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Challenges Faced by Hearing-Impaired Children in Mathematics at the Primary Level: A Perspective from Primary School Teachers in District Gilgit

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Abstract

This study explores the challenges encountered by hearing-impaired (HI) children in learning mathematics at the primary level in Gilgit District, Pakistan, drawing insights from 55 special education teachers. Using a quantitative research design and a purposive sampling technique**,** data were gathered through a structured Likert-scale questionnaire to assess teachers' perceptions of the mathematical difficulties faced by HI students. The study identifies major barriers in performing basic calculations, understanding inequality symbols, and participating in classroom activities, primarily due to communication constraints and limited auditory input. The findings highlight four central dimensions of these challenges. First, mathematical calculations pose persistent difficulties, as HI students struggle with fundamental operations such as addition and subtraction, and require additional time and support for complex tasks like money calculations. Second, in understanding mathematical concepts**,** students often misinterpret symbols, particularly inequality signs ("<" and ">") as a result of limited verbal instruction. Third, challenges in support and communication arise from teachers' insufficient sign language proficiency and the absence of specialized mathematical support systems. Lastly, teachers identified effective instructional strategies**,** including the use of visual aids, hands-on learning, technology-based teaching, and individualized instruction tailored to diverse learner needs. The study emphasizes the need to strengthen teacher training in inclusive pedagogy, integrate assistive technologies, and promote collaborative partnerships among teachers, schools, and parents. These measures are essential to cultivating an inclusive and equitable learning environment that enhances the mathematical comprehension and classroom participation of hearing-impaired learners.

Keywords: Hearing-Impaired Children, Mathematics Education, Special Education, Gilgit- Baltistan

Introduction:

Hearing loss is one of the most common disabilities that affect a large number of people globally and, as a result, has a major negative effect on the education system, especially in subjects such as mathematics, which highly depend on effective communication. The World Health Organization (WHO) report reveals that around 6.4% of children in Pakistan suffer from hearing impairment which not only puts a load of serious challenges on their academic and personal growth but also

the whole educational system (WHO, 2019). Differentially, children who are hearing-impaired (HI) face difficulties in learning mathematics, which is better explained by considering their restricted auditory input that plays a decisive role in grasping mathematical concepts, problem-solving strategies, and teachers' instruction (UNESCO, 2017). The issues become even more formidable at the primary school level, which is the stage where basic skills in mathematics are meant to be established. The lack of auditory input makes it difficult for hearing-impaired (HI) kids to understand fundamental mathematical ideas that involve numbers, operations, and problem-solving methods. The communication barriers that exist make these problems even more severe; thus, the children become socially isolated, and their participation in classroom activities is lowered (Bat-Chava, 2000). To overcome these issues, teachers use visual means such as figures, charts, and manipulative that help to demonstrate to the students the abstract mathematical concepts in a way that is more understandable (Mayer, 2009). The studies show that visual aids do not only help to make the concepts clearer but also to the development of problem-solving skills as well as to the retention of the memory of the HI students (Nunes & Moreno, 2002; Kritzer, 2009). Nevertheless, the extent to which these instruments are effective is contingent upon the training of teachers and the availability of resources, which, can be quite different from one school to another, especially in underdeveloped areas like Gilgit District (Antia & Wang, 2010; Kritzer & Allen, 2009). Memory related to hearing is a frequent source of trouble for children with diminished hearing faculties, especially when it comes to mental calculations and complex problem-solving in mathematics. These children usually depend on visual and tactile information, which makes the learning process more mentally demanding for them. As a result, they become tired and their level of interest decreases (Kritzer, 2009). Apart from that, hearing-impaired children may face social and emotional problems, such as difficulty establishing friendships with peers, which in turn becomes a barrier to creating a safe environment for mutual learning in math (Bat-Chava, 2000). This study is dedicated to understanding the challenges faced by HI students in learning math at primary level in Gilgit District through the lens of primary school teachers. It is a journey to find the methods of teaching that would bring about the positive changes in the learning experiences and academic achievements of these students. Mathematically, hearing-impaired students are left behind due to the various problems that come their way; these problems are mainly the language barrier that they face, their limited access to the information, and the lack of suitable methods for their teaching, etc. Although the need for an inclusive education is more and more emphasized, there is still a big silence of research that speaks about the problems of hearing-impaired children in learning mathematics at the primary level in the region of Gilgit District, Pakistan. The present investigation is thus meant to fill this void and to realize the first goal by finding out teachers' views about the challenges and the second goal by getting teachers' guidance to support hearing-impaired students in math.

