Teachers' Conceptualisation of the Learning Needs of Pupils with Cochlear Implants in Dar es Salaam's Inclusive Primary Schools, Tanzania

Sarah Ezekiel Kisanga[1] & Zamoyoni Ozeniel Foya[2]
[1]Department of Educational Psychology and Curriculum Studies, School of Education, University of Dar es Salaam, Dar es Salaam, Tanzania
[2]Manzese Secondary School, P.O. Box 34602, Dar es Salaam, Tanzania
Corresponding Author[1]: sarahdalton08@gmail.com
Email[2]: moyoni4eva@gmail.com

Abstract

This study employed a multiple case study design to examine teachers' awareness of the learning needs of pupils with deafness using cochlear implants (PCIs) in inclusive primary schools in Dar es Salaam, Tanzania. Data were collected from 25 participants through semi-structured interviews and observations and analysed thematically. The findings revealed that most teachers had limited knowledge of cochlear implants and the specific learning needs of PCIs, with only a few demonstrating adequate understanding. Teachers with special education training showed greater awareness than their counterparts in general inclusive schools. To bridge this gap, the Ministry of Education, Science, and Technology (MoEST) and the Tanzania Institute of Education (TIE) should integrate cochlear implant education into teacher training programmes. Furthermore, school management is encouraged to implement continuous professional development in collaboration with cochlear implant specialists to enhance teacher capacity in supporting PCIs.

Keywords: *inclusive education, cochlear implants, deafness, hearing impairment, special education*

DOI: *https://dx.doi.org/10.56279/ped.v42i2.7*

Introduction

Article 24 of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD-2006) acknowledges the fundamental principle of equal access to education for individuals with disabilities devoid of any form of discrimination. This provision underscores how individuals with disabilities, including Pupils with Cochlear Implants (PCIs), should be integrated into the mainstream educational system solely on the grounds of their disability. Nevertheless, to ensure effective inclusion, state parties must provide reasonable accommodation of individuals' requirements and support required within the general education system, such as teachers' preparation to support needs diversity in inclusive settings, facilitating in sign language, Braille and other co-

mmunication formats. In addition, the Salamanca Statement and Framework of Action on Special Needs Education of 1994 necessitates providing universal education to children, youth and adults with special needs in the regular education system. As such, governments ought to adopt the principle of inclusive education and enrol all children in regular schools as a matter of law or policy (UNESCO, 1994; Armstrong, 2016; Avramidis and Norwich, 2016).

Pupils with cochlear implants are considered learners with special needs due to their hearing impairments. In this study, hearing impairment is categorised into two main types: *deaf* and *hard of hearing*. Pupils who are hard of hearing can access verbal information with the help of amplification devices, whereas pupils with deafness cannot process verbal input through audition, even with hearing aids (Hallahan et al., 2019; Kisanga, 2019). Cochlear implants (CIs) have been defined in various ways by scholars worldwide. According to Heward (2014), a cochlear implant is a surgically implanted device that bypasses damaged hair cells in the inner ear and directly stimulates the auditory nerve. This enables individuals with profound hearing loss to gain auditory awareness and understand speech. A cochlear implant consists of two main components: an external processor, worn behind the ear, which captures sound signals, and an internal receiver, surgically implanted under the skin, which receives these signals and transmits them to electrodes placed in the inner ear. These electrodes stimulate the auditory nerve, allowing the signals to be sent to the brain for interpretation.

Globally, there are about 360 million individuals with hearing impairment, or about 5.3 per cent of the global population, of which 32 million are children (Alshuaib et al., 2015). In Africa, nearly eight million children grapple with disabling hearing loss, with more than 200,000 children born with this condition (Medel, 2021). In Tanzania, an estimated 0.5 per cent incidence of hearing loss among neonates translates into five cases for every 1000 live births (Kahinga & Jaffer, 2021). According to the World Health Organisation (WHO), hearing loss in children can have a detrimental effect on their learning and development of speech and language skills, resulting in academic underachievement when compared to their peers in general education. Pupils with hearing impairment learn differently depending on the severity of their respective condition. Traditionally, pupils with deafness learn using sign language and speech reading, whereas hard of hearing learn through auditory means aided by implication means such as hearing aids (Kisanga, 2019; Hallahan et al., 2019). The use of sign language and speech reading requires educational institutions equipped with skilled teachers or the availability of professional sign language interpreters, which developing countries such as Tanzania lack (Kisanga, 2019). Besides sign language, the use of hearing aids, and speech reading, pupils with hearing impairments also benefit from using cochlear implant technology.

