Exploring Special Education Teachers' Perception, Readiness, and Practices for ICT Integration in Classrooms for Students with Hearing Impairment

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Abstract

This article delves into the captivating world of Information and Communication Technology (ICT) integration and its potential to revolutionize the teaching and learning process for students with hearing impairment in Punjab, Pakistan. The current study was conducted to explore the current situation of ICT integration in the teaching-learning process of students with hearing impairment. Employing an innovative and comprehensive approach, this research adopted mixed methods to uncover the current state of ICT integration in the teaching-learning process of students with hearing impairment. Through questionnaires and semi-structured interviews, researchers embarked on a journey to understand the perspectives of male and female special education teachers specializing in hearing impairment across Punjab's diverse regions. The sample of the study was carefully selected from secondary schools of special education, comprised of 200 special education teachers, complemented by the invaluable insights from 10 interviewees. The findings of the research highlighted that ICT integration in education for students with hearing impairment is not up to the mark because special education teachers have almost never used ICT (software and hardware) for teaching students with hearing impairment due to the unavailability of ICT-based teaching resources.

Keywords: ICT, Students with Hearing Impairment, Teaching-learning Process.

Introduction

The integration of Information and Communication Technology (ICT) offers the potential to address the challenges and provide new learning opportunities for students with hearing impairment. It is evident that unique challenges faced by students with hearing impairment, particularly in communication and language, directly impact their literacy skills (Wesimer et al., 2021). However, ICT can be leveraged to overcome these challenges and improve educational outcomes for these students. Studies have shown that technology-based interventions and skillful utilization of ICT tools can enhance the learning experiences of students with hearing impairment (Ismaili & Ibrahimi, 2017; Beal-Alvarez & Cannon, 2014).

The integration of ICT tools and teachers' competence in digital technologies in the education of students with hearing impairment brings numerous benefits. It enables effective communication through digital platforms, facilitating real-time interaction and fostering inclusive classroom environments. ICT tools such as captioning and sign language interpretation software assist in

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delivering content in accessible formats, ensuring equal access to information (Al-Sarayrah & Shamaileh, 2022). Interactive multimedia applications and virtual reality simulations provide immersive learning experiences, enhancing engagement and knowledge retention (Tabassum & Ullah, 2021). Moreover, ICT facilitates collaboration among students and teachers, encouraging peer learning and support (Kramarenko et al., 2021). Limited access to appropriate technology, including hearing aids and assistive listening devices, can hinder the seamless incorporation of ICT tools (Florian & Hegarty, 2004). Ensuring that ICT tools and platforms comply with accessibility standards is crucial for accommodating diverse learning needs (Kurt, 2018).

Various ICT tools and strategies show promise in supporting students with hearing impairment (Debevc & Vogler, 2020). Augmented Reality (AR) applications can provide visual and interactive content to complement classroom instruction. Speech-to-text transcription services and voice recognition technologies enable real-time transcription, facilitating communication and note-taking. Online learning platforms and mobile applications offer flexibility in accessing educational resources and collaborative opportunities. Social media platforms and online communities provide avenues for peer support, resource sharing, and networking. Additionally, the lack of trained educators in utilizing ICT for students with hearing impairment poses a significant obstacle (Garzon, 2021).

The current state of ICT integration in the teaching-learning process for students with hearing impairment presents both opportunities and areas for improvement. Continued research and development are necessary to harness the full potential of ICT. Efforts should focus on enhancing accessibility features, creating specialized software and applications, and providing professional development programs for educators. Collaboration among educators, researchers, technology developers, and organizations supporting the hearing-impaired community can drive innovation and address the specific needs of students with hearing impairment. The integration of ICT holds promise in enhancing education for students with hearing impairment by leveraging ICT tools and strategies, educators can address communication and language barriers.