Research Objectives

1. To investigate the essential challenges of children with hearing disabilities grasping and performing mathematical calculations at a primary school level.
2. To study the problems of hearing-impaired children's understanding and applying math concepts**,** such as the use of inequality symbols at the primary level.
3. To find out the views of teachers about the obstacles that the hearing-impaired children face in learning math and the kind of help they need.
4. To suggest efficient methods of teaching and a system of support that would motivate the hearing-impaired students to learn mathematics at the primary level.

Review of Literature

Hearing-impaired students are often challenged in the comprehension and execution of mathematical calculations. The cause of their difficulty is essentially their reliance on the spoken mode of instruction. Since most conventional methods of teaching mathematics depend on verbal communication, hearing-impaired students face the problem of grasping the most elementary concepts unless suitable changes are made. The research indicates that such students frequently find themselves in situations where they cannot follow the teacher's instructions, which may cause them not to understand mathematical operations and processes (Lakner, 2008). These problems become even more severe in classes where teachers' methods do not provide for the requirements of these students, thus making them unable to understand mathematical concepts. Besides academic challenges, students with impaired hearing may also suffer emotionally and socially. They might feel socially isolated, which, in turn, would lower their academic performance. If there are no appropriate means of communication, such as a sign language interpreter or a specially designed teaching method, students may feel left out. This makes it difficult for them to communicate with their peers and teachers (Chava, 2000). Such social obstacles may result in anxiety and frustration, which, in turn, have a negative effect on the academic performance of students with hearing impairments in mathematics. As a result of the interaction between communication difficulties and emotional isolation, they are less able to keep up with mathematical calculations, thus making the subject more intimidating. Research underpinning the education of hearing-impaired children further points out the insufficiency of the standardized testing procedures, which barely consider the specific learning needs of students with hearing impairments. Therefore, their academic potential might be wrongly estimated, which subsequently misleads the judgment of their performance in sectors such as mathematics (Khathare, 2020). The shortage of proper accommodations in testing settings causes the deaf or hard-of-hearing students to be unable to demonstrate their skills in mathematical calculations accurately. Hence, it is evident that hearing-impaired children need the implementation of more inclusive assessment methods as well as classroom tactics that boost their academic growth in mathematics.

Teaching Inequality Symbols to Hearing-Impaired Children:

Students who are deaf or hard of hearing are especially challenged with understanding mathematical principles that are based on oral descriptions, like symbols of inequalities. The students tend to have trouble with the syntax and vocabulary of mathematics, hence finding it difficult to solve word problems, symbolic notations, and mathematical processes like inequality. The language gap is particularly conspicuous when dealing with abstract ideas, which not only involve learning the vocabulary but also using it to solve problems. Consequently, most students with hearing disability do not understand and utilize mathematical symbols, which affects their comprehension of inequalities and other mathematical operations (Pagliaro, 1998). One of the main challenges that enhance these difficulties is the inability to access specialized teaching techniques and materials. The conventional use of verbal language and oral explanation in the classroom is not designed to meet the communication needs of the hearing-impaired. Since these students mostly use visual learning aids, their inability to apply mathematical concepts, such as inequality symbols, is exacerbated. Moreover, unprepared teachers who are not equipped to handle the special learning needs of deaf students impede their interaction with these sophisticated concepts even more (Bobzien, 2015). The lack of sign language instruction and visual displays in mathematical lessons presents an obstacle to the comprehension of abstract mathematical symbols and functions. To counter these challenges, studies indicate that using visual means of instruction and giving precise and simplified descriptions can go a long way in helping hearing-impaired students acquire mathematical concepts. Expressing mathematical problems in the form of

informal stories or employing everyday stories to introduce inequalities provides students with the ability to better relate with the content. Moreover, instructors are encouraged to include various modes of communication, such as sign language and visual materials, that facilitate students to comprehend and use mathematical concepts more meaningfully (Singleton, 2000). By embracing different teaching approaches, instructors can facilitate bridging the learning gap of inequality symbols and other mathematical concepts for hearing-impaired individuals.

