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Original Article

Quality of Academic Environment in Relation to Availability and Usage of Technology, Teachers' Awareness and Leadership of Principals in Schools for Hearing Impaired

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Abstract

The study looked at the use of assistive technology in special schools for children with hearing impairments, as well as its usefulness, teachers' attitudes toward technology, and the differences between public and private schools. A poll of instructors was undertaken, with an overall response rate of 88%. The study included tools with clear instructions and explanations, such as the Assistive Technology Availability Checklist and the Assistive Technology Use Scale for Teachers in Deaf Schools. The findings advocated for the use of assistive technology in deaf education, highlighting the necessity of specific talents such as core pedagogy, topic comprehension, expanded curriculum, and communication. Teachers must also be knowledgeable about Deaf culture, assistive technology, and inclusive education. Technology can transform society by increasing differentiation, diminishing isolation, and providing new opportunities. Finally, the research confirms the rising usage of assistive technology in deaf education and shows differences in technology utilization by instructors in various roles. Training and professional development are required for targeted assistance.

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Keywords : Hearing Impairment, Assistive Technology, Assistive Devices, Assistive Listening Devices (ALD), Augmetative and Alternative Communication (AAC), Alert systems.

1. INTRODUCTION

Education is important to develop children's inherent potential and foster a more developed community. About 15% of the world's population has a disability, 80% of whom live in poor countries like Pakistan (Mitra and Yap, 2021). Equal educational opportunities are essential for children with disabilities, and supportive provisions can improve children's participation in educational programs (Disability Benefit Database, 2021). However, government investment in education and employment for people with disabilities is the lowest, with more than 75% of children not benefiting from the network of services (Patrinos, 2015).

Duhaney & Duhaney (2000) indicated that schools are important educational institutions that shape students' mental alertness, physical strength, cultural health, social effectiveness, and emotional stability. Schools for special children should focus on developing balanced personality traits in children with disabilities. They also summarized that technological advances have greatly benefited people with disabilities, especially those with hearing loss. Hearing aids, computers, alerting devices, cochlear implants, captioned media, and adaptive devices have changed the way deaf children are educated.

Hearing impairment and disability are significant burdens in developing countries. McPherson (2014) discussed the need for amplification devices and initiatives to improve access to hearing aids. Barriers to

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access are identified, and potential solutions are discussed. Successful programs in developing countries often combine appropriate technology with a sustainable local support base. With a rising middle class, technology advancements, and ongoing training, hearing device usage rates may eventually reach parity with developed economies.

The Individuals with Disabilities Education Act (IDEA) of 2004 requires the inclusion of assistive technology (AT) in the education of all students with disabilities. Special education teachers play an important role in teaching the use of AT, identifying its benefits for deaf students, and advocating for its use in the classroom (Mittler, 2007). AT can improve academic achievement by allowing students to use print to improve their writing skills, thereby enhancing literacy and academic achievement.

Technology can improve problem solving and higher-level thinking skills in students, especially those with hearing loss (Jeffs, Behrmann & Bannan-Ritland, 2005). The adoption of assistive technologies in special schools depends on factors such as teacher awareness, accessibility, success, expertise, training, student awareness, acceptance, and curriculum response and technology integration for the children with hearing impairment (Olumorin, Babalola & Amoo, 2022). Raising awareness about assistive technology for deaf students can help teachers understand and support them better, thereby improving their skills, attitudes, and interest in education (Cortés, Annicchiarico, Vázquez-Salceda, Urdiales, Cañamero, López & Caltagirone, 2003).

Hameed & Bano conducted a study in 2021 that found that assistive technology has revolutionized disability management, but deaf children in Pakistan still face many challenges due to high costs and inaccessibility. A sample of 105 students from three schools revealed the gap between rich and poor when it comes to the usefulness of assistive technology.

Farooq, Aasma & Iftikhar (2015) analyzed the impact of assistive devices on the learning of 200 deaf students. It has been found that assistive technologies are most effective in helping students with hearing loss without any alternative solutions. The study also highlights the role of high-tech and low-tech assistive devices. Parents of students with hearing loss said they were satisfied with their children's use of assistive devices, and also expressed the need to reduce the cost of these devices. Overall, assistive technologies are essential for the health of deaf students.

Despite its potential benefits, the question remains why don't special education teachers in Pakistan use technology-integrated teaching strategies more widely? Investigators found many barriers to using technology in special schools, mainly due to inadequate teacher preparation. Numerous scholars emphasized the need for essential technology training and continuing staff education programs to improve teaching and learning in special education. They also emphasized the importance of implementing technology workforce development programs that provide the greatest reach for teachers.