Through an examination of the viewpoints, preparedness, and existing practices employed by special education educators in the incorporation of Information and Communication Technology (ICT), this study makes valuable contributions to the academic domain in various aspects. First and foremost, the promotion of inclusive education is a key objective, with information and communication technology (ICT) playing a crucial role in providing equal learning opportunities for students who have hearing impairments. Additionally, the results of the study have the potential to provide valuable insights for the development of educational policies and strategies aimed at enhancing the overall quality of special education throughout the nation. Through an examination of instructors' instructional methods, this study highlights potential avenues for innovative use of information and communication technology (ICT) to enhance educational outcomes. Finally, through the evaluation of teachers' preparedness to integrate information and communication technology (ICT), this research contributes to the customization of focused professional development initiatives. These initiatives aim to equip educators with the necessary competencies and tools to improve the educational journey of students with hearing impairments. This study presents a thorough examination of the present condition of special education, aiming to establish a basis for evidence-based suggestions that promote inclusive and efficient education for this specific group of students.

Literature Review

The integration of Information and Communication Technology (ICT) has become vital in the field of education, with a growing demand for its use in teaching and learning processes in this digital era (Liu et al., 2020). However, research conducted on the integration of ICT in learning in Pakistan reveals that the country's education system still lags in effectively incorporating ICT. Numerous barriers hinder the adoption of ICT at the school level, including limited financial resources, inadequate English language proficiency, lack of infrastructure, poor internet connectivity, outdated curriculum, and teachers' lack of awareness and proficiency in utilizing ICT for teaching and learning purposes (Ismail et al., 2020). In the context of special education in Pakistan, it is evident that ICT is not given priority in the special education curriculum and teacher education programs. Furthermore, stakeholders involved in special education have not fully leveraged the benefits of ICT for teaching students with special needs. Therefore, it is imperative in the current era to raise awareness among educators and other stakeholders about the potential advantages of ICT for students with special needs (Farooq, 2012).

The National Policy for Persons with Disabilities (2002) emphasizes the use of computers for the education and training of individuals with disabilities. Additionally, the National Action Plan of 2006 was developed to implement the goals outlined in the National Policy for Persons with Disabilities. Action 8 of the plan aims to promote "access to information and communication and assistive technology among persons with disabilities". However, there appears to be a significant gap between policy objectives and their actual implementation. In the context of special education in Pakistan, comprehensive data and research are lacking in identifying the specific ICT needs for teaching students with hearing impairment. To bridge this gap, it is essential to collect baseline data by identifying the specific areas of the teaching-learning process that can benefit from the integration of Information Communication Technology (ICT) for students with hearing impairment.

The integration of ICT in the teaching-learning process has become crucial in the education system. However, the education system in Pakistan faces various barriers to effectively incorporating ICT, particularly in special education. It is necessary to gather comprehensive data and conduct research to identify the areas where ICT integration can enhance the teaching-learning process. Ultimately, this study holds the potential to empower teachers in overcoming the barriers to learning encountered by students with hearing impairment in educational settings. By employing ICT in the teaching and learning process (TLP), educators will be equipped with innovative tools to mitigate these challenges and create inclusive classroom environments conducive to the academic progress of students with hearing impairment.

Theoretical Foundations

The research is based on a theoretical framework that integrates the Technology Acceptance Model (TAM) and the Diffusion of Innovations theory. This conceptual framework facilitates the comprehension of the potential interconnections among variables within our investigation. The interrelationship between special education teachers' perspectives on information and communication technology (ICT), their existing use of technology in instructional practices, and their preparedness to adopt ICT are interdependent variables. Positive impressions have the potential to result in heightened adoption of information and communication technology (ICT). Furthermore, the implementation of efficient ICT practices can improve educational achievements among students who have hearing impairments. Furthermore, the preparedness of educators, which includes proficiency in technology, professional development, and access to necessary resources,

significantly influences their capacity to integrate information and communication technology (ICT) in a meaningful manner. Through a comprehensive analysis of these associations, our research attempts to elucidate the intricacies of ICT integration and offer valuable perspectives for enhancing the educational encounters of students with hearing impairment within specialized educational environments.