Math Learning Challenges for Hearing-Impaired Children:

Teachers' views concerning the difficulties hearing-impaired students have in mastering mathematics uncover some important observations of the inadequacies of contemporary teaching practices. Most teachers complain of not having proper training in special education and deaf education, which restricts their capacity for teaching hearing-impaired students efficiently. Research shows that teachers who are not equipped with training in inclusive education feel they are not prepared to deal with the peculiar challenges faced by deaf students in areas such as mathematics. This professional vacuum accounts for the poor assistance given to these students, which affects their academic development (Krischler, 2019). Additionally, instructors point out that delivering impactful mathematics teaching to deaf students necessitates the employment of specialized techniques, like the use of sign language and other communication methods. Teachers constantly stress the necessity of having signing language interpreters during the classes in order that students grasp the material being given. Nevertheless, a good number of teachers are also admitting that their own deficiency in sign language skills and the lack of interpreters that are trained for the classroom being their major obstacles for effective teaching. These educators say that they sometimes modify their instructional activities according to the personal requirements of deaf students, thus they can be that this way they consume more time and it is more difficult especially in overcrowded classrooms (Khathare, 2020). Teachers suggest various ways to support hearing-impaired students more effectively. One of them is the use of assistive technology along with visual aids to make the traditional teaching methods more attractive and understandable. Moreover, Total Communication is a method combining signing, lip reading, and other forms of communication, and it is considered the most efficient way of ensuring that no student is left out in the classroom. Teachers also acknowledge that it is very important for them to have continuous professional development programs focusing on the different needs of hearing-impaired students. Once teacher training is enhanced and a more inclusive environment is created, teachers will be able to provide better support to the academic success of hearing-impaired students, especially in mathematics (Marasabessy, 2021).

Strategies and Support for Math Learning in Hearing-Impaired Children:

Bringing up mathematics teaching to a higher level for hearing impaired kids, one can think of various helpful teaching strategies and means of support. Chief among the propositions is definitely the employment of sign language as the main communication way in mathematics teaching. Experiments confirm that deaf students who master sign language make higher academic achievements since they are more capable of getting involved with and understanding mathematical concepts. Thus it is absolutely necessary to use sign language as the norm in interaction in the classroom for hearing-impaired students in order to guarantee that these students possess equal opportunities of acquiring mathematical knowledge as their counterparts (Bobzien, 2015). Teachers are advised to implement different kinds of visual aids in their teaching such as Sign language, charts, graphs, and pictorial representations to help the students understand the mathematical concepts better. The use of educational technology such as interactive software and apps that visually demonstrate mathematical operations can also be a source of support for hearing-

impaired students. With the help of these tools, students can get a better grasp of abstract concepts such as inequalities since these tools provide visual and interactive experiences which are more easily accessible than the traditional methods that rely on the auditory explanations (Khathare, 2020). In addition to this, it is very important to provide the teachers with the necessary training so that they will be able to use the tools effectively for instruction. Pagliaro states that the use of personalized teaching methods, which specifically address the needs of hearing-impaired students, is highly effective. Since these students might need more time to understand mathematical concepts, teachers are advised to use flexible teaching methods that facilitate differentiated instruction. Moreover, teachers are urged to work hand in hand with parents and caregivers in order to get them involved in reinforcing mathematical learning at home. Through such a supportive environment being established not only in the classroom but also at home, hearing-impaired students can achieve higher levels of success in mathematics (Pagliaro, 1998).