In summary, the quality of the learning environment for students with hearing impairment is influenced by the availability of technology, teacher awareness, and principal leadership, which, when prioritized and addressed, can foster a positive and inclusive school.

2. OBJECTIVES OF THE STUDY

The study aimed to evaluate the availability of assistive technology in special schools for children with hearing impairment, its effectiveness in supporting these children, teachers' perceptions of technology, and compare the use of assistive technology in public and private schools.

3. METHODOLOGY

Design of the Study

A survey was conducted among special education teachers to assess their integration of assistive technology (AT) into instructional practices, technology training, and leadership role in supporting assistive technology at school. The researcher conducted a descriptive survey, visited schools serving deaf children, and provided selected teachers with tools and time for clarification.

Sampling

The study surveyed 134 teachers from 15 special schools for deaf children between September 2021 and February 2022, and 118 teachers responded to the survey instrument, resulting in an overall response rate of 88%. Table 1 lists the deaf schools surveyed.

Table 1

Sample indicating the number of teachers and students drawn from special schools of children with hearing impairment – Karachi

Serial No	Name of the School	No. of Teachers	No. of Students
1.	Deaf Education Welfare Association (DEWA) Academy	25	286
2.	ABSA School & College for the Deaf	17	110
3.	Ida Rieu Welfare Association	20	203
4.	The Korangi School for Deaf	09	95
5.	The Deaf Reach School & College	16	136
6.	Shaheed e Millat Special Education Centre	08	46
7.	JS Academy for the Deaf	12	63
8.	Center of excellence for the Deaf	04	27
9.	Pakistan Navy Special School Karsaz	08	44
10.	Quaid e Azam Rangers School	06	29
11.	Islamic School for the Deaf	05	34
12.	Bahria Model School, PNAD	03	25
13.	Pakistan Airforce School (Maripur)	03	19
14.	Pakistan Airforce school (Korangi Creek)	02	15
15.	Agosh special children school	03	17
	Total	134	1149

Instruments of the Study

In this study, the investigator used the following instruments:

- Checklist of Availability and Usage of Assistive Technology Used
- Teachers' Awareness of Assistive Technology Used for Children with Hearing Impairment

Checklist of Availability and Usage of Assistive Technology Devices

An extensive online search was conducted to identify assistive technologies for people with hearing loss. Current and potential plans were identified through review of documents and specific school locations. These devices are classified into hearing technology, alerting devices, media, and speech-to-text/signature software. Five special education experts approved the list and the final list was compiled, including a usability checklist and a usage rating scale.

Checklist of Availability of Assistive Technology and Rating Scale of Usage of Assistive Technology

The researcher developed a checklist and rating scale to evaluate the availability and use of assistive technology in schools for the deaf in Pakistan. The checklist asks respondents to rate their use of assistive technologies on a scale of "Always," "Sometimes," "Rarely," or "Never." The total available score is calculated by adding the score for each device. The average scores of all teachers were then combined to determine the school's overall assistive technology score. The research aims to improve access and use of assistive technologies in schools for people with hearing loss.

Data Collection

The investigator provided tools, such as the Assistive Technology Availability Checklist and the Assistive Technology Use Scale for Teachers in Deaf Schools, to teachers of children with hearing loss. Teachers were given enough time to complete the tools, with clear instructions and explanations. There was no time limit for answering but participants must complete their task quickly. The surveys were accompanied by a letter certifying their compliance with the guidelines of the Advanced Studies and Research Board (ASRB), University of Karachi. Participants were informed that their participation was voluntary and that their responses would be kept confidential.

Statistical Techniques Used to Analyze the Data

The study used descriptive statistics to analyze data on availability, usage, cognition, and academic achievement of deaf children. Inferential statistics were used to compare means across teachers and evaluate differences in the availability and use of assistive technology by school type and locality for deaf

schools.

4. FINDINGS

This section analyzes teachers' access to, use of, and perceptions of assistive technology, learning outcomes of deaf students, and teachers' perceptions of assistive technology in general.

Table 2

Availability of Assistive technology in schools for hearing impaired

Availability of Assistive technology	Score Limit	N	Percentage
High	> 60	5	33
Low	< 60	10	67
		15	100

Table 2 shows that 33% of deaf schools have good availability rates for assistive technology, while 67% have low availability rates.