Methodology

This research employed an explanatory sequential mixed-methods approach to comprehensively investigate the current state of ICT integration in the teaching and learning process of students with hearing impairment. The study first collected quantitative data through questionnaires followed by qualitative data gathered through interviews. The population of this study comprised both male and female special education teachers specializing in the field of hearing impairment in the Punjab region, Pakistan. Data were collected from 9 divisions in Punjab, Pakistan using multistage random sampling, administering a questionnaire as the primary instrument. The questionnaire facilitated the collection of quantitative data, while semi-structured interviews were conducted to gather in-depth qualitative insights. The sample size consisted of 200 special education teachers, selected through a purposive sampling technique. The participants were selected from secondary schools of special education in Punjab, Pakistan. Additionally, a total of 10 interviewees actively participated in this study. The participants in the study comprised both male (13.5%) and female (86.5%) special education teachers. Among the respondents, 29.0% had 1 to 5 years of teaching experience, 41.5% had 6 to 10 years of experience, 20.5% had 11 to 15 years of experience, 5% had 16 to 20 years of experience, and 4% possessed more than 20 years of experience. Furthermore, 70% of the respondents held a Master's degree, 29% held an M. Phil degree, and only 1% possessed a Ph.D. The data obtained from the questionnaires were analyzed using the Statistical Package for the Social Sciences (SPSS) software, employing appropriate statistical techniques i.e., frequency, mean and standard deviation. The qualitative data gathered from interviews were analyzed using NVivo, qualitative data analysis software, to identify key themes, patterns, and insights.

Findings

Table 1: Perception about using ICT

Items	SA	Agree	UD	Disagree	SD	Mean	SD
Importance of ICT for HI	71.5	28.0	-	-	0.5	4.71	0.489
ICT for teaching HI	59.5	40.5	-	-	-	4.60	0.492
Effects of ICT at School	52.5	40.5	5.5	1.0	0.5	4.44	0.691
Teaching HI students online	20.0	26.5	30.5	22.0	1.0	3.43	1.072
ICT as part of the curriculum	15.0	38.0	9.5	19.5	18.0	3.13	1.374

Note*: SA - Strongly Agree, A - Agree, UD - Undecided, D - Disagree, SD - Strongly Disagree, Mean - Mean score, SD - Standard Deviation*

The survey result shows the perception of teachers for using ICT for students with hearing impairment. It reveals that special education teachers have good perceptions or positive opinions about using ICT for students with hearing impairment with the highest mean (Mean=4.71, SD=0.489). Teachers also believe that ICT should be used to teach students with hearing impairment (Mean=4.60, SD=0.492). Above average means of this table reveal that teachers have a positive perception about integrating ICT in the teaching and learning process of students with hearing impairment.

Table 2: Access and uses of ICT-based instructional resources

Items	Always	Often	Sometimes	Seldom	Never	Mean	SD
Electricity availability	21.5	47.0	10.5	11.5	9.5	3.60	1.216
A printer provided in the classroom	1.0	3.0	1.5	8.0	86.5	1.24	0.718
Overhead projector availability	6.5	5.5	8.5	6.0	73.5	1.66	1.230
Computer access availability	6.5	5.5	7.5	6.0	74.5	1.64	1.224
Computer with Internet access at home	62.0	24.0	2.5	8.0	3.5	4.33	1.085

The survey results indicate that the availability of electricity during all school hours is reported to be consistent, with 21.5% of respondents stating it is always available. Printer availability in the classroom is limited, as only 1.0% reported always having a printer, while the majority (86.5%) reported never having one. Overhead projectors are available to varying degrees, with 6.5% reporting always, 5.5% often, and 73.5% never having access to them. Similarly, computer access at school is limited, with the majority (74.5%) reporting never having access. In contrast, respondents reported having a computer with an internet connection at home, particularly 62.0% who reported always having access. Mobile access during school time was reported by 19.5% as always available, 33.5% as often available, and 12.0% as sometimes available. The mean satisfaction rating for computer access at home is relatively high (4.33), while the mean satisfaction ratings for other aspects range from 1.24 to 3.60.