Research Methodology

This study employed a quantitative research design using a structured questionnaire to evaluate the effectiveness of existing teaching methods and identify the challenges encountered by hearing-impaired students in learning mathematics. The instrument consisted of Likert-scale items designed to capture teachers' perceptions regarding the learning difficulties experienced by these students at the primary level. A purposive sampling technique was adopted to ensure the inclusion of teachers with relevant experience in teaching mathematics to hearing-impaired learners. A total of 55 special education teachers from District Gilgit participated in the study, including both male and female educators, to ensure diverse perspectives. Data were collected through a self-administered survey, allowing respondents to provide their views independently and without external influence. The quantitative data were analyzed to identify patterns, trends, and the overall effectiveness of instructional strategies used in special education settings. All ethical considerations were strictly observed throughout the research process. Participants were informed about the purpose and scope of the study and assured of the confidentiality and anonymity of their responses. Informed consent was obtained before participation, and respondents were given the right to withdraw at any stage without any consequence. The study adhered to institutional ethical standards to ensure integrity and respect for participants' rights.

Data analysis

Table 1: Demographic Information of Teachers Teaching Hearing-Impaired Children in District Gilgit

Sr. No.	Category	Number of Teachers
1	**Gender**	
	Male	8
	Female	47
2	**Age**	
	20–25	18
	26–30	17
	31–35	8
	36–40	12

Sr. No.	Category	Number of Teachers
3	**Designation**	
	Principal	3
	Teacher	34
	Junior Teacher	12
	Senior Teacher	6
4	**Qualification**	
	B.Ed.	9
	MA	32
	M.Phil.	12
	Ph.D.	2
5	**Teaching Experience**	
	1–5 years	34
	6–10 years	6
	11–15 years	7
	16–20 years	8
6	**Teaching Experience with Disability**	
	1–5 years	35
	6–10 years	4
	11–15 years	9
	16–20 years	7
7	**Mathematics Teaching Experience**	
	1–5 years	37
	6–10 years	9
	11–15 years	6
	16–20 years	3
8	**Classroom Environment**	
	Inclusive Classroom	13
	Special Education Classroom	42

Table 1.1 provides demographic details about 55 teachers who teach hearing-impaired children in Gilgit District. A large majority of the teachers are female (85.5%), with only 14.5% being male. The age group with the most teachers is 20-25 years (32.7%), followed by the 26-30 years group (30.9%), indicating a relatively young teaching workforce. In terms of designation, most teachers are regular teachers (61.8%), with a smaller number of junior (21.8%) and senior teachers (10.9%). Only a few teachers hold principal positions (5.5%). Most teachers have a Master's degree (58.2%), followed by those with M.Phil. (21.8%) and B.Ed. (16.4%), and only 3.6% have a Ph.D. Regarding experience, 61.8% of teachers have between 1-5 years of teaching experience, and 63.6% have similar experience working with students with disabilities. Most teachers (67.3%) have 1-5 years of experience teaching mathematics, reflecting a fairly inexperienced mathematics teaching force. Most teachers (76.4%) work in special education classrooms, while 23.6% are in inclusive classrooms. This demographic data indicates that the majority of teachers are relatively

new and hold advanced degrees, but they mostly work in specialized, rather than inclusive, settings.

Table 1.2: Descriptive Statistics of Teachers' Opinions on the Challenges Faced by Hearing-Impaired Children in Mathematics

Statement	SD	D	N	A	SA	M	SD
Hearing-impaired children have trouble with simple math calculations	9 (16.4%)	16 (29.1%)	3 (5.5%)	19 (34.5%)	8 (14.5%)	6.04	2.76
Children with hearing impairment struggle with basic math concepts like addition and subtraction	7 (12.7%)	17 (30.9%)	10 (18.2%)	20 (36.4%)	1 (1.8%)	5.67	2.24
Children with hearing impairment have trouble with math calculations involving money	5 (9.1%)	21 (38.2%)	7 (12.7%)	20 (36.4%)	2 (3.6%)	5.75	2.25
Children with hearing impairment are slow in completing math calculations	9 (16.4%)	14 (25.5%)	17 (30.9%)	11 (20.0%)	4 (7.3%)	5.53	2.34
Children with hearing impairment need extra help with math calculations	4 (7.3%)	4 (7.3%)	11 (20.0%)	27 (49.1%)	9 (16.4%)	7.20	2.16