The cochlear implant made its debut in the 1970s, with the first recipient hailing from Austria. From the 1970s to 1992, some 800 children worldwide benefited from cochlear implantation. By 1999, this number had reached 11,000 children globally. Notably, the use of cochlear implants among pupils aged 6 to 11 years increased from less than 15 per cent in 1999 to 22 per cent between 2002 and 2003 (Mauldin, 2016). Globally, by the end of 2012, the number of individuals with cochlear implants had surpassed 324,000 (Jaffer, 2017). South Africa was the first African country to introduce cochlear implantation in 1986, when the first procedure was performed. Two years later, the first child received a cochlear implant. Since then, over 1,000 individuals in South Africa have undergone the procedure (Muller & Wagenveld, 2020). Prior to the introduction of cochlear implantation in Tanzania, more than 70 children received implants abroad. In 2017, the service was established locally at Muhimbili National Hospital, where over 40 children have since received cochlear implants (Kahinga & Jaffer, 2021).

Cochlear implants for children born with profound hearing loss have rapidly increased due to their facilitative role in acquiring hearing and promoting the development of spoken language. The increase in CIs in the world has been attributable to universal newborn hearing screening [UNHS] (Medel, 2021). In many countries, including Tanzania, the age of implantation has decreased up to 12 months or even earlier. As a result, many children with profound hearing loss can develop speech and language naturally, which facilitates their inclusion in general elementary schools (Fitzpatric et al., 2015). Moreover, such implantation enables them to hear and understand speech without lip readings, unlike deaf children who depend on lip reading and sign language. Such assistive technology further allows them to pick up various sounds at different levels that similarly make them control their own voices (Sharma et al., 2020). Early CI for pre-lingual deaf children plays a vital role in developing language and gives children a better of attending inclusive schools in the general education system (Hoen et al., 2018).

Cochlear implant technology also enhances access to education for children with deafness worldwide. With CIs, children get integrated into inclusive schools, where they derive comparable educational benefits as their peers without such implants. For pupils with cochlear implants to thrive in inclusive educational settings, teachers should first perform a daily check on the CI to ensure the batteries are fully charged. In this regard, a trained teacher can additionally verify that the device is working properly before beginning the class. Secondly, teachers with support from professionals such as audiologists and speech therapists ought to acquire the necessary skills for instructing pupils with CIs effectively. Such training should also cover how to maintain and troubleshoot CI devices, including replacing depleted batteries and providing additional support to pupils with CIs to ensure they grasp the classroom content and outside classroom instructions (Davenport & Alber-morgan, 2016).

Likewise, to optimise the auditory environment for pupils with CIs, they must sit in positions offering the best auditory and visual access to classroom information. The classrooms should be equipped with Frequency Modulation (FM) or Infrared Systems (IRS) to enhance hearing, especially in noisy settings. The designated teacher should also be skilled in troubleshooting to address minor issues as they arise swiftly, thus ensuring uninterrupted learning for the CI pupil (Stith & Drasgow, 2015). Ultimately, facilitating the learning of pupils with CI in primary schools highly depends on the teacher's conceptualisation of the learning needs of PCIs.

Literature Review

The role of teachers in the inclusion of pupils with cochlear implants

Cochlear implants (CIs) offer a transformative opportunity for children with profound hearing loss by significantly enhancing their hearing and enabling participation in mainstream schools. However, to ensure academic success and improve future employment prospects, several support mechanisms must be in place to help these pupils adjust to their implants and the auditory environment. Teachers are responsible for routinely monitoring CI devices, ensuring they are charged and functioning properly before lessons begin. This task should be handled by a trained teacher with the knowledge to maintain and troubleshoot the devices as needed. Effective support also requires collaboration with audiologists, speech therapists, and families. These professionals play a critical role in training teachers to support CI users both inside and outside the classroom (Davenport & Alber-Morgan, 2016). Ongoing communication and experience-sharing among educators and specialists are essential in creating a supportive, inclusive learning environment for pupils with cochlear implants.