Table 3: Uses of ICT in lessons (software or hardware)

Activities	In all lessons	In most lessons	In some lessons	Almost never	Mean	SD
Word Processors (Word etc.)	4.5	9.0	14.0	72.5	1.46	.838
Spreadsheets (Excel etc.)	3.5	4.0	16.5	76.0	1.35	.721
Presentation Software (PowerPoint etc.)	2.5	5.0	16.5	76.0	1.34	.690
Databases (Access etc.)	1.5	6.0	13.0	79.5	1.30	.648
Computer Aided instruction software	1.5	6.0	13.0	79.5	1.36	.716
Web browsers	4.5	14.0	15.0	66.5	1.57	.894
Instructional films (video, CD)	12.0	16.0	15.0	57.0	1.83	1.090
Writing software	3.0	9.5	19.5	68.0	1.48	.789
Captioning and signing	10.0	24.5	16.0	49.5	1.95	1.069
Text to speech	7.5	14.0	14.0	64.5	1.65	.982
You use an Excel sheet for evaluation...	11.0	12.0	19.5	56.5	2.06	1.409
Students use video conferences	5.5	11.0	12.0	71.5	1.51	.897

Internet/Web environment	19.0	9.0	16.0	56.0	1.91	1.187
Television/ Video	6.5	15.5	12.0	66.0	1.63	.969
Video Camera	3.0	11.5	17.0	68.5	1.49	.814

According to this table majority of special education teachers have almost never used ICT in the form of software i.e., use of word processors(mean=1.46), word sheets (mean=1.35), presentation software (mean=1.34), Databases (mean =1.30), computer-aided instructional software (mean =1.36) web browsers (mean=1.57), electronic mail (mean=1.28), instructional films (mean=1.83), writing software (mean=1.48), captioning and signing (mean=1.95) and text to speech (mean=1.365) results also showed that SETs have never used video-conference for education purpose (mean= 1.51).

This table shows that the majority of special education teachers don't use ICT in the form of hardware i.e., use of overhead projectors (mean=1.23) cameras (mean=1.29), computer-projector systems (mean=1.66), television (mean=1.63), FM system (mean=1.19). Teachers only use printed material (mean=2.32) to teach students with hearing impairment.

Qualitative Responses

Figure 1: World cloud of teacher's interviews

Based on interviews conducted, special education teachers widely acknowledge the significance of ICT in the teaching and learning process of SWHI. They consider ICT to be an essential requirement due to its emphasis on visual learning and its ability to aid in comprehending complex concepts that cannot be easily conveyed through sign language.

Special education teachers utilize various types of audio-visual resources for teaching SWHI. However, despite their importance, these resources are not effectively employed. The lack of access to instructional resources or audio-visual aids is a common challenge reported by teachers of the hearing impaired. While flashcards and sign language videos are used to some extent, creating comprehensive flashcards for the entire syllabus is deemed impractical. Teachers primarily rely on written content, drawings, and limited pictorial materials. Occasionally, personal laptops or mobile devices are used to display relevant online content but, in many schools, teachers are not allowed to use these gadgets in classrooms.

In SWHI classrooms, ICT is used sporadically through personal mobile devices to explain concepts to students. However, it is not a regular practice. The availability of resources such as laptops and multimedia equipment in classrooms is limited. Some teachers face restrictions on mobile device usage, while others have permission to use them. Computer labs are available in secondary schools, but their functionality varies. Teachers often rely on their mobile internet for ICT usage since schools do not cover the cost of ICT or other educational resources.

