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TEACHERS' PERCEPTIONS OF STRATEGIES AS A DETERMINANT OF ACADEMIC ACHIEVEMENT IN MATHEMATICS AMONG PRIMARY SCHOOL LEARNERS WITH HEARING LOSS IN MERU AND THARAKA-NITHI COUNTIES, KENYA

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Absatract:
Education is a fundamental human right that contributes significantly to economic productivity and the development of a society. Learners with hearing loss commonly fall behind their typically developing classmates academically, and mathematics is one of the areas where they struggle to learn. If appropriately taught, research indicates that learners with hearing loss could be just as competent as their typically developing peers. This study sought to explore how teachers perceived to be the role of choice of teaching strategy on academic achievement in mathematics among primary school learners with hearing loss in Meru and Tharaka-Nithi Counties, Kenya. The study was guided by the Brunner Theory of Instruction (1996). It adopted a descriptive research design. The study targeted 215 learners with hearing loss. Additionally, the head teachers of the two schools and grade four, five, and six teachers teaching mathematics were also targeted. It utilized purposive, stratified, and random sampling techniques. A total of 78 respondents were

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sampled. The main tools of data collection were questionnaires, an interview schedule, and an observation schedule for data collection. Both qualitative and quantitative data were collected. Quantitative data were analysed and reported descriptively with the aid of Statistical Packages for Social Sciences, version 26. The qualitative data were analysed thematically and presented in the form of narratives. The findings show that teachers used various teaching strategies, such as lecturer-based teaching, demonstration and modelling, problem-solving approaches, and interactive teaching. They, however, failed to differentiate instructions to fit the learning needs of learners with hearing loss. Given that they have been demonstrated to be the most successful in improving subject acquisition and retention, the study recommends that teachers of mathematics prioritize group discussions, use of concrete materials, scaffolding, task analyses, peer teaching, and the implementation of IEP as essential strategies in their mathematics instruction for learners with hearing loss.

Keywords: inclusive education, teachers' attitudes, job satisfaction, teachers' burnout

1. Background of the Study

Historically, whenever a civilization placed a great value on mathematics ability, it made extra remarkable progress. Mathematical ability contributes to technological and scientific advancement (Algani, 2022). Mathematical knowledge is a collection of facts used for computation, addition, subtraction, rotation, and other operations with numbers (Tanridiler *et al.*, 2015). It is an important tool that helps people navigate the world around them through estimate and precise calculation. It is crucial since it develops the ability to think critically, solve problems and logically reason (Sigus & Madamuk, 2014). It is also an entry requirement to most careers such as science engineering and finance in many institutions of higher learning throughout the world.

The majority of education systems worldwide place a high priority on the teaching and study of mathematics. It is seen as a gateway to employment and technical development (Bakker *et al.*, 2021). It is argued that mathematical accomplishment in a learner's scholastic career lays the groundwork for success in a number of other areas. Additionally, it is said that the way to a wider job market is through the study of mathematics (Kathare, 2020).

The degree of hearing loss might have an adverse effect on a person's growth and academic performance. Learning mathematics has been observed to be challenging for learners with hearing loss, despite the fact that they have a number of options to improve their academic achievement, including special schools, regular schools with special units, or regular schools with regular and inclusive classrooms (Adeniyi & Kuku, 2018). The instructional strategy used during the teaching and learning process has been found to be a contributing factor in this problem, in addition to hearing loss and language barriers. According to Tanridiler *et al.* (2015), learners with hearing loss can learn mathematics

concepts at a slower speed than their hearing counterparts. Pagliaro and Kritzer (2005) suggested that the low achievement of learners with hearing loss was caused by their strong dependence on procedural knowledge and rote learning, with little attention paid to higher-order thinking and actual problem solving.

In the United States of America, Shelton *et al.* (2016) established that scheduling, curriculum integration, training, and other resource limitations hinder the teaching and learning of mathematics for learners with hearing loss. Learners with hearing loss struggle with arithmetic problems because it is somehow abstract, hence difficult to understand and apply. Although it is acknowledged that learners may understand mathematical concepts intuitively, a lack of explicit knowledge of these concepts may make it challenging for young learners to draw on their prior knowledge and make crucial connections when they encounter formal mathematics in school.

In Pakistan, Parvez *et al.* (2019) established that learners with hearing loss employ distinct learning strategies than those of typically developing individuals. Since they communicate and learn using total communication (TC) rather than natural language, they must work very hard to master various topics utilizing traditional pedagogies. As a result, assistive technology is desperately needed to increase their comprehension and learning potential.

