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RESEARCH PAPER

Mathematics without Barriers: Empowering Hearing-Impaired Students in Numerical Fluency

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ABSTRACT

This study aims to explore strategies to empower Pakistani math students with hearing impairments to have greater autonomy in their educational journey. The objective is to identify effective methodologies and examine the viewpoints of educators. A quantitative research approach was used to choose a sample of 150 teachers using simple random selection. Data was collected using a questionnaire that was prepared by the researchers themselves. The collected data was then analyzed using descriptive and inferential statistics. The findings indicate that the implementation of inclusive policies, targeted training, and collaborative initiatives to enhance mathematical education for children with hearing impairments are positively welcomed. Teachers' judgments were influenced by variables such as gender, age, education, and posting location. It is recommended to implement specialized teacher training, promote collaboration between educators and families, and allocate finances to ensure universal access to support services. The study emphasizes the necessity of establishing inclusive strategies tailored to meet the diverse needs of students with hearing impairments and highlights the importance of providing instructors with sufficient support and resources. Policymakers and stakeholders should strive to create an inclusive environment that promotes success in mathematics education for all children by addressing inequalities and understanding the factors that influence teachers' viewpoints.

KEYWORDS Barriers, Empowering, Hearing-Impaired, Mathematics, Students

Introduction

In modern educational discourse, the idea of inclusion is considered vital. It asserts that all students, irrespective of their background or ability, should have equitable access to education of excellent quality. During the process, it becomes evident that mathematics education plays a crucial role in encouraging inclusivity. However, students who are hearing impaired face specific challenges while trying to comprehend mathematical concepts. Due to the advancement of assistive technologies, innovative teaching approaches, and collaborative collaborations, an increasing body of research is being carried out to improve the mathematical fluency of students with hearing impairments.

Hearing aids, FM systems, and captioning are instances of assistive technologies that have fundamentally transformed the educational encounter for students with hearing impairment. These gadgets enable students to engage in communication during math sessions and have access to auditory material (Jones &Kadamus, 2018; Marschark& Harris, 2018; Thompson, 2020). By empowering students to actively interact with mathematical material, these technology advancements not only reduce the barriers caused by hearing impairment but also establish the basis for inclusive mathematics education.

Furthermore, it is crucial to change and adapt the curriculum in order to accommodate the diverse learning needs of children with hearing impairments

(Marschark&Wauters, 2019). Teachers have the ability to create inclusive learning environments that allow all students, including those with hearing impairments, to effectively access, participate in, and showcase their comprehension of mathematical concepts. This can be achieved by employing visual aids, digital resources, and adhering to the principles of Universal Design for Learning (UDL) (Hall, Meyer, & Rose, 2012; Meyer & Rose, 2019).

By offering chances for students with hearing impairments to access mathematical knowledge, engage in meaningful discussions, and collaborate with their peers, communication strategies in mathematics instruction enhance their learning experiences (Lang, 2017; Woodward, 2016). Teachers can enhance the mathematical fluency and social integration of hearing-impaired students in mathematics classes through the implementation of interactive tasks, written communication, and visual aids.

Despite these advancements, there is a significant lack of research about the efficacy of specific teaching approaches and communication strategies when it comes to teaching mathematics to children with hearing impairments. Further empirical research is necessary to investigate the intricacies of these interventions and their impact on the academic performance of students with hearing impairments. Although the existing literature provides insights into the benefits of assistive technologies, curriculum modifications, and communication techniques, more in-depth studies are needed. The present study aims to address this research deficiency and contribute to the growing body of knowledge on inclusive mathematics education, thereby enhancing instructional approaches and promoting academic achievement among students with hearing impairments.

Literature Review

Technologies and tools used to enhance accessibility

Assistive technologies have significantly improved educational opportunities for children with hearing impairments, particularly in the field of mathematics. An integral aspect of this endeavor involves the utilization of hearing aids, which offer improved auditory input that is crucial for understanding spoken mathematical concepts. As to the findings of Jones and Kadamus (2018), hearing aids significantly enhance comprehension and participation in classroom environments by amplifying various sounds, such as speech and instructional material. Recent advancements in hearing aid technology, namely digital signal processing, have led to increased customisation and improved effectiveness in addressing individual hearing requirements (Smith & Clark, 2020). These devices provide students with equal access to mathematics instruction, thereby eliminating the disparity in auditory learning and instilling a feeling of empowerment.