Table 1.2 provides descriptive statistics on teachers' views regarding the challenges faced by hearing-impaired children in mathematics. It includes responses to five statements about the difficulties these children experience when learning math. The first statement, "Hearing-impaired children have trouble with simple math calculations," was agreed upon by 34.5% of teachers, with a mean of 6.04, indicating moderate consensus and variability in their opinions. The second statement, "Children with hearing impairment struggle with basic math concepts like addition and subtraction," also showed 36.4% agreement, with a mean of 5.67, suggesting that teachers recognize significant challenges in understanding basic math concepts. A stronger agreement was seen for the third statement, "Children with hearing impairment have trouble with math calculations involving money," with 36.4% of teachers agreeing and a mean of 5.75, indicating that financial math problems are a major struggle for these students. In response to the statement, "Children with hearing impairment are slow in completing math calculations," 30.9% of teachers remained neutral, with a mean of 5.53, showing some variability in teachers' perceptions of students' speed in completing math tasks. Finally, the statement, "Children with hearing impairment need extra help with math calculations," received strong agreement from 49.1% of teachers, with the highest mean score of 7.20 and the lowest standard deviation of 2.16. This reflects a clear consensus that hearing-impaired children require additional math support.

Overall, the findings indicate that teachers recognize the significant academic challenges faced by hearing-impaired children in mathematics, particularly in performing basic and financial math tasks. Additionally, there is a strong consensus on the need for extra support to help these students succeed.

Table 1.3: **Descriptive Statistics of Teachers' Opinions on Challenges Faced by Hearing-Impaired Children in Understanding Inequality Symbols**

Statement	SD	D	N	A	SA	M	SD
Children with hearing impairment face difficulty in recognizing digits (e.g., < and >)	7 (12.7%)	20 (36.4%)	10 (18.2%)	13 (23.6%)	5 (9.1%)	3.27	1.43
Children with hearing impairment struggle to apply inequality symbols in math problems	5 (9.1%)	13 (23.6%)	13 (23.6%)	18 (32.7%)	6 (10.9%)	3.17	1.29
Children with hearing impairment often confuse inequality symbols (e.g., < and >)	4 (7.3%)	11 (20.0%)	12 (21.8%)	24 (43.6%)	4 (7.3%)	3.27	1.23
Children with hearing impairment have difficulty using inequality symbols to compare numbers	7 (12.7%)	5 (9.1%)	14 (25.5%)	22 (40.0%)	7 (12.7%)	3.30	1.38
Children with hearing impairment need extra support in understanding and applying inequality symbols	5 (9.1%)	10 (18.2%)	10 (18.2%)	20 (36.4%)	10 (18.2%)	3.42	1.34

Table 1.3 presents the descriptive statistics of teachers' opinions on the challenges faced by hearing-impaired children in understanding inequality symbols. The table includes responses to five statements related to the difficulties these children experience with inequality symbols in mathematics. The first statement, "Children with hearing impairment face difficulty in recognizing digits (e.g., < and >)," shows that 36.4% of teachers disagreed, with a mean of 3.27 and a standard deviation of 1.43, indicating moderate difficulty in recognizing these symbols. For the statement "Children with hearing impairment struggle to apply inequality symbols in math problems," 32.7% agreed, with a mean of 3.17 and a standard deviation of 1.29, reflecting a general understanding of the challenge in applying these symbols. The third statement, "Children with hearing impairment often confuse inequality symbols (e.g., < and >)," saw 43.6% of teachers agreeing, with a mean of 3.27 and a standard deviation of 1.23, highlighting the confusion that these children often face with inequality symbols. In response to "Children with hearing impairment have difficulty using inequality symbols to compare numbers," 40.0% agreed, with a mean of 3.30 and a standard deviation of 1.38, indicating significant challenges in using inequality symbols for comparison. Finally, the statement "Children with hearing impairment need extra support in understanding and applying inequality symbols" had strong agreement from 36.4% of teachers, with a mean of 3.42 and a standard deviation of 1.34, confirming the consensus that additional support is needed for these students. Overall, the data underscores the challenges faced by hearing-impaired children in understanding and using inequality symbols, with a clear recognition of the need for extra support to help them overcome these difficulties.