Adeniyi and Kuku (2020) found that learners with hearing loss in Nigeria have a negative attitude toward mathematics. Poor mathematics performance was caused by a variety of factors, including a lack of teaching resources, a teacher's lack of qualifications, and a learner's fear of arithmetic. Learners can do better in mathematics by cultivating a good attitude, motivation, appropriate direction, and the availability of pertinent educational materials.

The application of interactive teaching techniques has been highlighted in South Africa (Prinsloo, 2000) as effective in teaching learners with hearing loss. In this instance, UNESCO (2016) recommends that educators create pedagogies that support diversity and make efficient use of instructors, other human and material resources, and learning assistance in order to ensure that learners participate fully. Unfortunately, a lot of regular teachers have trouble implementing integrated programs in inclusive classrooms because they don't have the skills and know-how to do so well.

According to research by Adeniyi and Kuku (2018), Ashmore (2017), and Sylvia (2015), learners with hearing loss lag behind their hearing classmates academically in many subjects, including mathematics. Communication issues may have led to the low accomplishment of learners with hearing loss, despite the fact that it has been observed that learners' achievement in mathematics has been relatively low (Kuku, 2019). Ashmore (2017) suggests that learners with hearing loss in middle and high school may have difficulty understanding mathematical concepts due to a language barrier. After several means of communication were examined but were unable to meet the needs of the learners in terms of communication, Kenyan Sign Language (KSL) was adopted in 2004 as a medium of instruction for learners with hearing loss (HL) (Ministry of Education

Science and Technology, 2016). It has been suggested that both ineffective teaching strategies and inappropriate use of instructional materials contribute to the achievement gap in mathematics among this group (Noorian *et al.*, 2013). Accordingly, the National Council of Teachers of Mathematics (2016) argued that teaching strategies that include learners in difficult mathematics tasks can raise achievement among learners with hearing loss.

2. Statement of the Problem

The constitution of Kenya (2010) guarantees the right to education for all learners with or without disabilities. Mathematics is a critical subject that improves the ability of an individual to solve problems and think critically. It is also a vital tool in the navigation of everyday life through precision and accuracy. In Kenya, mathematics is taught as a compulsory subject in all elementary, middle, and high schools, including those for learners with hearing loss. Learners with hearing loss have displayed dismal performance in Kenya Certificate of Primary Education during the last five years as per the Ministry of Education. Mathematics is a gateway subject to higher education and science and technology career courses. Poor performance has limited the ability of learners with hearing loss to further their education or join prestigious career courses like engineering and medicine. One way of improving performance for learners with hearing loss if differentiated instruction and modification of teaching strategies. It is important to investigate how teachers perceive choice of appropriate teaching strategy as a determinant of academic achievement in mathematics among learners with hearing loss. This intervention may be done to ensure appropriate teaching strategies for learners with hearing loss are adopted.

2.1 Purpose of the Study

The primary purpose of this research was to investigate teachers' perceptions on how choice of teaching strategy affects academic achievement in mathematics among learners with hearing loss.

3. Theoretical Framework

The theory of instruction developed by Brunner (1996) served as the study's compass. The theory of instruction is concerned with what one wishes to teach and how best it can be learned. According to Bruner, effective teaching and learning are impacted by the attitude of learners toward learning, teaching and learning strategies, the presentation of learning material, and the rewarding of learners. Teachers of mathematics should actively create conducive conditions for teaching and guiding learners with hearing loss on how to learn mathematics. A skilled educator will create lessons that assist learners in understanding the connections between reality and the subject matter. Experiences

should take into account the nature and the various cognitive levels of the learners. It is the duty of the instructor to pinpoint the ideas that constitute the fundamental framework of the subject matter, and the variables influencing mathematics performance. Teachers should choose appropriate, concrete and interactive teaching and learning materials and as well use student-centered teaching strategies while teaching learners with hearing loss.

The mathematics curriculum is set out in a spiral and hierarchical way. As a result, the teacher, having the so-called BIG IDEA in mind, should create lessons that allow concepts to be organized hierarchically, which helps the learners grasp the concepts more fully by integrating them into their prior understanding of the subject matter. More interactions between teachers and learners, learners and peers as well as between learners and resources should be enhanced.