FM systems have become crucial elements of the educational toolkit for children with hearing impairments, in addition to hearing aids. Marschark and Harris (2018) emphasize the efficacy of FM systems in reducing ambient noise and enhancing the intelligibility of spoken instructions, leading to improved communication between teachers and students. FM systems ensure that crucial information is effectively and clearly transmitted by having the teacher utilize a microphone that directly transmits their voice to a receiver worn by the students. Furthermore, this technology not only enhances the learning environment in the classroom, but also fosters inclusivity for students with hearing impairments, allowing them to actively participate in mathematical discussions with their peers.

Two additional forms of help for students with hearing impairments in mathematical learning contexts are the provision of captions and the availability of sign language interpreters. Thompson (2020) states that closed-captioned instructional films and live captioning of in-class lectures both enhance the accessibility of spoken content. Interpreters play a crucial role in facilitating communication between teachers and students who rely on

sign language as their main form of communication. Irrespective of a student's auditory condition, these accommodations ensure that mathematical content is effectively conveyed, promoting an inclusive learning environment where all students can thrive.

In summary, assistive technology has revolutionized the learning experience for students with hearing impairments in mathematics by offering a diverse range of tools and resources that enhance accessibility and facilitate communication. These technologies, encompassing captioning, sign language interpreters, FM systems, and hearing aids, empower students by guaranteeing equitable access to mathematical instruction and promoting active participation in class. With the advancement of technology, it is crucial to prioritize the integration of these resources into educational settings to ensure the success of all students, including those who are deaf, in mathematics.

Modifications and adjustments to the curriculum

Curriculum modifications and adaptations are crucial in the realm of instructing mathematics to students with hearing impairments to ensure equitable access to mathematical content and foster stimulating educational experiences. One of the key challenges is modifying curriculum materials to meet the diverse learning needs of students with hearing impairments, while maintaining the quality and difficulty of the mathematics subject. Curriculum changes, as described by Marschark and Wauters (2019), encompass many strategies including modifying teaching methods, incorporating visual aids, and revising instructional materials, with the aim of supporting the learning process for students with hearing impairments. These adjustments are essential for eliminating comprehension barriers and promoting mathematical proficiency in children with varying degrees of hearing impairment.

Furthermore, the incorporation of technologically advanced instructional materials has emerged as a potentially beneficial method of enhancing mathematical understanding in children with hearing impairments. Digital resources such as interactive simulations, multimedia presentations, and online learning platforms offer dynamic and engaging ways to deliver mathematical ideas (Meyer & Rose, 2019). By utilizing technology, educators have the potential to design personalized learning experiences that cater to the specific requirements and preferences of individual students. This enhances the accessibility and relevance of mathematics content for students who have hearing impairments.

Moreover, implementing Universal Design for Learning (UDL) principles holds great potential for fostering inclusive math classrooms that cater to the diverse needs of all students, including those with hearing impairments. UDL, as described by Hall, Meyer, and Rose (2012), prioritizes the proactive creation of curriculum materials and instructional techniques to reduce learning obstacles and promote diverse forms of representation, expression, and engagement. By applying UDL frameworks, teachers can create flexible and inclusive learning environments that allow students with hearing impairments to access, engage with, and demonstrate their understanding of mathematical concepts using different methods and formats.

In conclusion, it is essential to make curricular adjustments and adaptations to ensure that mathematics training is both meaningful and accessible for students with hearing impairments. Teachers may create inclusive learning environments that allow all students, regardless of their hearing abilities, to succeed in mathematics by incorporating UDL principles, leveraging technology, and adapting curriculum materials.

Strategies for Communicating in Mathematics Instruction

An essential aspect of instructing mathematics to children with hearing impairments is the establishment of good communication, ensuring that crucial mathematical concepts are conveyed comprehensively and without ambiguity. Teachers employ many

communication strategies and techniques to assist students with hearing impairments in comprehending mathematics and fostering their full participation in classroom activities. One effective strategy is to utilize visual aids and manipulatives to augment verbal training and provide concrete representations of abstract mathematical concepts (Woodward, 2016). Visual aids such as graphs, diagrams, and geometric models can enhance the understanding and retention of mathematical concepts for students with hearing impairments, as they facilitate the perception of mathematical relationships.

