. In the present qualitative study, the researcher selected eight participants (four males and four females) using a purposive sampling technique. Bartholomew et al. [60] suggest that a sample size of 4 to 10 interview participants is reasonable for phenomenological research. Therefore, the sample of eight teachers is sufficient for the present qualitative inquiry. All the selected teachers had received training in ICT integration and accommodating students with SEN in mainstream schools and typical students. The demographic information of participants is provided below (Table 1).

Table 1.
Participants' Information.

Sr No	Names*	Gender	Qualification	Teaching experience
1	Imran Ali	Male	16 years	Ten years
2	Faisal Iqbal	Male	18 years	06 years
3	Bilal Hussain	Male	16 years	10 years
4	Asif Mehmood	Male	18 years	13 years
5	Ayesha Khan	Female	13 years	16 years
6	Maria Aslam	Female	18 years	10 years
7	Hina Batool	Female	18 years	08 years
8	Saba Qamar	Female	16 years	11 years

Note: *Pseudonyms.

Table 1 provides demographic information for the selected eight participants. None had less than 16 years of qualifications, while five held a Master's degree in Philosophy (M.Phil) in their relevant subjects. Their experiences ranged from 6 to 16 years.

3.3. Measure

We developed an in-depth, semi-structured interview protocol guide to collect data from the study participants. After developing the interview guide, we requested feedback from three experts (PhDs) on the interview questions. They provided input on the relevance of the questions to students' objectives and research questions, the language, and the appropriate understanding level of the questions for the study participants. Interview questions were modified and revised in light of feedback provided by the experts. The interview included sample questions, such as, 'Can you describe your experience using ICT tools in your teaching practice in the context of IE?' How do you integrate ICT in lesson planning and delivery to cater to diverse learning needs? Moreover, what future developments in ICT could further enhance its role in IE?

3.4. Data Collection

The first researcher conducted face-to-face interviews after obtaining informed consent from study participants. Following the interview guide, the researchers reached the participants' sites according to interview schedules. In-depth interviews with teachers were conducted in school settings. Moreover, considering cultural factors, the third author (female) interviewed female teachers. These interviews were recorded using the audio recording function present in Android mobile phones. The average length of the interviews was between 30 and 45 minutes.

3.5. Data Analysis

After recording the interviews, the third and fourth authors transcribed them manually within 48 hours. The first and second researchers validated the transcription by listening to the audio recordings again. The data were analyzed using thematic analysis, a widely used method for identifying, analyzing, and reporting patterns (themes) within qualitative data. Thematic analysis offers flexibility and accessibility, especially in exploring experiences and perspectives, and is particularly effective in educational and social research. We adopted Braun and Clarke's six-phase framework [61], which allows for a clear, rigorous, and transparent coding process, making it suitable for the depth and complexity of our data.

Unlike previous studies that often relied on pre-defined coding schemes or content analysis with narrower thematic scopes, our use of Braun and Clarke's reflexive thematic analysis allowed themes to emerge inductively from the data, ensuring that participants' voices guided the interpretation. This contrasts with more deductive or theory-driven thematic approaches, enhancing contextual sensitivity and depth in our findings.

In the first step, we familiarized ourselves with the data. In the second stage, initial codes were generated, and in the third stage, an attempt was made to search for relevant themes. In the fourth stage, themes were reviewed, then defined in the fifth stage, and in the last stage, we wrote these themes. The thematic data analysis scheme is provided in Table 2.

Table 2.
Coding Scheme.

Theme	Sub-themes	Description	Codes	Quotes
Integration of ICT in teacher education for IE	ICT experiences and perceptions	The present sub-theme details participants' experiences and perceptions regarding ICT integration in their teacher training.	User engagement, Digital literacy, Technology adoption.	ICT is indispensable in modern education.....
	ICT tool effectiveness	This sub-theme discusses participants' perceptions regarding the effectiveness of the ICT tool.	Usability testing. Tool reliability.	M-learning has fostered a collaborative spirit among students.
	ICT challenges and solutions	Here, we discussed the ICT challenges and their solutions in IE.	Technical barriers, Infrastructure issues,	The main challenge is the need for more resources and training.
	ICT training needs	Participants' views on the ICT training needs are incorporated into the current sub-theme.	Skill development, Capacity building.	More practical, hands-on training sessions are needed.
	ICT's impact on inclusion	Here, participants discussed the impact of ICT on IE.	Digital divide, Inclusive design.	ICT integration has had a positive effect on.....
	Future ICT prospects	In the last sub-theme, data were interpreted for future ICT prospects.	Emerging technologies, Sustainable development.	Future advancements in machine learning could significantly enhance learning.