4. Brief Literature Review

4.1 Teaching and Learning Strategies in Mathematics and Learners with Hearing Loss

Differentiated instruction is paramount if learners with hearing loss are to learn and understand mathematics like their peers. It refers to the process of adjusting curriculum methods to meet the needs of diverse learners. It improves learning by providing multiple ways for learners to understand and master the mathematics curriculum (Reis & Renzulli, 2018). Erbas (2017) looked into the methods teachers employ to encourage the inclusion of deaf and hard-of-hearing learners. This qualitative study was conducted in a small Midwest town to learn more about the general education teachers' instructional strategies in a sample of inclusive K–6 elementary classes. The goal of the study was to determine how general education teachers implemented inclusion-promoting tactics for learners who are deaf or hard of hearing (DHH) as well as whether they did so. Three general education instructors participated in the data collection process, which involved observations and interviews. The findings established that general education teachers made an effort to assist the inclusion of pupils who are DHH by using a variety of tactics. This included the use of workstations, various information representations by incorporating technological and visual aids into their instruction, the seating arrangement, the provision of assistive listening devices (hearing aids) for the hard of hearing, and the use of personal microphones (for those who can hear faintly) to support the use of assistive listening devices by the learners in the three classrooms.

In Namibia, a study by Abiatal and Howard (2019) intended to determine whether using digital assistive technology would help learners with hearing loss perform better in mathematics. The study obtained scientific evidence through the use of constructivist digital assistive technology in a quantitative experiment and qualitative interviews with the participating teachers. The results from the experiment and the interviews both support the idea that constructivist digital assistive technology may have improved the learners' mathematical achievement. This represents a fresh contribution to the area by

presenting an intervention that is feasible, useful, and possibly helpful for improving the teaching and learning of mathematics for learners with hearing loss.

A study conducted in Nigeria by Kuku and Adeniyi (2020) looked at how learning interventions affected the achievement of learners with hearing loss in mathematics. The investigation was conducted in Lagos State's public primary schools. The study population included learners who had hearing loss. A sample of twenty-four learners was chosen using simple and purposeful random sampling techniques. A quasi-experimental pretest posttest control group was the research design employed. Data were gathered using the Mathematics Knowledge Check (MKC), and the mean, standard deviation, mean difference, and analysis of covariance (ANCOVA) were used to examine the data. According to the study, mathematics achievement increases when learners with hearing loss are exposed to gamification and experiential learning techniques. Furthermore, the study found that both male and female learners with hearing loss benefited from the two therapies. It was suggested that mathematics classes for learners with hearing loss use gamification and experiential learning techniques.

Owino (2011) highlights the need to emphasize the Individualized Educational Program (IEP) when teaching mathematics to learners with hearing loss. By adjusting their teaching methods to meet the specific needs of their learners, teachers can improve the learning outcomes for learners with hearing loss. The teachers' teaching practices play a major role in the performance of learners with hearing loss in mathematics. It is, therefore, a key determinant in the education and academic achievement of learners with hearing impairment. Teachers should employ appropriate teaching tactics to help learners with hearing loss understand the mathematics concept. Due to poor training or lack of appropriate teaching and learning resources, teachers in many developing countries like Kenya are known to use traditional teacher-centered strategies like the lecture method, which disadvantage learners with hearing loss, among other disabilities. It is necessary to differentiate instructions to meet the individual learning needs of learners with hearing loss.

5. Research Methodology

This is mixed method research that adopted a descriptive research design. The design was chosen due to its ability to accurately convey the sentiments, perspectives, and opinions of the respondents regarding the perception of how choice of teaching strategy influences academic achievement in mathematics for learners with hearing loss.

5.1 Sampling Techniques

This study utilized three sampling techniques: purposive sampling, stratified sampling, and random sampling. Meru and Tharaka-Nithi counties were purposefully selected owing to previous information about poor performance in mathematics for learners with hearing loss (Uwezo, 2017). Also, the researcher purposefully selected two schools

(School A in Meru County and School B in Tharaka-Nithi County). This ensured that the study's sample was representative of the population's key features and increased the likelihood of obtaining relevant and informative data. Purposive sampling, according to Kothari (2017), enables researchers to choose individuals who have particular traits or experiences that are crucial for achieving the study's goals. Random sampling was utilized to choose the learners with hearing loss. Therefore, a proportional sample size was drawn from the two schools using stratified random sampling. According to Creswell and Clark (2017), stratified sampling ensures that each subgroup or stratum of the population is represented in the sample.

5.2 Research Instruments

Data was collected through questionnaires, interviews and direct class observation by the researcher.