Moreover, written communication has a crucial role in facilitating the learning of mathematics for children with hearing impairments. It provides them with a means to independently access mathematical content and reinforces key concepts taught in the classroom (Marschark& Spencer, 2020). Written instructions, worksheets, and textbooks are beneficial resources for students with hearing impairments as they enable them to study mathematical content independently and review it as needed. Moreover, written assignments and examinations provide an opportunity for students with hearing impairments to articulate their comprehension of mathematical concepts through writing, allowing for an equitable evaluation of their mathematical proficiency.

Additionally, the use of interactive exercises and cooperative learning environments is essential in promoting mathematical discourse and communication among students who have hearing impairments (Lang, 2017). Peer tutoring sessions, problem-solving activities, and group discussions provide students who have hearing impairments with opportunities to engage in social interactions, articulate their perspectives, and collaboratively construct understanding. Hearing-impaired students can enhance their understanding of mathematical topics, enhance their mathematical communication abilities, and boost their confidence in articulating mathematical ideas by participating in interactive activities and engaging with peers.

To summarize, communication strategies are crucial in facilitating the learning of mathematics for students with hearing impairments as they enable them to absorb mathematical content, engage in meaningful mathematical discussions, and effectively showcase their comprehension of mathematical concepts. By incorporating interactive activities, textual communication, and visual aids into mathematics instruction, educators can create inclusive learning environments that promote the academic achievement of all students, including those with hearing impairments.

Teacher's Professional Development and Preparation

Both the use of evidence-based methods and the attitudes, skills, and knowledge of teachers who educate students with hearing impairments are crucial for the achievement of effective mathematics instruction for these kids. Providing teacher training and ongoing professional development is crucial in equipping educators with the skills necessary to meet the diverse needs of students with hearing impairments in math classes. Andrews and Lupinacci (2019) argue that teacher preparation programs should provide comprehensive training in areas such as deaf education, sign language fluency, instructional methodologies, and the integration of assistive technology, to ensure that teachers are adequately equipped to address the unique needs of students with hearing impairments.

Furthermore, it is crucial for educators to have ongoing access to professional development opportunities to ensure they remain up-to-date with the most effective methods, recent discoveries, and technological advancements in the realm of teaching mathematics to children with hearing impairments (Moores&Krentz, 2019). Teachers can collaborate with colleagues, engage in self-reflection, and enhance their understanding of successful pedagogical techniques through professional development workshops, symposiums, and web-based courses. In addition, peer coaching programs and mentorship programs provide educators with the opportunity to connect with experienced professionals in the field who may offer them guidance, assistance, and valuable feedback.

In addition, fostering high-quality results in mathematics instruction necessitates the development of a tolerant and sensitive environment inside educational institutions for students with hearing impairments. In order to create supportive and nurturing learning environments for students with hearing impairments, it is essential for educators to receive training in cultural competency, disability awareness, and inclusive practices (Johnson &Erting, 2017). By cultivating a mindset of empathy, respect, and collaboration, educators may successfully address the distinctive learning needs of hearing-impaired children, establish meaningful relationships with them, and leverage their strengths.

In conclusion, teacher preparation and professional development are crucial for effectively instructing mathematics to students with hearing impairments. This is because they ensure that teachers possess the attitudes, knowledge, and skills necessary to fulfill the diverse requirements of these children. Schools can facilitate teachers in creating equitable and captivating learning experiences for students with hearing impairments in mathematics classes by providing comprehensive training, ongoing assistance, and an inclusive atmosphere.

Collaborative networks for peer support and cooperation

In the field of mathematics education, the presence of peer collaboration and support networks is crucial for fostering a sense of community, promoting academic achievement, and enhancing the social-emotional well-being of students with hearing impairments. Cawthon and Wurst (2019) state that collaborative learning activities provide students with hearing impairments the opportunity to engage with their peers, articulate their perspectives, and collectively construct understanding. By engaging in peer tutoring sessions, problem-solving activities, and group discussions, students with hearing impairments can collaborate, exchange ideas, and acquire knowledge from one other's experiences. By working together, students with hearing impairments improve their communication skills, build confidence, and promote a sense of togetherness in the mathematics classroom.