Special education teachers have various demands for ICT resources to teach SWHI effectively. They require multimedia projectors, computers with internet access, FM systems, captioned videos, sign language apps, speech and language software, e-books, LCDs with internet connection, tablets, and printers. These resources are seen as essential for integrating ICT into the teaching and learning process. Teachers emphasize the need for multimedia projectors for larger screen displays, captioned videos and sign language apps for visual instruction, and access to ICT-based resource rooms for all teachers. They also advocate for providing SWHI with tablets and ensuring frequent access to computer labs.

Unfortunately, special education teachers report that they are not provided with any ICT-based resources for their classrooms. They express dissatisfaction with the lack of audio-visual aids, instructional materials, and budget for printing worksheets. While some teachers actively demand ICT resources to enhance the teaching and learning experience for HI students, others have given up on making such requests due to unresponsiveness from relevant authorities. Teachers also revealed that deaf students have good IT skills to use different applications and software.

The use of Information and Communication Technology (ICT) by teachers of students with hearing impairment was explored in interviews, leading to several key themes. It explained that teachers use basic ICT i.e., personal mobiles and laptops intermittently for teaching students with hearing impairment.

The second theme focused on the objectives of integrating ICT in classrooms for students with hearing impairment. It emphasized enhancing learning outcomes and making learning more tangible through visual aids and interactive activities on tablets and laptops. ICT was found to promote independence, remove communication barriers, and improve socialization skills. Additionally, integrating ICT in the classroom helps students develop essential ICT literacy and skills for future employment, as employers increasingly seek candidates with such competencies. ICT also contributes to improving academic achievement, broadening students' perspectives, and expanding their knowledge of the world.

The third theme centered on recommendations for policymakers and authorities in special education departments. Providing access to ICT devices and applications to teachers and students was highlighted as a priority, requiring funding for schools and grants for families. Ensuring adequate training and support for teachers and students was also emphasized. Recognizing ICT as a basic necessity for students with hearing impairment, policymakers should integrate ICT into the classroom environment. This includes providing infrastructure, resources, and ongoing support to create a conducive environment for ICT integration in classrooms.

Discussions

The integration of qualitative and quantitative data in this study offers a comprehensive understanding of the availability, use, and requirements of ICT resources in special education classrooms for students with hearing impairment. By examining the survey results alongside insights from qualitative interviews, a more nuanced discussion can be presented, considering the similarities, differences, and implications for improving the integration of ICT in special education settings.

Consistent with previous literature, the survey results indicate that the availability of electricity during all school hours is reported to be consistent. This consistency is crucial for the effective use of ICT tools and devices in the classroom (Tandika et al., 2019). However, a significant concern highlighted in both the survey and qualitative responses is the limited availability of instructional resources i.e., printers, overhead projectors, and computer access in schools. This lack of resources

aligns with previous studies that have underscored the challenges of limited ICT access in special education classrooms (Edyburn, 2009; Kim & Hannafin, 2004). Interestingly, the survey findings reveal a stark contrast between the availability of computer and internet access at school versus at home for students with hearing impairment. While the majority of respondents reported never having access to computers at school, a significant percentage reported always having access to computers with an internet connection at home. This disparity underscores the existence of a digital divide and emphasizes the need to bridge this gap to ensure equitable access to ICT resources (Burgstahler, 2003; Erdogdu, 2022). Literature has consistently emphasized the importance of bridging the digital divide for students with disabilities, particularly in educational settings.