5.3 Data Analysis and Presentations

A descriptive analysis of quantitative data was conducted using the Statistical Packages for Social Sciences (SPSS v.26). Data were presented using descriptive statistics. Qualitative data was coded, transcribed and repeatedly read to establish patterns and themes and was reported narratively.

5.4 Ethical Consideration

Members signed an informed consent form. They were made to understand that their participation was voluntary and that they could withdraw anytime they so wished. They were also informed that the data would be only used for the purpose of research. Confidentiality was also guaranteed and only pseudonyms would be used.

6. Findings of the Research

The study sought to investigate teachers' perceptions on how choice of strategies influences academic achievement of learners with hearing loss. Questionnaires and interview schedules were used but before that, the researcher made a direct observation in class when lessons were taking place.

6.1 Findings from Observation Done in Classrooms on Teaching and Learning Strategies

When the researcher visited classes and made observations as teaching was taking place, she made the following observations. Visual aids and manipulatives (blocks, shapes, counters, clock dials, and pieces of paper) were used to provide a comprehensible representation of abstract mathematical concepts. However, due to unfavourable teacher-student ratio, they were not optimally utilized. There was minimal use of technology. Teachers improvised by allowing learners to use their laptops and phone gadgets and the

few computers available, but this was not sufficient. There was minimal or no collaboration among teachers, and cooperative teaching was not adequately utilised. There was an effort to use real-world relevance of mathematical concepts, but this was not very adequate. The I.E.P. were kept but rarely referred to while choosing teaching strategies and were not updated. Some learners did not have any I.E.P files. Teaching Pace was not adjusted based on the learning needs of individual learners with hearing loss, and teachers moved with the pace of bright learners. The classrooms were fairly well lit, but during electricity blackouts or when the generator was in use, there were learners who were struggling to see what was written on the chalkboard. There was fairly well-kept paper, but progress records had significant gaps. Performance in mathematics was notably very poor as per the records.

6.2 Teachers' Opinions on the Use of Differentiated Teaching and Learning Strategies for Learners with Hearing Loss

Teachers were given Likert scale questionnaires to respond to statements related to perceptions on the use of given strategies to teach learners with hearing loss. Below is a summary of their responses.

Table 1: Teachers Perceptions of Effectivenss of Teaching and Learning Strategies

Statements	SA		A		U		D		SD		Mean
	F	%	F	%	F	%	F	%	F	%	
The use of visual aids (e.g., videos, images, diagrams) in the classroom helps the learners understand the subject matter better.	4	66.7	2	33.3	-	-	-	-	-	-	3.98
Use of Kenyan Sign Language or other communication modes improves the comprehension of the lesson.	3	50.0	3	50.0	-	-	-	-	-	-	3.83
The availability of assistive listening devices (ALDs) or hearing aids in the classroom positively impacts the participation and engagement of learners.	2	33.3	4	66.7	-	-	-	-	-	-	3.51
Captioned videos and transcripts are provided for audio content learning.	3	50.0	2	33.3	1	16.7	-	-	-	-	3.86
Providing written summaries of lectures or key points helps the learners review and retain the material more effectively.	2	33.3	3	50.0	1	16.7	-	-	-	-	3.69
The provision of extra time for assignments and exams considers the unique challenges faced by learners with hearing loss.	2	33.3	3	50.0	1	16.7	-	-	-	-	3.62
Encouraging group discussions and peer interactions allows learners with hearing loss to learn from different perspectives and experiences.	3	50.0	2	33.3	1	16.7	-	-	-	-	3.79

Source: Field Data (2023).

From the observation done by the researcher, it is clear that the strategies used are not properly differentiated, and at the same time, teachers face a myriad of challenges. From the table above, however, it is clear that teachers really knew what it entailed to teach mathematics to learners with hearing loss and the strategies to be used. An unfavourable teacher-student ratio and lack of resources were hindering factors to the appropriate choice of teaching strategy. The results in Table 1 indicate that most teachers agreed that the use of visual aids (e.g., videos, images, and diagrams) in the classroom helps the learners understand the subject matter better, as presented by 4 (66.7%) strongly agreeing and 2 (33.3%) agreeing. The respondents also show that 50% of the teachers strongly agreed that using Kenyan Sign Language or other communication modes improves the comprehension of the lesson.