Peer support networks can be extremely beneficial for hearing-impaired students as they navigate the challenges of mathematics education. These networks offer validation, encouragement, and mentorship, which are crucial resources for these students (Antia et al., 2011). Peer mentors, who may have hearing impairments themselves, serve as advocates and role models, offering guidance, motivation, and practical advice for achieving success in academics. Peer support organizations and clubs provide avenues for children with hearing impairments to engage with peers who have experienced similar circumstances, discuss common challenges, and commemorate achievements collectively. Furthermore, these support systems not only enhance social ties but also equip hearing-impaired students with the necessary resources to effectively navigate the academic setting, assert themselves when necessary, and champion their own needs. Cooperative ties among educators, families, and community groups considerably assist in the academic and social development of hearing-impaired pupils in mathematics education (Wolbers& Wiley, 2018).

These partnerships ensure that students with hearing impairments receive comprehensive assistance and have access to resources both within and outside the classroom. This is achieved by promoting transparent communication, cooperation, and joint decision-making. Teachers and families can collaborate to develop customized support plans, share progress reports, and seek opinion on instructional approaches. Community groups and service providers can improve the educational opportunities and expand the social networks of hearing-impaired students by offering additional resources, workshops, and extracurricular activities tailored to their needs.

In conclusion, peer collaboration and support networks are essential components of a highly effective mathematics curriculum for children with hearing impairments. These systems promote academic success, social inclusion, and the cultivation of self-advocacy

skills. Educational institutions have the ability to establish inclusive learning environments that promote the academic and social success of hearing-impaired students. This can be achieved through the cultivation of collaborative learning experiences, the development of peer support networks, and the establishment of collaborative partnerships with educators, families, and community organizations.

Parental support and involvement

Parental involvement and advocacy are crucial in mathematics education to enhance the academic achievement and overall well-being of hearing-impaired students. Collaborative partnerships between educators and families are essential for creating a learning environment that is both inviting and inclusive for children with hearing impairments, enabling them to thrive academically and socially (Antia et al., 2011). Engaging in school activities, attending meetings with teachers, and promoting completion of homework are some ways in which parental involvement can support positive academic outcomes and enhance learning outside of school. Furthermore, the active involvement of parents is essential in ensuring that students with hearing impairments receive appropriate accommodations, support services, and educational opportunities that address their individual learning needs (Marschark& Spencer, 2020).

Parents play a crucial role in promoting their children's academic growth and engagement in mathematics education by advocating for them, advocating for specialized training, assistive technologies, and readily available learning resources. Parents can influence decision-making processes, enhance comprehension of the requirements of kids with hearing impairments, and advocate for practices and regulations that promote inclusion and fairness in education by collaborating with educators, administrators, and lawmakers.

In order to enhance parental involvement and advocacy in mathematics education for hearing-impaired students, it is necessary to establish efficient communication and collaboration between the home and the school (Johnston &Erting, 2017). Teachers can establish a rapport of transparent communication with parents by providing consistent progress reports on their child's academic growth, soliciting feedback on their instructional approaches, and offering guidance on facilitating their child's mathematical learning at home. In order to ensure that the educational goals are aligned with the specific needs, abilities, and aspirations of children with hearing impairments, teachers should involve parents in the development of transition plans and individualized education plans (IEPs).

In conclusion, parental advocacy and involvement play a crucial role in ensuring a successful mathematics education for students with hearing impairments. This is because they promote academic achievement, improve access to resources, and create inclusive learning settings. Educational institutions have the ability to establish conducive learning environments for hearing-impaired students, ensuring they have the necessary support and resources to excel in mathematics. This can be achieved through fostering collaborative partnerships between educators and families, advocating for parents, and facilitating effective communication between the home and school.

Material and Methods

Research Design

This study used a quantitative research design to systematically examine the views, behaviors, and obstacles encountered by teachers who work with hearing-impaired kids in Punjab. This approach enables the methodical gathering and examination of quantitative data, enabling statistical inference and the ability to draw broad conclusions from the findings.