Table 1.4: Descriptive Statistics of Teachers' Perceptions on Supporting Hearing-Impaired Children in Mathematics

Statement	SD	D	N	A	SA	M	SD
I feel confident in my ability to teach mathematics to children with hearing impairment	1 (1.8%)	3 (5.5%)	5 (9.1%)	35 (63.6%)	11 (20.0%)	4.01	0.97
Teachers are supportive of children with hearing impairment in math classes	3 (5.5%)	3 (5.5%)	5 (9.1%)	33 (60.0%)	11 (20.0%)	4.00	1.02
Teachers communicate effectively with hearing-impaired children about math	3 (5.5%)	6 (10.9%)	8 (14.5%)	25 (45.5%)	13 (23.6%)	3.82	1.04
The school offers math support services for children with hearing impairment	5 (9.1%)	12 (21.8%)	29 (52.7%)	9 (16.4%)	0	3.52	1.04
Children with hearing impairment receive regular math feedback from teachers	2 (3.6%)	4 (7.3%)	9 (16.4%)	24 (43.6%)	16 (29.1%)	4.01	1.02

Table 1.4 provides descriptive statistics on teachers' perceptions of supporting hearing-impaired children in mathematics. The table presents responses to five statements about the level of support and communication provided to these students in math classes. The statement "I feel confident in my ability to teach mathematics to children with hearing impairment" showed strong agreement from 63.6% of teachers, with a mean of 4.01 and a standard deviation of 0.97, indicating that most teachers feel confident in their teaching abilities. Similarly, for the statement "Teachers are supportive of children with hearing impairment in math classes," 60.0% of teachers agreed, with a mean of 4.00 and a standard deviation of 1.02, reflecting general agreement on the supportive role teacher’s play. The statement "Teachers communicate effectively with hearing-impaired children about math" had 45.5% agreeing, with a mean of 3.82 and a standard deviation of 1.04, suggesting that while communication is generally effective, there is room for improvement. Regarding the statement "The school offers math support services for children with hearing impairment," 52.7% of teachers were neutral, with a mean of 3.52, and a standard deviation of 1.04, indicating some variability in teachers' experiences with school-based support services.

Finally, the statement "Children with hearing impairment receive regular math feedback from teachers" showed strong agreement (43.6%) with a mean of 4.01 and a standard deviation of 1.02, confirming that regular feedback is an important aspect of support for these students.

Table 1.5: Descriptive Statistics of Teachers' Perceptions on Effective Teaching Strategies for Hearing-Impaired Children in Mathematics

Statement	SD	D	N	A	SA	M	SD
Children with hearing impairment learn mathematics better through collaborative learning	5 (9.1%)	7 (12.7%)	10 (18.2%)	24 (43.6%)	9 (16.4%)	3.47	1.19
Children with hearing impairment learn mathematics better through individualized instruction	5 (9.1%)	5 (9.1%)	8 (14.5%)	27 (49.1%)	10 (18.2%)	3.68	1.12
Children with hearing impairment learn mathematics better through visual aids	4 (7.3%)	2 (3.6%)	8 (14.5%)	29 (52.7%)	12 (21.8%)	3.81	1.05
Children with hearing impairment learn mathematics better through hands-on activity	2 (3.6%)	3 (5.5%)	7 (12.7%)	33 (60.0%)	10 (18.2%)	3.84	1.01
Children with hearing impairment learn mathematics better through technology-based instruction	2 (3.6%)	4 (7.3%)	9 (16.4%)	21 (38.2%)	19 (34.5%)	3.91	1.05