Research indicates that one key strategy in teaching learners with hearing loss involves the use of technology. It enhances learner communication and socialisation, especially for those with hearing loss. The roles played by technology include assistive technology, use of visual aids and language development (Rehman *et al.*, 2024). Internet can be used to provide animated explanations, captioned videos, sign language interpretation and text-based explanations. This significantly enhanced learners' interaction with education and learning materials (Patrick *et al.*, 2015).

Further, teachers agreed that the availability of assistive listening devices (ALDs) or hearing aids in the classroom positively impacts the participation and engagement of learners, as indicated by 2 (33.3%) strongly agreeing and 4 (66.7%) agreeing. ALDs or hearing aids amplify sound, making it clearer and louder for learners with hearing loss (Abiatal & Howard, 2019). This ensures that they hear the teacher's instructions as well as those of their peers during classroom discussion

The findings revealed that captioned videos and transcripts are provided for audio content learning, as presented by 3 (50%) strongly agreed and 2 (33.3%) agreed. The use of a variety of strategies to aid learning by learners with HL resulted in highly successful material delivery. The results revealed that 3 (50.0%) teachers agreed that providing written summaries of lectures or key points helps the learners review and retain the material more effectively. They also supported having learners work in groups. This finding supports that of Mwangi (2014), who found that active and working discussion groups are one of the strategies for educational enhancement in teaching for improved performance of a learner or learners.

Teachers agreed that the provision of extra time for assignments and exams considers the unique challenges faced by learners with hearing loss, as indicated by 3 (50.0%). Moreover, 3 (50.0%) strongly agreed that teachers encouraging group discussions and peer interactions allows learners with hearing loss to learn from different perspectives and experiences. The results align with the research conducted by Kuku and Adeniyi (2020), who found that mathematics achievement increases when learners with hearing loss are exposed to gamification and experiential learning techniques. It is

important to note that despite the above results on teachers' perceptions, the actual use of the same in the field is different. This was evident from the interview responses below.

6.3 Interview Responses and Related Discussion

Through face-to-face interviews, teachers were asked to comment on their use of differentiated instruction for learners with hearing loss. Below are thematically sampled responses.

> *"I strongly believe in modifying instructions for learners with hearing loss. Unfortunately, I do not get enough support from the administration. Some of the modifications require money which is not readily available. I cannot, however, blame the head teacher because sure he cannot use his personal money if the government has not provided. Administration work is also overwhelming for him."* (Teacher 1)

> *"I have to be honest with you. I do not differentiate instructions while teaching mathematics. To start with, I personally do not like teaching mathematics. I am not competent but I am required by the head teacher to do so due to staff shortage. On the same note, since I left college, we have not received any in-service training on how to best teach learners with hearing loss. Technology and research findings call for enhancement training. The current situation has led to continued poor performance of our learners in Mathematics."* (Teacher 2)

Asked whether there is collaboration and teamwork in differentiating work among teachers, the following was the response:

> *"Sadly, the collaboration is minimal. There is too much work, hence very little time for meetings. We cannot have collaboration without meetings, so we have discussions on how to go about it. On the same note, the head teacher is always in meetings outside the institution and when around, he is too busy doing administrative duties."*

The teacher was probed further on what she thought was the implication of lack of differentiated teaching on academic performance in Mathematics. This was the response:

> *"Honestly, this is not something I am proud of. The performance of mathematics has not been very appealing compared to other subjects. Something must be done."*

The two head teachers were also interviewed on what they perceived to be the state of use of Kenya Sign Language and differentiating instructions to fit the needs of learners with hearing loss:

"While Kenya Sign Language is a good intervening language to use to teach mathematics to our learners, the majority of the teachers have different competence variations which cause confusion to the learners with hearing loss. Most of these learners are also used to nonconventional language of communication normally used in their homes before joining this school. We also have diverse cultural nuances among them due to diverse cultural backgrounds." (Teacher 3)

"I strongly believe in the use of KSL, but some of us were not trained to use it. In my teacher's training institution, I was taught to use American Sign Language. While the two are somehow related, I find it a challenge. As well, some learners have not been exposed to either of the two sign languages but use nonconventional sign language." (Teachers 4)

According to Njoroge (2019), the use of Kenyan Sign Language contributes to a more inclusive classroom environment. It empowers learners to participate fully in discussions, ask questions, and collaborate with their peers, fostering a sense of belonging and community within the mathematics classroom.