3.6. Research Ethics

The current study was conducted in natural settings, and the interviews were carried out at participants' sites. Therefore, no potential harm was involved. Considering the religious and cultural aspects, female participants were interviewed by the female researcher. To ensure the confidentiality and anonymity of respondents, interviews were recorded using the audio function only, and pseudonyms were used to protect their identities in interpreting the results presented in this publication. Before collecting data, informed consent was obtained from participants. Their participation was voluntary, and they were also given the right to withdraw from the study at any time. The research ethics committee of the School Education Department of Punjab approved the research.

4. Results

This qualitative inquiry was conducted in the Kasur district of Punjab, Pakistan, to investigate the role of ICT in teacher education for IE. We interviewed eight secondary school teachers, and after transcribing the data, it was analyzed following the six-stage thematic data analysis guide by Braun and Clarke [61]. We used NVivo software to visualize the data. The results are categorized into themes and sub-themes, enriched with participant quotes supplemented by the authors' insights. The details of the themes and sub-themes are shown in Figure 1.

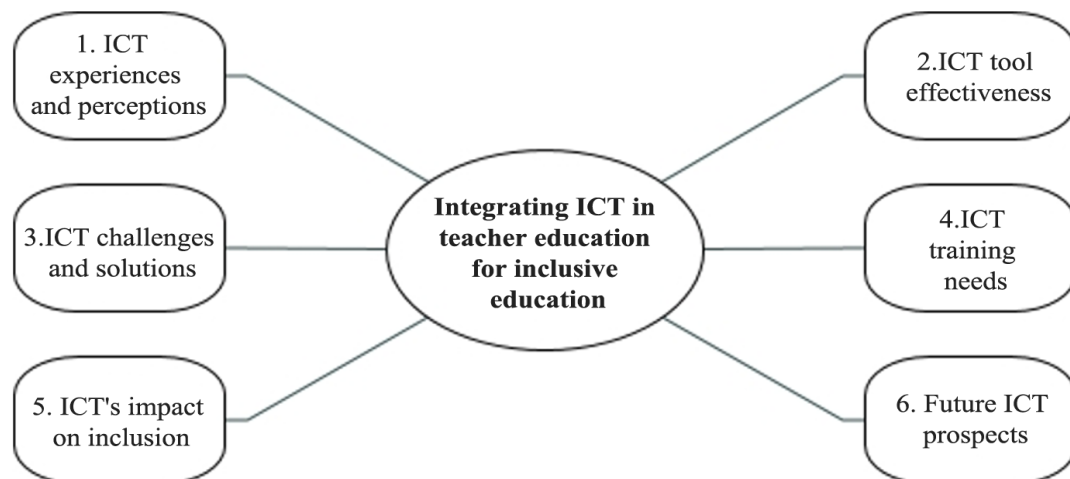
**Figure 1.**
Mind Map for Theme and Sub-themes.

Figure 1 shows that the data were analyzed and categorized under one central theme and six sub-themes. The data is interpreted under the heading of relevant themes and sub-themes.

4.1. Integration of ICT in Teacher Education for IE

The central theme that emerged from the data analysis is the integration of ICT in teacher education within the context of IE. It has six further sub-themes, which are presented below.

4.2. ICT Experiences and Perceptions

The present sub-theme encompasses the diverse range of responses from participants regarding their ICT experiences and perceptions. Teachers conveyed varied experiences with ICT, unified by a perception of its transformative role in education. In response to the question, Ayesha Kahn argued,

"Using ICT in my classroom has been transformative, making lessons more interactive and accessible."

Like Saba Qamar and Maria Aslam, Ayesha Khan believed that ICT is crucial for transformation and interaction in the classroom. In support of the above argument, Faisal Iqbal also mentioned that.

"ICT is indispensable in modern education, ensuring that education is accessible to every student, regardless of their abilities."

None of the participants denied the emerging role of ICT in modern education, but one teacher found it very challenging. Bilal Hussain said,

"Initially, it was challenging, but ICT tools like screen readers are invaluable for students with impairments."

The responses of the above participants recognize the importance of ICT in modernizing and diversifying teaching methods, although experiences vary based on individual and infrastructural factors. Although ICT tools such as screen readers did not fully meet the requirements of students with SEN, all teachers still had positive experiences and perceptions of the role of ICT in education.

4.3. ICT Tool Effectiveness

The authors were very keen to identify the effectiveness of ICT tools. The participants were very sure of the tools' effectiveness. While answering a question, Saba Qamar responded,

"Online forums and Google Classroom have fostered a collaborative spirit among students."