Table 1.5 presents descriptive statistics on teachers' perceptions of effective teaching strategies for hearing-impaired children in mathematics. The table includes responses to five statements about different instructional methods. For the statement "Children with hearing impairment learn mathematics better through collaborative learning," 43.6% of teachers agreed, with a mean of 3.47 and a standard deviation of 1.19. Similarly, 49.1% agreed that individualized instruction is beneficial for hearing-impaired students, with a mean of 3.68 and a standard deviation of 1.12. The statement "Children with hearing impairment learn mathematics better through visual aids" had 52.7% agreeing, with a mean of 3.81 and a standard deviation of 1.05. The statement "Children with hearing impairment learn mathematics better through hands-on activity" received agreement from 60.0% of teachers, with a mean of 3.84 and a standard deviation of 1.01, reflecting strong support for hands-on learning approaches. Lastly, the statement "Children with hearing impairment learn mathematics better through technology-based instruction" showed the strongest agreement, with 38.2% agreeing and 34.5% strongly agreeing, resulting in a mean of 3.91 and a standard deviation of 1.05. Overall, the data indicate that teachers strongly favor collaborative, hands-on, and technology-based learning strategies for hearing-impaired children, with visual aids and individualized instruction also being recognized as effective methods.

Summary:
This study investigates the challenges hearing-impaired (HI) children face in learning mathematics at the primary level in Gilgit District, Pakistan. Hearing loss creates a significant barrier to education, especially in subjects like mathematics, where clear communication is essential. The study looks at how communication difficulties and the lack of auditory input affect HI children's ability to understand key mathematical concepts. It also aims to identify teaching strategies and support systems that can improve math learning for these students. The research was carried out through a questionnaire given to 55 special education teachers who have experience teaching mathematics to HI children. The questionnaire asked teachers to rate various challenges, such as the difficulty HI children have with basic calculations, understanding mathematical symbols (particularly inequality symbols), and engaging with the subject due to communication barriers.

The results highlight the importance of specialized teaching methods, including the use of sign language, visual aids, and assistive technologies, to improve learning outcomes for HI students.

Findings:

1. **Challenges in Mathematical Calculations:**
   Teachers shared that hearing-impaired (HI) children struggled significantly with basic math calculations, including simple operations like addition and subtraction. They also faced difficulties with more complex tasks, such as money calculations. Many teachers noted that HI students were slower at completing math tasks and often needed extra help to stay on track.

2. **Difficulties with Mathematical Concepts:**
   HI students found it hard to understand concepts that rely heavily on verbal explanations, such as inequality symbols like "<" and ">". Teachers observed that students often misinterpreted these symbols, pointing out the need for additional support in this area.

3. **Support and Communication:**
   While teachers generally felt confident about teaching HI children and showed a supportive attitude, communication was identified as a major area for improvement. The lack of sign language skills among teachers and the absence of specialized math support services were noted as key obstacles in effectively communicating with HI students.

4. **Teaching Strategies:**
   Teachers highlighted a variety of strategies that were helpful in teaching HI students, including:
   - **Visual Aids:** Charts, graphs, and pictures were found to be highly effective in helping HI children grasp mathematical concepts.
   - **Hands-On Activities:** Teachers stressed the importance of hands-on learning, which allows HI students to connect theory with practical application.
   - **Technology-Based Instruction:** Interactive software and apps were seen as useful tools for teaching math to HI students.
   - **Individualized Instruction:** Customizing lessons to meet the specific needs of each HI student was recognized as an essential approach for effective teaching.

Discussion:

The findings of this study align with previous research, highlighting the significant challenges faced by hearing-impaired students in learning mathematics, particularly at the primary school level. The lack of auditory input disrupts the acquisition of fundamental mathematical concepts, which traditionally rely on verbal explanations. According to Bat-Chava (2000), hearing-impaired children often experience social isolation, and communication barriers lead to reduced participation in class activities. These barriers are particularly detrimental in mathematics, a subject that heavily depends on auditory communication during teaching. Studies by Nunes and Moreno (2002) and Kritzer (2009) emphasize that visual aids, such as diagrams and charts, significantly enhance understanding and retention of mathematical concepts, which corroborates the findings of this study. However, the findings of this research also support the work of Khathare (2020), who identifies the inadequacy of standardized testing for hearing-impaired students. These students are often at a disadvantage in traditional testing environments, where the assessment methods do not accommodate their specific learning needs. This gap in evaluation practices leads

to inaccurate representations of their academic abilities, particularly in subjects such as mathematics, where the reliance on verbal instructions is common. The need for inclusive assessment methods and specialized teaching strategies, as outlined in this study, has also been discussed by Antia and Wang (2010), who argue for the importance of tailored educational tools and techniques to support HI students.