Table 3

Availability of Assistive Devices in schools for children with hearing impairment (N = 15)

Availability of Assistive Listening Device (ALD)	Percentage
Frequency Modulated System	73 (N=11)
Infrared System	67 (N=10)
Induction Loop	87 (N=13)
Audio Loop	100 (N=15)
Availability of Personal Amplification	**Percentage**
Behind-The-Ear Hearing Aid	73 (N=11)
In-The-Ear-Hearing Aid	67 (N=10)
In –The –Canal Hearing Aid	47 (N=07)
Completely In-The Canal	13 (N=02)
Body Worn Hearing Aid	100 (N=15)
Availability of Alerting Devices	**Percentage**
Door Bell with amplified sound	93 (N=14)
Smoke Alerting Device	60 (N=09)
Vibration alerting device	40 (N=06)
Light alerting device	27 (N=04)
Availability of Telecommunication Devices	**Percentage**
Cell Phone	100 (N=15)
Captioned Telephone	27 (N=04)
Video Phone	40 (N=06)
Subtitle visual screen	100 (N=15)
Availability of Voice to Text / Sign Software	**Percentage**
Caption Mic TM	47 (N=07)
i Communicator	27 (N=04)
Video Remote Interpreter	20 (N=03)
Availability of Person to Person Communication Devices	**Percentage**
Ubi-Due Face to Face	53 (N=08)
Availability of Note taking Devices	**Percentage**
Computer Assisted Note	80 (N=12)
Digital Pen	60 (N=09)
Interactive Whiteboards	33 (N=05)
Availability of Voice to Text / Sign Software	**Percentage**
Communication Access Real Time Captioning (CART)	13 (N=02)
C Print	13 (N=02)
Remote Captioning	13 (N=02)

The study found that 67% of deaf teachers had moderate knowledge of assistive technology, only 20% had very good knowledge, and 13% had limited knowledge. The study found that 67% of schools for the deaf had low levels of assistive technology availability, while 33% had high levels. All areas have audio loops, induction loops, frequency control systems and infrared systems. Body-worn hearing aids are present in 100% of schools, followed by behind-the-ear hearing aids at 73%. Smoke detectors and amplified doorbells ranked second among schools, at 60% and 93% respectively.

Most schools did not have video phones or captioning, with 40% having video phones and 27% having captioned phones. Ubi-Due direct communication devices are used by 53% of schools serving deaf children, while only 33% have interactive whiteboards. Text-to-speech/signature software was least readily available, with only 47% of schools having Caption Mic TM, 27% using i-I-Communicator and 3 schools using text-to-speech software for video interpretation from far away. Real-time captioning is not offered in most public and private schools, but 13% of NGO-run schools offer it.

HYPOTHESIS 1: The availability of assistive technology did not significantly differ amongst deaf schools.

According to hypothesis Ho.1.1, The chi-square value of 0.79, below the significance level of 0.05, shows that there is no significant difference in access to assistive technology between public, private, military and non-governmental organizations. Table 4 presents the findings.

Table 4

Summary table of chi square for significant difference among various types of schools of hearing impaired with respect to Availability of Assistive Technology

Type of Schools	Availability of AT		Chi Square	difference	Significance
	High	Low			
Public schools	00	01	0.79	3	NS
Private schools	04	02			
Schools run by Armed Forces	03	02			
Schools run by NGOs	02	01			

The study tested the hypothesis Ho.1.2, that there is no significant difference in the provision of assistive technology between single-disability deaf schools and multiple-disability deaf schools. The calculated Chi-square value is 1.665, which is lower than the value in the table for degrees of freedom 1. Therefore, null hypothesis is accepted, indicating that there is no obvious difference in the provision of assistive devices between people with single disabilities and multiple disabilities in the field of hearing loss. Table 5 presents the findings.

Table 5

Summary table of chi square for significant difference between single-impairment and multiple-disability deaf schools with respect to Availability of Assistive Technology

Disability Served	Availability of AT		Chi Square	difference	Significance
	High	Low			
Single-impairment schools	06	03	1.665	1	NS
Multiple-disability schools	02	04			

HYPOTHESIS 2: The usage of assistive technology did not significantly differ amongst deaf schools.

The study's chi-square value of 14.204, which is lower than the tabulated value for degrees of freedom 3, supports the null hypothesis 2.1, indicating no significant differences in assistive technology usage across public, private, military organizations, and non-governmental schools. Table 6 presents the findings.

Table 6

Summary table of chi square for significant difference among various types of schools of hearing impaired with respect to Usage of Assistive Technology

Type of Schools	Usage of AT		Chi Square	difference	Significance
	High	Low			
Public schools	00	01	14.024	3	NS
Private schools	05	01			
Schools run by Armed Forces	04	01			
Schools run by NGOs	03	00			

Table 7 shows that at the 0.05 level of significance, the estimated chi-square value of 7.93 is less than the tabular value for degrees of freedom 1. As a result, null hypothesis 2.2 is chosen since there is no evident difference between hearing-impaired schools with a single handicap and those with multiple impairments.