To enhance the auditory environment for students with cochlear implants (CIs), teachers should ensure that these pupils are seated in positions that maximise both auditory and visual access to classroom content. Classrooms should also be equipped with assistive technologies such as Frequency Modulation (FM) or Infrared Systems (IRS) to help CI users hear more clearly in noisy settings. Teachers must be trained to handle minor technical issues with CI devices to ensure uninterrupted use during school activities (Stith & Drasgow, 2015). Teachers play a central role in fostering an inclusive learning environment for students with CIs. This includes ensuring access to appropriate educational resources and addressing individual needs outlined in each pupil's Individual Education Plan (IEP). For instance, written materials such as lesson outlines and notes can support comprehension, while strategic seating arrangements can optimise both listening and visual engagement (Stith & Drasgow, 2015). Moreover, teachers should work to reduce background noise by closing classroom doors and using padded furniture to minimise disruptions from moving chairs and

tables. These adjustments help improve the learning environment for CI users (Davenport & Alber-Morgan, 2016; Kisanga, 2019).

Ensuring that students with CIs have access to the curriculum requires teachers to conduct regular checks on the functionality of the implants and to ensure that the learning environment is suitable. Close cooperation between staff, parents, and CI professionals is essential in this process. Melton and Higbee (2013) also emphasised the importance of consistent collaboration between cochlear implant specialists and school staff to meet the needs of students with cochlear implants effectively. Specialists can offer valuable insights into students' audiological profiles and evaluate their auditory performance within the classroom setting, contributing to an improved educational environment. Teachers should also provide teaching resources, such as microphones, FM systems, infrared systems, and desktop sound fields, to enhance sound volume during lessons. Moreover, classrooms should be free from excessive background noise, both inside and outside, and special safety considerations must be addressed. Classroom size can also affect the learning environment for students with CIs. Larger classrooms generate more noise, hindering the effectiveness of hearing devices. Excessive noise can interfere with a student's ability to hear clearly, thus compromising their learning experiences (Kisanga, 2019). Therefore, the design of the learning environment must take into account the specific needs of CI users, which highly depends on Teachers' awareness of the learning needs of PCIs.

Teachers' awareness of the learning needs of pupils with cochlear implant

Research has shown that teachers' awareness of the needs of learners with cochlear implants remains inadequate in many educational settings. A study by Ershad and Noreen (2020) in Pakistan highlighted the lack of teacher awareness about the functioning of CI devices and the instructional strategies necessary to support these students. The authors emphasised the need for targeted teacher training on differentiated instruction and strategies to assist students with CIs in mainstream settings. Moreover, the study pointed out the absence of policies supporting CI users in schools. Similarly, Krijger et al. (2020) found that students with CIs in Belgium experienced greater listening difficulties compared to their peers, attributed to factors such as low signal-to-noise ratios, limited multimedia resources, physical distance, and microphone-related issues. The study also identified a general lack of teacher awareness in supporting CI students effectively, although it did not explore the broader needs of CI users.

In Kenya, Gathumbi et al. (2015) examined the preparedness of teachers and school administrators to implement inclusive education. While the study assessed the general preparedness of teachers and administrators, it did not specifically address their aware-

ness of the needs of CI students. The study found inadequacies in physical infrastructure and instructional resources and a lack of staff training in supporting learners with special needs. The lack of collaboration among stakeholders was also noted. Blumenthal (2021) conducted a study in South Africa that explored the academic challenges faced by learners with CIs in mainstream schools. The study revealed that CI users faced both academic and social difficulties, primarily due to limited awareness among educators. Blumenthal recommended targeted teacher training to enhance the support for CI users, although the study did not examine the specific involvement of teachers in addressing the needs of these students. These findings underscore the importance of raising teacher awareness about the particular needs of CI users and providing the necessary training and resources to ensure that these students can thrive in mainstream educational environments. This study, therefore, assessed the teachers' conceptualisation of the learning needs of pupils with cochlear implants in Dar es Salaam's inclusive primary schools. Specifically, the study was guided by two research objectives:

i. To explore teachers' conceptualisation of the term 'cochlea implants'
ii. To assess levels of teachers' conceptualisation on the learning needs of pupils with cochlear implants do teachers possess?