Population

The research population consists of educators who teach students with hearing impairments in educational institutions throughout Punjab, including both public and private schools. This demographic comprises the primary stakeholders engaged in providing mathematics instruction to pupils with hearing impairments in the region.

Sample

A research sample of 150 teachers is obtained by employing a simple random sampling procedure from the research population. This methodology guarantees that each teacher within the population has an equitable opportunity to be selected for the sample, so reducing any potential bias and improving the sample's representativeness.

Research Tool

The main method of gathering data is through a questionnaire that has been specifically created to collect information on teachers' views, methods, and encounters in regards to mathematics education for children with hearing impairments. The questionnaire is prepared by a comprehensive examination of current literature and consultation with field specialists. The questionnaire undergoes meticulous validation methods to assure its validity and reliability. A panel of five specialists in the field of special education and quantitative research assesses the questionnaire for its content validity, offering input and recommendations for enhancement. In addition, the questionnaire's reliability is evaluated through the use of a reliability coefficient, which results in a value of .085, suggesting a high level of dependability.

Data Collection

Data is gathered using both physical and online methods to improve accessibility and engagement. The researchers physically distribute the questionnaire to instructors at workshops, conferences, and school visits. Furthermore, a digital version of the questionnaire is provided through Google Forms, enabling teachers to easily and flexibly participate in the survey at their preferred time and convenience.

Data Analysis

The gathered data is examined using descriptive and inferential statistical methods with the use of Statistical Package for the Social Sciences (SPSS). Descriptive statistics are used to describe and convey the features of the sample, whereas inferential statistics, such as correlations and regression analysis, are used to analyze relationships and patterns within the data, allowing for meaningful interpretations and conclusions.

Results and Discussion

Table 1
Demographics

Title	Description	Frequency	Percentage (%)
Gender	Male	52	34.7%
	Female	98	65.3%
		150	**100%**
Age of Respondents	21-30 Y	17	11.3%
	31-40 Y	63	42.0%
	41-50 Y	68	45.3%
	51-60 Y	2	1.3%
		150	**100%**
Designation	SSET	80	53.3%
	JSET	70	46.7%
		150	**100%**
Qualification	Master	51	34.0%

	M.Phil.	99	66.0%
	PHD	0	0.0%
		150	**100%**
Place of Posting	School	80	53.3%
	Center	70	46.7%
		150	**100%**
Area of Posting	Rural	80	53.3%
	Urban	70	46.7%
		150	**100%**

Table 1 displays the demographic attributes of the participants. The gender distribution of the respondents was predominantly female, with females making up 65.3% of the sample, while males accounted for 34.7%. The majority of respondents, accounting for 42.0% of the sample, were between the ages of 31 and 40. This was followed by individuals aged 41 to 50, who made up 45.3% of the sample. A little fraction of the participants, specifically 11.3%, belonged to the age group of 21-30 years, while a negligible number, only 1.3%, fell within the elder age range of 51-60 years. The distribution of designations in the sample was nearly equal between SSET (Special Education School Teacher) and JSET (Junior Special Education Teacher), with SSET accounting for 53.3% and JSET accounting for 46.7%. In terms of qualifications, the survey found that the majority of respondents possessed a Master's degree (34.0%), while a higher proportion held an M.Phil. degree (66.0%), and none had a PhD. Regarding the location of posting, an equal proportion of respondents were assigned to schools and centers, with each category representing 53.3% of the sample. Ultimately, the respondents reported a relatively equal distribution of postings in both rural and urban locations, with 53.3% and 46.7% reporting rural and urban postings, respectively.

Table 2
Frequency Distribution (Based on Teacher's Perceptions)