Table 7

Summary table of chi square for significant difference between single-impairment and multiple-disability deaf schools with respect to Usage of Assistive Technology

Disability Served	Availability of AT		Chi Square	difference	Significance
	High	Low			
Single-impairment schools	08	01	7.93	1	NS
Multiple-disability schools	04	02			

HYPOTHESIS 3: There is no significant difference in Teachers' Awareness of Assistive Technology among those belonging to the categories of gender and seniority.

Table 8 shows that the obtained "t" value at the 0.05 level is 0.134, which is less than the calculated value of 1.98. As a consequence, null hypothesis 3.1 is accepted, and it is concluded that there is no discernible difference in the comprehension of assistive technology between male and female teachers.

Table 8

Summary table of 't' test of awareness of assistive technology according to gender basis teachers of hearing impaired schools

Gender	N	Mean	SD	Chi Square	difference	Significance
Male	52	82.19	42.06	0.134	111	NS
Female	66	81.14	40.98			

Table 9 shows that at a 0.05 level of significance, the calculated F value of 12.676 is greater than the tabulated F value of 8.50 for degrees of freedom 3 and 109. As a consequence, the null hypothesis is rejected, and the alternative hypothesis - that teachers at public schools, private schools, military institutions, and non-governmental schools have considerably different degrees of comprehension of assistive technology - is accepted.

Table 9

Summary table of one way ANOVA of significant difference among different types of schools for hearing impaired with respect to Teachers' Awareness of Assistive Technology

Source of Variance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	49338.736	3	16446.245	12.676	.000
Within Groups	141421.429	109	1297.444		
Total	190760.165	112			

*Significant at 0.05 level

As shown in Table 10, the estimated "t" value of 1.04 is less than the tabulated values of 1.64 and 2.61, suggesting that null hypothesis 3.3 is accepted, indicating that instructors from schools serving children with impairments have comparable perspectives on assistive technology.

Table 10

Summary table of 't' test of awareness of assistive technology belonging to single-impairment and multiple-disability hearing impaired schools

Disability Served	N	Mean	SD	t	df	Significance
Single-impairment schools	47	84.36	45.99	1.04	111	NS
Multiple-disability schools	71	75.68	28.35			

5. DISCUSSION

The study investigates the use of assistive technology in deaf education by the teachers of children with hearing impairment. It emphasizes the importance of specialized abilities such as core pedagogy, topic understanding, extended curriculum, and communication. Teachers should also be familiar with Deaf culture, assistive technology, and inclusive education. Technology has the potential to revolutionize society through enhancing differentiation, decreasing isolation, offering specialized resources, and improving productivity. The study verifies the increased use of assistive technology in deaf education and identifies variances in technology utilized by teachers in different positions. Targeted help necessitates training and professional growth.

Lesar (1998) discovered that respondents are concerned about their understanding and usage of assistive technology, and she indicated areas for more training. Anderson & Petch-Hogan (2001) discovered that participation in technology-rich field activities boosts pre-service special educators' understanding about utilizing suitable technology to promote learning for children with disabilities. According to Ashton's (2004) research, students may quickly access and apply components of AT that are familiar to teachers. The most accessible resources were reported by 18% of speech-language pathologists and 10% of resource specialists. Pencil clips, calculators, markers, tilt boards, and FM amplifiers were the most often utilized low-tech products. Pre-service teachers were not comfortable utilizing AT in inclusive classrooms, according to Brady, Thies & Cutrell (2014) research. This discovery supports the study's findings.

According to the survey, most deaf teachers have just a basic understanding of assistive technology, which has to be addressed through coordinated programs and continued education. AT includes products and correlated services that progress in working with children with hearing impairment (CwHI). At this juncture, Mubin, Tian You, Samiraj & Jaafar (2022) mentions some approaches to overawe the barriers by enhancing capabilities and resources to reviewing the AT to be more flexible to supply the requirements of CwHI in an inclusive classroom setting. Government teachers are more aware, yet they are underutilized owing to insufficient training. Universities should include a primer on assistive technology for deaf students in their pre-service teacher training programs, as well as providing professional development opportunities through collaborations.

Deaf children can learn about assistive technologies through field visits to national organizations. Santoso et al (2020) support this research, stating that creating educational programs using assistive technology can help overcome feelings of inferiority and increase social adaptation. Technology plays a crucial role in clouded communication and information requirements for students with hearing impairments, enabling real-time translation of sound into text.

Competing Interests

The authors did not declare any competing interest.

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