Methodology

This qualitative research applied a multiple case study design with four private and one public inclusive primary school (Bryman, 2016; Creswell & Creswell, 2018). All five inclusive primary schools are located in the Dar es Salaam Region and are notable for actively enrolling pupils who utilise cochlear implants. The multiple case study design allowed the researchers to explore in-depth the teachers' awareness of the learning needs of PCIs in both private and public inclusive primary schools in the Dar es Salaam region, which was purposively selected because it has more than 800 pupils with hearing impairment enrolled in its primary school (PO-RALG, 2020). The region also has inclusive primary schools with deaf children using CIs, including the ready availability of cochlear implant clinics, cochlear implant experts, cochlear implant speech pathologists, and rehabilitation centres (Jaffer, 2017; Kahinga & Jaffer, 2021).

Participants and sampling procedures

Study's participants

The study involved twenty-five (25) participants, including 20 teachers and five PCIs. Out of the 20 teachers, 16 had more than 10 years of teaching experience. Five were head teachers, five were discipline teachers, and six were class teachers. The remaining four comprised two academics and two class teachers, each with less

than 10 years of teaching experience. Overall, most of the interviewed participants possessed substantial experience in teaching within inclusive school environments.

Sampling techniques

A purposive sampling procedure was employed to select both the participants and the schools (Yin, 2016; Bryman, 2016). The selection of participants in this study was conducted purposively from four private schools and one public school. To enhance anonymity and confidentiality, the study refers to these selected schools using alphabetical letters A, B, C, D and E (Cohen et al. 2018). The 25 study participants comprised five head teachers, five academic teachers, five discipline teachers, five class teachers and five PCIs. The selection of teachers was based on their strategic roles at their respective schools: the head teachers are responsible for all administrative roles; the academic teacher supervises all academic matters; the discipline teacher handles administrative issues related to pupils' behaviours and their general conduct; class teachers work closely with pupils using cochlear implants during classroom activities; and, finally, pupils with cochlear implants in standard five, six and/or seven helped to confirm the responses from other participants as direct beneficiaries of CI.

Research methods and tools

Semi-structured interviews

The study used semi-structured interviews to solicit information from all the teachers and PCIs. Interview questions were on teachers' awareness of the needs of learners with cochlear implants. PCIs were interviewed for triangulation purposes to authenticate information from head, academic, discipline, and class teachers (Cohen et al. 2018).

Non-participant observations

Non-participants' observation further verified the teachers' practices in catering for the learning needs of PCIs. The researchers observed teachers and classroom environments without actively engaging or interacting with participants. The researchers detached themselves from the participants, striving to minimise their influence on the participants being studied. A checklist was used to observe the qualities of a good classroom environment that enhances learning for PCIs. Specifically, the researchers noted the presence of classrooms with reduced background noises, FM, infrared system, desktop sound field and microphones that teachers and peers used during classroom sessions and break time. Therefore, not only did the use of multiple data sources enhance the credibility of the study's findings, but it also helped minimise potential threats to validity (Robson, 2011; Robson & McCartan, 2016).

Data analysis

The resultant qualitative data was then subjected to thematic analysis to understand various types of data, examine data classifications, and establish related themes (Bryman, 2016; Braun & Clarke, 2006). Particularly, data analysis entailed thorough reading notes and listening to the audio recordings for data organisation and familiarisation. Then transcription and labelling followed to obtain a general picture of the information. Data coding then proceeded to omit irrelevant information and create a backdrop for themes without distorting the main points. Thereafter, we organised, compressed, and integrated data according to the research objectives, in addition to classifying emerging themes into texts, phrases, and sentences.