As noted from the above responses, there are challenges in collaboration and the use of KSL. Research indicates that among the challenges affecting the use of sign language is a lack of teachers who are proficient in the language, cultural biases or nuances, regional variation in sign language and difficult adapting some concepts in sign language (Bintoro *et al*., 2023). The catchment area of the two schools of research is quite wide, leading to the interaction of cultures. On the other hand, some mathematic concepts are difficult to conceptualize in sign language. This remains a challenge in the institutions of research.

Teachers were also asked to comment on their use of cooperative learning and multi-disciplinary teaching approaches. The following were their response:

"I strongly believe in the two, but logistics have made it difficult. Cooperative teaching has been hard to apply here because learners vary in their communication competence. On the same note, the numbers are too many. Our teacher-learner ratio is quite overwhelming. Further, we do not have interpreters for some of our learners who are not conversant with American Sign Language. On the multidisciplinary teaching approach, we do not have enough cooperation from both parents and related professionals. A multi-disciplinary team approach entails a number of partners." (Teacher 1)

Teacher 2, had the following to say:

"I have a number of challenges in this. A multidisciplinary team approach requires several meetings that are time-consuming. Getting a common time for all stakeholders is a difficult task. With the introduction of a competence-based curriculum, there is not much time for meetings. The curriculum is too overwhelming. On the same note, our school population

is too high. Teachers Service Commission has not deployed enough teachers despite enrolment being too high." (Teacher 2)

Probed further about use of Individualized Educational Program, this was the response

"Many of our learners come here with incomplete records. Their I.E.P. files are incomplete. We have a lot of gaps. Some have been poorly assessed for comorbidity. Apart from having hearing loss, they seem to have secondary conditions like AD/HD, learning disabilities and Autism. We try our best, but some of the key areas, such as competence levels and teaching and learning strategies, are incomplete. This is quite frustrating when half of the class is in that category."

The above teacher response clearly indicates that there are challenges in collaboration and use of multidisciplinary team approach in both institutions. A multidisciplinary team is a collaborative approach where professionals, including educationists, psychologists, etc, work together to address a common goal. This gives a holistic approach to dealing with a challenge in special education.

The interactive experience depends on mastery of the knowledge and professional experience and the ability to consume and respond to knowledge brought by other professionals in the meeting (Bagadood & Saigh, 2022). It means that knowledge from several disciplines is employed in solving a particular problem, and they are supplementary to one another to the point of getting a clear-cut solution to the problem (Ogwuegbu, 2018). A good example, as mentioned by one of the respondents above, is when reviewing or writing an I.E.P. This document outlines an education program and services that a particular learner needs to have to have her education needs addressed. Depending on the assessment done, several stakeholders and professionals may be involved (Roy, 2023). Depending on the learner's needs, they may include medics, psychologists, and occupational therapists. They have to work hand in hand with the parents.

6.4 Summary of Findings on Teachers' Perceptions on Choice of Teaching and Learning Strategies and Implication to Academic Achievement

The findings of this research show that there was an effort to use teaching strategies appropriate for learners with hearing loss, but this was not adequately done. There is no effective differentiation of instructions to fit the learning needs of learners with hearing loss. The results show that teachers used various teaching strategies, such as lecturer-based teaching, demonstration and modelling, problem-solving approaches, and interactive teaching. These traditional strategies were not modified to meet the learning needs of learners with hearing loss. Teachers demonstrated that they knew how to improve the academic achievement of learners with hearing loss. However, they lacked

support from the administration and resources and were not appropriately trained. No in-service training has been done recently. The teacher-student ratio was also a detrimental factor. Individualized Education Programs were not correctly updated, and progress records were poorly maintained.

7. Recommendations

Below are recommendations to both practitioners and policy makers.

7.1 For Practitioners

It is also important that the teachers use collaborative teaching approaches and enhance multidisciplinary team approaches as they teach mathematics to learners with hearing loss. At the same time, they should take personal initiative to improve their computer teaching skills. Finally, they should acquaint themselves with learner-friendly or student-centred teaching approaches such as scaffolding, task analyses and peer tutoring. Individualized education plans should also be appropriately updated and used.