Sr.	Statements of Questions	SA	A	UD	DA	SDA	M	SD
1	I am of the opinion that integrating visual aids and manipulative into mathematics training helps augment comprehension for students with hearing impairments.	23	121	6	0	0	4.11	0.43
		15%	81%	4%	0%	0%		
2	Assistive technologies, such as hearing aids and FM systems, are essential for promoting communication and enabling learning in mathematics courses for students with hearing impairments.	42	107	1	0	0	4.27	0.46
		28%	71%	1%	0%	0%		
3	Offering captions for mathematical content, such as lectures and instructional videos, greatly enhances accessibility and understanding for students with hearing impairments.	43	105	1	0	1	4.26	0.54
		29%	70%	1%	0%	1%		
4	Collaborative learning activities, such as engaging in group discussions and receiving peer tutoring, have proven to be highly successful in improving mathematical fluency among students with hearing impairments.	50	90	3	7	0	4.22	0.70
		33%	60%	2%	5%	0%		
5	Teachers should undergo specific training in deaf education and instructional methodologies to proficiently assist hearing-impaired children in mathematics.	13	119	10	8	0	3.91	0.60
		9%	79%	7%	5%	0%		
6	Implementing inclusive classroom approaches, such as Universal Design for Learning (UDL), is crucial for establishing fair learning environments for students with hearing impairments in the field of mathematics.	47	95	8	0	0	4.26	0.43
		31%	63%	5%	0%	0%		
7	Written communication, such as written instructions and worksheets, is a highly successful method for assisting the mathematics learning of students with hearing impairments.	27	121	2	0	0	4.17	0.46
		18%	81%	1%	0%	0%		

8	In my opinion, the involvement of peers and support networks can be advantageous in improving both the mathematical proficiency and social-emotional well-being of children with hearing impairments.	29	108	7	6	0	4.07	0.54
		19%	72%	5%	4%	0%		
9	Parents/guardians have a crucial role in advocating for the educational requirements of kids with hearing impairments in the subject of mathematics.	33	116	1	0	0	4.21	0.70
		22%	77%	1%	0%	0%		
10	The partnership between educators and families is crucial in fostering academic achievement and inclusiveness for kids with hearing impairments in the field of mathematics education.	41	95	13	1	0	4.17	0.60
		27%	63%	9%	1%	0%		
11	I advocate for the provision of more professional development opportunities for educators to augment their proficiency in assisting hearing-impaired pupils in the field of mathematics.	47	95	8	0	0	4.26	0.55
		31%	63%	5%	0%	0%		
12	Integrating tangible instances and practical uses of mathematics can heighten involvement and significance for pupils with hearing impairments.	46	95	8	1	0	4.24	0.41
		31%	63%	5%	1%	0%		
13	Teachers should undergo training in sign language and other modes of communication to proficiently interact with students who have hearing impairments in the subject of mathematics.	27	121	2	0	0	4.17	0.41
		18%	81%	1%	0%	0%		
14	Schools should ensure that they offer sufficient resources and support services to cater to the varied requirements of students with hearing impairments in the field of mathematics education.	29	108	7	6	0	4.07	0.63
		19%	72%	5%	4%	0%		

The findings from Table 2 demonstrate an overall favorable impression towards several initiatives designed to empower hearing-impaired pupils in the field of mathematics education. The respondents expressed a high level of agreement with statements about the efficacy of integrating visual aids, assistive technologies, captioning, collaborative learning experiences, specialized teacher training, inclusive classroom practices, written communication, peer collaboration, parental advocacy, collaboration between educators and families, professional development opportunities, real-life examples, and sufficient resources and support services. The findings indicate that the respondents agree on the significance of implementing inclusive practices and offering suitable assistance to improve the mathematical learning experience for students with hearing impairments in Pakistan.

Table 3
Gender (Independent Sample t-test)

Description	N	M	SD	t	df	Sig.
Male	52	66.333333	3.17	-2.61	148	0.01
Female	98	67.166667	3.13			

Table 3 presents the outcomes of an independent sample t-test performed to investigate the disparities between genders in the average scores of a specific variable (not stated in the table). The analysis comprises 52 male respondents and 98 female respondents. The average score for male participants is 66.33 with a standard deviation of 3.17, but the average score for female participants is slightly higher at 67.17 with a standard deviation of 3.13. The t-value of -2.61 with 148 degrees of freedom reveals a statistically significant difference between the average scores of male and female respondents. The t-test result is $t(148) = -2.61$, with a p-value less than 0.01. This indicates that there is a statistically significant disparity in the variable of interest between male and female respondents.