The qualitative responses further reinforce the significance of ICT in special education classrooms. Special education teachers widely acknowledge the importance of ICT in teaching students with hearing impairment, particularly for visual learning and comprehension of complex concepts. However, the lack of access to audio-visual aids and instructional materials poses a challenge and restricts the effective utilization of ICT resources. The demands expressed by teachers in the qualitative responses, such as multimedia projectors, computers with internet access, sign language apps, tablets, and other resources, highlight the need for comprehensive ICT integration to enhance the learning experience for students with hearing impairment (Parette et al., 2008). Examining the uses of ICT in lessons, the survey results indicate both similarities and differences compared to existing literature. Word processors, web browsers, and text-to-speech software are reported to be frequently used, aligning with the literature that highlights the benefits of these tools for students with hearing impairment (Yeni & Parmaksis, 2016). However, there is a low usage of databases, computer-aided instruction software, and video conferencing, suggesting the underutilization of these potentially valuable resources (Yeung et al., 2016). The qualitative responses further emphasize the utilization of visual and multimedia resources, such as captioning and signing, instructional films, and video-based materials, to facilitate better comprehension of complex concepts. However, the usage of these resources could be further optimized to maximize their impact on the learning experience of students with hearing impairment (Marschark et al., 2013).

The findings of this study have important implications for policymakers and authorities in the special education department. Recognizing ICT as a basic need for students with hearing impairment is crucial.

Conclusion

In conclusion, the integration of quantitative survey results and qualitative interview responses provides a comprehensive understanding of the availability, use, and requirements of ICT resources in special education classrooms for students with hearing impairment. These findings underscore the importance of addressing resource limitations, bridging the digital divide, and providing necessary support to optimize the integration of ICT in special education settings.

The study revealed the consistent availability of electricity in special education classrooms, which is vital for the effective use of ICT tools and devices. However, the limited availability of certain resources such as printers, overhead projectors, and computer access poses significant challenges. This aligns with previous research highlighting the limitations of ICT access in special education classrooms.

A digital divide was evident between school and home environments, with students having better access to computers and the internet at home compared to school. Bridging this gap is crucial to ensure equitable access to ICT resources for students with hearing impairment. Policymakers and

educational authorities should take proactive steps to provide appropriate resources and infrastructure in special education classrooms, addressing the limitations identified in the study.

The qualitative responses emphasized the significance of ICT in special education especially for students with hearing impairment, particularly for their visual learning and comprehension of complex concepts. However, the lack of access to audio-visual aids and instructional materials restricts the effective utilization of ICT resources. Special education teachers expressed the need for multimedia projectors, computers with internet access, sign language apps, and tablets. Policymakers should consider these recommendations to enhance ICT integration in the teaching and learning process.

The study also highlighted both similarities and differences in the use of ICT resources compared to existing literature. While word processors, web browsers, and text-to-speech software were rarely used, other resources such as databases, computer-aided instruction software, and video conferencing were underutilized. Optimizing the usage of visual and multimedia resources, including captioning, signing, instructional films, and video-based materials, can greatly enhance the learning experience for students with hearing impairment.

Recommendations

Based on the findings of this study, several recommendations can be made to policymakers and authorities in the special education department:

1. Recognize ICT as a basic need: Policymakers should acknowledge ICT as an essential requirement in special education classrooms for students with hearing impairment. It should be treated as a fundamental aspect of inclusive education.
2. Address resource limitations: Efforts should be made to provide adequate resources such as printers, overhead projectors, and computer access in special education classrooms. This will enable teachers and students to effectively utilize ICT tools and devices.
3. Bridge the digital divide: Policymakers should work towards reducing the digital divide by ensuring equitable access to computers and the internet for students with hearing impairment, both at school and at home. This can be achieved through initiatives such as providing laptops, internet connectivity, and assistive technologies.
4. Training and support: Comprehensive training and support should be provided to special education teachers and students to maximize the utilization of ICT resources. This includes training on using multimedia projectors, sign language apps and other tools that facilitate effective teaching and learning.
5. Optimize resource utilization: Special education teachers should be encouraged to explore and utilize a wider range of ICT resources, including databases, computer-aided instruction software, and video conferencing. This can enhance the learning experience and improve the comprehension of complex concepts among students with hearing impairment.

   By implementing these recommendations, policymakers and authorities can contribute to the effective integration of ICT in special education classrooms, thereby promoting inclusive and accessible education for students with hearing impairment.

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