7.2 For Policy Makers

The government should ensure that each teacher training institution prepares potential teachers for learners with hearing impairments who have a component of ICT in their curriculum. It is also important to make policies that ensure regular in-service training courses for teachers teaching Mathematics to learners with hearing loss. More funding should be available in institutions teaching learners with hearing loss, and the government should ensure regular electricity in these learning institutions.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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References

Adeniyi, S. O., & Kuku, O. (2018). Effectiveness of two instructional methods on reasoning ability of children with hearing impairment in Nigeria. *Specijalnaedukacija irehabilitacija, 17*(4), 395-417. https://doi.org/10.5937/specedreh17-18600

Adeniyi, S., & Kuku, O. (2020). Impact of gamification and experiential learning on achievement in mathematics among learners with hearing impairment in Lagos State, Nigeria. *African Journal of Educational Studies in Mathematics and Sciences*, *16*(2), 51-65. http://dx.doi.org/10.4314/ajesms.v16i.2.4

Akpinar, B., Selim, E. & Yılmaz, E. (2010). Problems encountered in the applications of multiple intelligence theory in primary schools in Turkey. *Procedia - Social and Behavioral Sciences. 9*. 1873-1877. http://dx.doi.org/10.1016/j.sbspro.2010.12.416v

Ashmore, B. (2017). A study of the performance of deaf/hard of hearing learners in high school mathematics on conceptual understanding, procedural fluency, and mathematical reasoning tasks. Master Thesis, The College at Brockport, State University of New York. Retrieved from 896. https://digitalcommons.brockport.edu/ehd_theses/896

Bakker, A., Cai, J., & Zenger, L. (2021). Future themes of mathematics education research: An international survey before and during the pandemic. *Educational Studies in Mathematics, 107*, 1–24. https://doi.org/10.1007/s10649-021-10049-w

Bintoro, T., Fahrurrozi, Kusmawati, A. P., & Dewi, R. S. (2023). The teacher strategies in teaching sign language for deaf students in special schools Jakarta. *Cogent Education*, *10*(2). https://doi.org/10.1080/2331186X.2023.2258294

Bizimana, D. B., & Orodho, J. A. (2014). Teaching and learning resource availability and teachers' effective classroom management and content delivery in secondary schools in Huye District, Rwanda. *Journal of Education and Practice*, *5*(9). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3178220

Charema, G., & Charema, J. (2013). The effects of the verbal language on the performance of children with hearing impairments in mathematics in Zimbabwe. *Journal of Languages and Cultures*, *4*(8), 139-149. http://dx.doi.org/10.5296/ire.v1i1.4284

Charema, G., & Charema, J. (2013). The effects of the verbal language on the performance of children with hearing impairments in mathematics in Zimbabwe. *Journal of Languages and Cultures*, *4*(8), 139-149. Retrieved from http://dx.doi.org/10.5296/ire.v1i1.4284

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage Publications. Retrieved from https://collegepublishing.sagepub.com/products/designing-and-conducting-mixed-methods-research-3-241842

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications. Retrieved from

https://www.ucg.ac.me/skladiste/blog_609332/objava_105202/fajlovi/Creswell.pdf

Damrongpanit, S. (2019). From modern teaching to mathematics achievement: The mediating role of mathematics attitude, achievement motivation, and self-efficacy. *European Journal of Educational Research*, *8*(3), 713-727. https://doi.org/10.12973/eu-jer.8.3.713

Githaiga, E. W., Mutahi, D., & Mwenda, M. P. (2018). Influence of Learner's Attitude in Mathematics Performance among Learners in Public Secondary Schools in Kilifi Sub-County, Kenya. *International Journal of Novel Research in Humanity and Social Sciences* Vol. 5, Issue 5, pp: (228-237). Retrieved from https://www.noveltyjournals.com/upload/paper/Influence%20of%20Student-1513.pdf

Hwang, S., & Son, T. (2021). Learners' Attitude toward Mathematics and Its Relationship with Mathematics Achievement. *Journal of Education and e-Learning Research*, *8*(3), 272-280. Retrieved from https://files.eric.ed.gov/fulltext/EJ1313916.pdf

Kathare, N. M. (2020). Effect of teaching methods on academic performance in mathematics among learners with hearing impairment in Meru County, Kenya. (Unpublished Doctoral dissertation, Kenyatta University). Kenya. Retrieved from https://ir-library.ku.ac.ke/items/8e08d01c-2192-4755-9ec9-6b7352558ab1

Kothari, C. (2017). Research methodology methods and techniques by CR Kothari. *Published by New Age International (P) Ltd., Publishers*, *91*. Retrieved from http://dl.saintgits.org/jspui/bitstream/123456789/1133/1/Research%20Methodology%20C%20R%20Kothari%20%28Eng%29%201.81%20MB.pdf

Kuku, O. O., & Adeniyi, S. O. (2020). Impact of learning interventions on mathematics achievement among learners with hearing impairment. *Contemporary Educational Researches Journal*, *10*(4), 131-143. Retrieved from http://dx.doi.org/10.18844/cerj.v10i4.5214