Table 4
Designation (Independent Sample t-test)

Description	N	M	SD	t	df	Sig.
SSET	80	19.15	3.17	-0.1	148	0.93
JSET	70	19.19	3.22			

Table 4 displays the outcomes of an independent sample t-test that investigates the disparities in average scores between two groups categorized by their designation: SSET (Special Education School Teacher) and JSET (Junior Special Education Teacher). The analysis comprises 80 respondents from the SSET group and 70 respondents from the JSET group. The average score for SSET respondents is 19.15 with a standard deviation of 3.17, whereas the average score for JSET respondents is slightly higher at 19.19 with a standard deviation of 3.22. The t-value of -0.1 with 148 degrees of freedom indicates that there is no statistically significant difference in the mean scores between SSET and JSET respondents. The t(148) value of -0.1 corresponds to a p-value of 0.93. Consequently, drawing from these findings, it can be deduced that the designation (SSET or JSET) does not exert a noteworthy influence on the variable being assessed.

Table 5
Place of Posting (Independent Sample t-test)

Description	N	M	SD	t	df	Sig.
School	80	18.41	3.23	-3.69	148	0
Center	70	19.91	2.98			

Table 5 presents the results of an independent sample t-test conducted to evaluate the difference in average scores between two groups classified by their location of posting: School and Center. The analysis includes 80 participants from schools and 70 participants from centers. The average score for participants from schools is 18.41 (standard deviation = 3.23), whereas for participants from centers, it is significantly higher at 19.91 (standard deviation = 2.98). The t-value of -3.69 with 148 degrees of freedom reveals a significant difference in mean scores between the two groups. The $t(148) = -3.69$, $p < 0.05$. Therefore, the data indicates that there is a notable difference in the variable being studied depending on where the respondents are assigned. Those assigned to centers have better average scores compared to those assigned to schools.

Table 6
Area of Posting (Independent Sample t-test)

Description	N	M	SD	t	df	Sig.
Rural	80	17.46	3.06	-4.45	148	0
Urban	70	19.63	3.07			

Table 6 displays the results of an independent sample t-test that was done to assess the disparity in average scores between two groups categorized by their posting location: Rural and Urban. The analysis comprises 80 participants from rural regions and 70 from metropolitan regions. The average score for participants from rural areas is 17.46 (standard deviation = 3.06), whereas for participants from urban areas, it is significantly higher at 19.63 (standard deviation = 3.07). The t-value of -4.45 with 148 degrees of freedom indicates a significant difference in mean scores between the two groups. The $t(148) = -4.45$, $p < 0.001$. Therefore, the results indicate a significant difference in the variable being assessed depending on the location where the respondents are assigned. Specifically, individuals in urban regions exhibit higher average scores compared to those in rural areas.

Table 7
Age (One-way ANOVA Test)

Description	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	189.276	4	47.319	4.979	0.001
Within Groups	2185.916	230	9.504		

Total	2375.191	234			

Table 7 displays the outcomes of a one-way ANOVA analysis performed to investigate the variations in average scores among various age groups of participants. The analysis categorizes respondents into five age groups. The variance between groups, also known as the sum of squares, is 189.276. It has 4 degrees of freedom, which leads to a mean square value of 47.319. The F-ratio (F) of 4.979 shows a statistically significant difference in mean scores across the age groups. The degrees of freedom for the F-ratio are 4 and 230, and the p-value is 0.001. This implies that age has a substantial impact on the variable being assessed. To identify the precise age groups that have significant differences, it is necessary to do post-hoc tests such as Tukey's HSD or Bonferroni correction. Overall, the data suggest that age has an impact on the variable being studied among the participants.

Table 8
Qualification (One-way ANOVA Test)

Description	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	243.361	2	121.68	13.242	0
Within Groups	2131.831	232	9.189		
Total	2375.191	234			

Table 8 presents the results of a one-way ANOVA analysis conducted to examine the disparities in average scores among participants with different qualifications. The analysis classifies participants into three categories depending on their credentials: Master's, M.Phil., and PhD. The variation between groups, also known as the Sum of Squares, is 243.361. It has 2 degrees of freedom, which leads to a Mean Square value of 121.68. The F-ratio (F) of 13.242 suggests a substantial difference in mean scores among the qualification groups, as indicated by the statistical analysis ($F(2, 232) = 13.242$, $p < 0.001$). Therefore, the results indicate that the qualification of the respondents has a notable impact on the measured variable. Additional post-hoc tests can be run to determine which particular qualification groups show substantial variations in average scores. Overall, the findings suggest that the credentials of the respondents have an impact on the variable being studied.