Moreover, the challenges in understanding abstract mathematical concepts, such as inequality symbols, further substantiate the arguments of Pagliaro (1998) and Bobzien (2015), who emphasize the linguistic and cognitive hurdles faced by HI students in comprehending mathematical language and symbols. As noted by Pagliaro (1998), HI students struggle with the structure and language of mathematics, which complicates their understanding of concepts like inequality. This study similarly found that many teachers observed confusion and difficulty in applying inequality symbols among HI children, which suggests that a significant gap exists in their conceptual understanding of basic mathematical operations.

Despite these challenges, the study's findings also support the importance of alternative teaching strategies and the integration of diverse modes of communication, which have been widely endorsed in the literature. Kritzer (2009) highlights the effectiveness of combining multiple teaching methods, such as visual aids, hands-on learning, and technology-based instruction, to engage hearing-impaired students. This study's results align with these findings, with teachers reporting positive outcomes when using visual aids, hands-on activities, and technology to facilitate learning. Research by Singleton (2000) similarly advocates for the use of Total Communication, which combines sign language, lip-reading, and other forms of communication, to address the diverse learning needs of HI students in mathematics.

In contrast, studies by Antia and Wang (2010) and Khathare (2020) also caution against the over-reliance on technology without sufficient teacher training and adequate resources. They argue that the effective use of technology and assistive devices depends significantly on teachers' preparedness and the availability of appropriate tools, which is a concern highlighted in this study. Many teachers reported limited access to technology and resources, which may hinder the full potential of these teaching methods.

The findings also confirm the work of Krischler (2019), who observed that teachers' lack of training in deaf education often results in a suboptimal learning environment for HI students. In this study, many teachers expressed a need for more specialized training to effectively address the unique challenges of teaching mathematics to HI children. This gap in teacher preparation has been a recurrent issue in inclusive education research, as noted by Bobzien (2015) and Marasabessy (2021), who argue that professional development in deaf education and inclusive teaching methods is essential for improving educational outcomes for HI students.

Thus, while the study reaffirms the challenges faced by hearing-impaired children in learning mathematics, it also supports the idea that effective teaching strategies such as the use of sign language, visual aids, and technology can significantly improve learning outcomes for these students. However, for these strategies to be effective, they must be supported by adequate teacher training, resources, and institutional support, as emphasized by both this study and the broader literature on inclusive education.

Recommendations:

1. **Incorporating Sign Language and Visual Aids:**
   It is important for schools to use sign language as the main way of communicating in math lessons. Teachers should also make use of visual aids such as charts, graphs, and digital tools to help explain mathematical ideas more clearly.
2. **Teacher Training and Professional Development:**
   Teachers need ongoing training in inclusive education, especially focusing on sign language, visual aids, and teaching strategies designed for HI students. Professional development programs should also cover specific techniques for teaching math to hearing-impaired children.
3. **Use of Assistive Technology:**
   Schools should introduce assistive technologies, like interactive math software, to provide more visual and hands-on learning experiences that are easier for HI students to access and understand.
4. **Individualized Instruction:**
   Teachers should use flexible, individualized teaching approaches. This means offering different methods of instruction that cater to the unique needs of each HI student to help them succeed.
5. **Collaboration with Parents and Caregivers:**
   Teachers, parents, and caregivers should work closely together to reinforce learning outside of the classroom. This teamwork ensures that students get consistent support at home and school.
6. **Improvement of Support Services:**
   There is a need to improve specialized support services for HI students, such as providing more sign language interpreters and creating learning materials tailored to their needs. This will help create a more inclusive and supportive learning environment.

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