Saba Qamar's response aligns with what other participants, such as Imran Ali and Asif Mehmood, said. Most respondents viewed ICT tools as very effective in creating an interactive classroom environment in IE. While supporting the above arguments, Maria Aslam also commented.

"The use of interactive whiteboards and educational websites like Sabaq.pk has been very effective in my classroom."

These responses highlight teachers' resourcefulness in employing various ICT tools. The researcher notes a growing competence in using technology to address diverse learning needs in IE. It was evident that all participants accepted the role and effectiveness of ICT tools in modern education, especially in IE.

4.4. ICT Challenges and Solutions

The researcher presented participants' narratives regarding the ICT challenges and solutions in the current sub-theme. In response to one question, Asif Mehmood said,

"The main challenge is the lack of resources and training."

The above response supported the responses of Saba Qamar and Hina Batool, who also mentioned that significant challenges are related to the lack of resources and training. Saba Qamar and Hina Batool believed these challenges could be managed by providing sufficient resources and training to pre-service teachers. By overcoming these challenges, teachers can be better equipped with the resources to cater to the diverse learning needs of students in IE. In support of the above arguments, Hina Batool further commented,

"Integrating ICT was a learning curve, but it made my teaching more effective."

She commented that it was challenging to integrate the ICT tools in IE, but it polished her abilities and made her more skilled and effective. Besides the challenges, Bilal Hussain mentioned the barrier of power shutdown by saying,

"Frequent power outages are a problem. I use battery-powered devices to overcome this."

Highlighting the factors contributing to the country's power shutdown and energy crisis, Bilal Hussain presented a solution involving the use of battery-assisted classroom tools. This might help them to work without any problems.

These challenges highlight a disconnect between ICT's potential and its implementation. The researchers need systematic support, including infrastructure and professional training. Pakistan is a country with limited resources. Therefore, appropriate use, adequate awareness, and training of these resources have become increasingly important.

4.5. ICT Training Needs

Under the heading of ICT training needs, we presented participants' views and experiences regarding their perceptions of training challenges and further development in using ICT tools to manage diversity in the classroom. While replying to a question, Maria Aslam mentioned,

"Continuous and updated training on the latest ICT tools is essential."

Education and ICT are evolving and dynamic. Hence, the participants recognize the need for continuous professional development and training. The responses of Imran Ali, Faisal Iqbal, and Bilal Hussain were also aligned with Maria Aslam's. Hina Batool further argued,

"More practical, hands-on training sessions are needed."

We found that all study participants believed that updating knowledge and hands-on practices with the effective use of ICT tools are very important for managing diversity in the classroom. Considering the importance of training, Ayesha Khan argued,

"Ongoing training, particularly on new ICT tools, would be extremely beneficial."

The present sub-theme aligns with the broader educational focus on teacher preparedness. Participants emphasized the importance of regular and relevant professional development for successful ICT adaptation in managing diversity in IE.

4.6. ICT's Impact on Inclusion

The current sub-theme highlights participants' perspectives on the impact of ICT tools on the special educational needs (SEN) of students in IE. In response to a question, Hina Batool responded.

"ICT motivates and includes Students with special needs. It can make them feel more involved and respected."

Hina Batool believed that students with SEN feel more involved, participatory, and motivated, which might help them achieve satisfaction. Considering the diversity, Ayesha Khan further elaborated by saying,

"There is a noticeable improvement in engagement among these students."

She was happy that integrating ICT has improved students' class participation. Maria Aslam also participated by saying,

"ICT integration has positively impacted learning outcomes for special needs students."

Maria Aslam's response above was aligned with those of Imran Ali, Bilal Hussain, Saba Qamar, and Faisal Iqbal, who stated that ICT positively impacted students with SEN. These findings highlight the role of ICT in democratizing education. The researcher notes its potential to bridge educational gaps and foster an inclusive learning environment.

4.7. Future ICT Prospects

According to study participants, the present sub-theme provides information that fosters optimism about future ICT development that will be prevalent. While responding to a question, Faisal Iqbal argued,

"I am very excited about artificial intelligence (AI) and virtual reality (VR): these could lead to personalized learning experiences."

Like Maria Aslam, Faisal Iqbal was also very optimistic about the future of ICT. They believed that more ICT tools should be integrated in the future to better accommodate diversity in classrooms. Emphasizing the importance of extended ICT tools, Ayesha Kahn commented,

"Looking forward to augmented reality (AR), which could make learning more tangible for all students. Future advancement in machine learning could significantly enhance learning."

These responses indicate that all participants are highly confident about the future of ICT integration in education. This forward-looking perspective aligns with educational trends toward more personalized and technologically advanced experiences. The researchers view this optimism as reflective of a broader trend in educational technology. The researcher also analyzed data to explore keywords, highlighting the importance of participants' comments. The word cloud is presented in Figure 2.