Findings and Discussion

The sample exhibits diversity in terms of gender, age, qualification, location of posting, and posting area, as evidenced by the demographic profile of the respondents. There were approximately the same number of respondents with M.Phil. degrees from both SSET and JSET. The majority of respondents were female and their ages ranged from 31 to 40. The presence of many perspectives ensures a comprehensive understanding of the ways in which students with hearing impairments might be empowered in mathematics instruction (Dammeyer, 2010).

The data presented in Table 2 indicates that several interventions aimed at enhancing arithmetic learning for students with hearing impairments are viewed positively. The majority of respondents strongly agreed or agreed with statements supporting the use of visual aids, assistive technologies, collaborative learning experiences, specialized teacher training, inclusive classroom practices, written communication, peer collaboration, parental advocacy, educator-family collaboration, professional development opportunities, real-life examples, and sufficient resources and support services (Luckner, 2001). These findings underscore the need of implementing inclusive strategies and providing appropriate support to facilitate the learning of mathematics for children with hearing impairments.

The analysis of gender disparities uncovers a significant divergence in the mean ratings of male and female participants for a specific factor, suggesting potential gender-related nuances in attitudes towards facilitating mathematics education for children with hearing impairments. As expected, the respondents' classification had no noticeable effect on their perception of strategies for enabling children with hearing impairments in

mathematics. Similarly, the geographical location and posting region of the participants had a significant influence on their viewpoints. Posts originating from metropolitan and central areas were associated with higher average scores, indicating that these locations may provide better resources and support.

Moreover, the views of the participants on the enhancement of mathematical skills among students with hearing impairments were greatly influenced by their age and level of education. The findings suggest that both age and level of education have an impact on how individuals perceive and understand effective strategies for aiding the mathematical learning of hearing-impaired students. In summary, the findings emphasize the importance of implementing inclusive strategies, providing adequate resources and support, and addressing any potential differences in attitudes related to gender, age, or qualifications in order to effectively empower hearing-impaired students in mathematics education in Pakistan.

Conclusion

To summarize, the research provides valuable insights into strategies for facilitating the learning of students with hearing impairments in mathematics classes in Pakistan. The findings indicate that educators hold a predominantly favorable view of the various inclusive initiatives and support systems aimed at enhancing the mathematical learning experience for students with hearing impairments. Some examples of these include visual aids, assistive technology, cooperative learning opportunities, specialized teacher training, inclusive classroom strategies, written communication, peer collaboration, peer advocacy, parent advocacy, collaboration between educators and families, professional development opportunities, real-world examples, and adequate resources and support services.

The report also emphasizes specific disparities and factors that influence educators' viewpoints. The respondents' perspectives on empowering students with hearing impairments differed based on their gender, suggesting that there may be gender-specific nuances in their opinions. In addition, although the classification did not have any noticeable effect on views, there were distinct differences based on the posting location and region. Postings in metropolitan and central areas were associated with higher average scores, suggesting that these locations provide better resources and support. The opinions of respondents towards strategies for empowering students with hearing impairments were shown to be influenced by their age and level of degree.

Overall, the findings emphasize the importance of implementing inclusive practices that are tailored to the diverse needs of children with hearing impairments, as well as the necessity of providing instructors with the necessary support and resources. To create a welcoming and helpful environment for students with hearing impairments in math classes, it is necessary to acknowledge and understand the factors that affect teachers' viewpoints and to address any differences that may arise. In order to enhance the mathematical fluency of Pakistani children who are hearing impaired, it is imperative for policymakers, educators, and stakeholders to collaborate and implement evidence-based policies and initiatives that promote inclusivity. Through this approach, we can strive to eliminate barriers and ensure equitable opportunities for all students, irrespective of their auditory capacity, to excel in the field of mathematics.

Recommendations

1. Establish and execute targeted teacher training initiatives that concentrate on deaf education and instructional methodologies to proficiently assist hearing-impaired children in mathematics.

2. Promote academic performance and inclusivity in mathematics education for hearing-impaired kids by fostering collaboration among educators, families, and support networks.

3. Provide resources and support services to schools and centers, with a special focus on rural areas, to provide fair and equal access to educational opportunities for kids with hearing impairments.

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