Lashley L. (2017). The effects of computer-aided instruction in mathematics on the performance of grade four pupils—Guyana. *SAGE Open*. Advance online publication. https://doi.org/10.1177/2158244017712775

Livumbaze, A. G., & Achoka, S. J. (2017). Analysing the effect of teaching/learning resources on learners' academic achievement in public secondary schools, Hamisi Sub-County, Kenya. *European Journal of Education Studies* 3(1). https://doi.org/10.5281/zenodo.244169

Lyons, A. (2012). Workers of tomorrow, Education in progress, Ministry of Education and Scientific Research. Port Fortis: Fiji.

Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: Quantitative and qualitative approaches* (Vol. 2, No. 2). Nairobi: Acts press. Retrieved from https://ir-library.ku.ac.ke/items/0769481e-46cb-4710-b595-5806ae7db90e

Ngetich, S.K. Wambui, B.K & Kosgei, Z.K. (2014). Determining optimal size and cost efficiency of Nandi District Secondary Schools. *European Scientific Journal, 10* (16),

211-220 Retrieved from http://eujournal.org/index.php/esj/article/download/3522/3294.

Njoroge, S. N. (2019). Effects of Teaching and Learning Resources in Lower Primary School Children in the Eastern Zone of Nakuru Municipality, Kenya. Retrieved from https://saudijournals.com/media/articles/SJHSS_412_776-782_c.pdf

Noorian, M., Maleki, S. A., & Abolhassani, M. (2013). Comparing of mathematical learners of deaf and normal types. *International Research Journal of Applied and Basic Sciences*, *7*(6), 367–370. Retrieved from https://europub.co.uk/articles/comparing-of-mathematical-students-of-deaf-and-normal-types-A-6395

Nordin, Norazah & Zaharudin, Rozniza & Yasin, Mohd & Din, Rosseni & Embi, Mohamed & Lubis, Maimun. (2013). ICT in education for deaf learners: Teachers' perspective. *Research Journal of Applied Sciences. 8.* 103-111. http://dx.doi.org/10.3923/rjasci.2013.103.111

Owino, C. O. (2011). Factors Contributing to Poor Performance in Mathematics at KCPE among Standard Eight Pupils in Primary Schools for Learners with Hearing-Impairment in Nyanza Province, Kenya (Doctoral dissertation). Retrieved from https://ir-library.ku.ac.ke/items/5218f007-f3bf-49cd-825c-df0fc68c2f4d

Roy, Suprajit. (2023). Individualized Education Plan, Process of IEP With Special Reference To Its Development and Implementation. Retrieved from https://www.researchgate.net/publication/374660928_Individualized_Education_Plan_Process_of_IEP_With_Special_Reference_To_Its_Development_and_Implementation

Su, J. Y., Guthridge, S., He, V. Y., Howard, D., & Leach, A. J. (2020). The impact of hearing impairment on early academic achievement in Aboriginal children living in remote Australia: a data linkage study. *BMC Public Health*, *20*, 1-13. Retrieved from https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-020-09620-6

Subia, G. S., Salangsang, L. G., & Medrano, H. B. (2018). Attitude and performance in mathematics I of bachelor of elementary education learners: A correlational analysis. *American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)*, *39*(1), 206-213. Retrieved from https://asrjetsjournal.org/index.php/American_Scientific_Journal/article/view/3821

Sylvia, M. (2015). Factors contributing to low achievement levels in mathematics among hearing impaired learners: A case of selected schools of Lusaka, Zambia. Master Dissertation, The University of Zambia, Lusaka. Retrieved from https://dspace.unza.zm/server/api/core/bitstreams/77d2457f-9dca-4e56-9f73-eea19d8e0cc8/content

Tanridiler A, Uzuner Y, Girgin U (2015). Teaching and learning mathematics with hearing impaired learners. *Anthropologist; 22*(2): 237-248. [Accessed on 16 Sep 2017]. Available from: https://doi.org/10.1080/09720073.2015.11891874

Yusta, N., Karugu, G., Muthee, J., & Tekle, T. (2016). Impact of Instructional Resources on Mathematics Performance of Learners with Dyscalculia in Integrated Primary Schools, Arusha City, Tanzania. *Journal of education and practice*, *7*(3), 12-18. Retrieved from https://eric.ed.gov/?id=EJ1089780