Our study found that integrating ICT positively impacted students with SEN, increasing their motivation, engagement, and learning outcomes. This aligns with previous studies emphasizing the potential of ICT to create an inclusive environment [17, 62]. It highlights ICT's role in democratizing education and bridging educational gaps in IE.

Looking ahead, participants in our study expressed excitement about the future of ICT developments, particularly AI, VR, and AR. They believed these advancements could lead to more personalized and immersive learning experiences, aligning with the trend of technologically advanced education. This optimism about the future aligns with broader trends in educational technology [38].

6. Conclusion

The two research questions guided the present study. The first one was related to how ICT contributes to the training of teachers for IE, and the findings of our study illuminated the significant contribution of ICT to teacher education. Our research underscored that ICT is a tool and a transformative force, enhancing teaching and learning experiences. Teachers acknowledged that ICT tools fostered collaboration, interactive teaching methods, and personalized learning experiences, aligning with the broader goals of IE. This reinforces the idea that ICT catalyzes effective teacher training in the context of IE. The second research question was designed to explore how teachers perceive the role of ICT in supporting students with special educational needs (SEN). Our study revealed that teachers overwhelmingly recognized the positive impact of ICT on students with SEN. Their perceptions indicated that ICT tools facilitated increased engagement, motivation, and improved learning outcomes among these students. These findings affirm the pivotal role of ICT in creating an inclusive learning environment and align with the broader educational discourse on leveraging technology to support diverse learners in IE. This research contributes to the ongoing dialogue surrounding ICT integration in education and underscores its relevance in addressing the diverse needs of students in inclusive settings.

6.1. Limitations

Although the present study provides valuable insights into integrating ICT in teacher education for IE, it has several key limitations. The first limitation was that the research was conducted in a specific context, focusing on teachers in Pakistan. This regional focus may limit the generalizability of the findings to other educational contexts with varying resources and infrastructures. Secondly, the study relied on self-reported teacher data, which can introduce potential biases and social desirability effects. Future research could consider incorporating additional data sources or observational methods to complement self-reported insights. Thirdly, the study's sample size, although providing rich qualitative data, was relatively small. A larger and more diverse sample could yield further insights and nuances regarding ICT integration in teacher training for IE. Lastly, the research was conducted at a specific time despite these limitations. This study offers a valuable contribution to the field of ICT in teacher education for IE, encouraging further research and exploration of this critical area.

6.2. Implications

The present study has several implications mentioned under the relevant heading.

6.2.1. Practical Implications

The findings of this study have several practical implications for teachers, policymakers, and teacher training institutions. First and foremost, the recognition of ICT as a transformative tool in teacher education underscores the importance of integrating technology-related training into teacher preparation programs. Teacher training institutions should prioritize including ICT skills development as a core component of teacher education to ensure that teachers are well-prepared to meet the demands of modern classrooms, especially those striving for inclusive education (IE). Additionally, it addresses the challenges identified, such as resource limitations and power outages, and calls for practical solutions, including investments in infrastructure and ongoing support for teachers. Moreover, the positive impact of ICT on students with special educational needs (SEN) highlights the need for specialized training programs that equip teachers with the skills and knowledge to effectively support diverse learners in IE.

6.2.2. Social Implications

The social implications of this research are significant, especially within the context of inclusive education (IE). The study reaffirms the role of information and communication technology (ICT) as a powerful enabler of equitable educational opportunities. By promoting inclusive practices through ICT integration, educators can foster a learning environment that values diversity and addresses the individual needs of all students, including those with special educational needs (SEN). This approach enhances students' educational experiences and supports the development of a more inclusive society by breaking down barriers and challenging stereotypes. Additionally, the study highlights the importance of ongoing teacher training and professional development, which can lead to a more competent and confident teaching workforce capable of delivering quality education to all, thereby advancing social equity.

6.2.3. Research Implications

The present study also provides a foundation for future research into ICT integration in teacher education for IE. The study's focus on the Pakistani context highlights the need for cross-cultural studies that examine how ICT can be effectively leveraged in diverse educational settings worldwide. Researchers can build upon the findings of this study to conduct

larger-scale studies and quantitative investigations that provide a broader perspective on the impact of ICT on teacher training and inclusive practices. Additionally, the study highlights the potential of emerging technologies such as AI and VR in education. Future research can delve deeper into the specific applications of these technologies and their effectiveness in promoting IE. Overall, this study encourages continued exploration of ICT's role in shaping the future of teacher education and its impact on fostering an inclusive educational environment.

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