Results and Discussion

Teachers' conceptualisation of cochlea implants

To assess the teachers' conceptualisation of the term cochlear implant, devices' capabilities, and its requirements, the study used interviews to collect data. During the analysis, two distinct themes surfaced: teachers' limited knowledge of the term cochlear implants and substantial awareness among teachers of cochlear implants. Four criteria, as outlined by Melton and Higbee (2013, helped to determine whether teachers had the required adequate knowledge based on their ability to:

i. describe cochlear implants and their functions,
ii. recognise cochlear implant users,
iii. distinguish cochlear implants from other hearing devices,
iv. state the device's components and the implantation process.

These criteria were used in accordance with the USA Individuals with Disabilities Education Act (IDEA) of 2004. The researcher classified those who could meet at least three out of these four criteria as having adequate knowledge. In contrast, those who could not meet three criteria were treated as having inadequate knowledge.

Teachers' adequate knowledge of cochlear implants

Only five teachers out of 20 participants demonstrated adequate knowledge of cochlear implants. These comprised three school heads and two class teachers from schools B, D, and E, who had adequate knowledge of the description of cochlear implants, their operations, and the crucial requirements for pupils using them. It was further established that this knowledge was experience-based and linked to their specialisation as special needs educators. However, some had also acquired such knowledge through collaboration with the parents of pupils who use cochlear implants. During the interview, the head teacher of School B and class teacher of School E were found to be conversant with the description of the cochlear implant,

as the following narration substantiates:

> Yes, I am familiar with cochlear implants. They are devices surgically implanted in individuals with hearing impairments to enable them to hear. I gained knowledge about cochlear implants when a concerned parent raised objections to her child being placed in a deaf classroom as the child was using a cochlear implant. The parent described the cochlear implant as a device that aids deaf individuals in hearing. It is implanted beneath the skin behind the ear, requiring additional supervision and care (Interview, HT, School B).

A class teacher made a similar response from school D, who noted, '*From my understanding, cochlear implants are highly beneficial devices for students with deafness. They enhance the processing of information through the auditory sensory system and are typically implanted in an individual through surgical procedures*' (Interview, Class Teacher, School D).

The narratives above indicate that teachers and headteachers possess sufficient knowledge about cochlear implants. The participants were able to explain the device's function, noting that it helps pupils hear and that its placement requires surgical intervention. More precisely, cochlear implants aid individuals with hearing loss in perceiving sound and developing language skills. This head teacher acquired information on cochlear implants through collaboration with parents of children with cochlear implants.

Moreover, class teachers from schools B and E demonstrated a thorough knowledge of cochlear implant technology and were well-versed in how to interact with pupils who use it. The teachers described the cochlear implant and its process during installation thusly:

> I am aware that a cochlear implant is a device surgically implanted in individuals with hearing impairments to enable them to listen and communicate verbally. This device aids deaf individuals to capture sounds from their environment and transmit them to the brain for interpretation, thus facilitating hearing and language development. I can easily identify pupils with cochlear implants by observing them wearing their hearing devices. Even without the visible hearing devices, I can recognise them by determining the location where the internal device is implanted (Interview, Class teacher, School B).

A class teacher from school E added:

> A cochlear implant helps pupils with hearing difficulties to hear sounds around them and send these sounds to the brain, where they

> are understood. This helps the child not only to hear better but also to learn and improve their language skills, which are important for communication. It is easy to identify a child using this device because they usually wear external hearing parts that can be seen. These external parts work together with the internal implant to help the child hear (Interview, Class teacher, School E).

The two statements, besides describing the device, also include identifying learners with CIs and familiarisation with the installation process. Apart from active collaboration with parents, the teacher had undergone formal special training, hence the solid knowledge. Davenport and Alber-morgan (2016) in their study describe the function of cochlear implants for young children as assisting them in developing their spoken language and listening abilities. More significantly, both the head teacher of school B and the class teacher distinguished CIs from other hearing devices when they spotted pupils wearing a cochlear implant. The two teachers of this school were also familiar with the cochlear implantation process. On the contrary, the academic teacher and discipline teacher of the same school were unaware of cochlear implant technology. Impliedly, there appears to be a lack of collaboration among teachers in the school in order for them to share knowledge effectively.

Regarding the teachers' awareness of the requirement for pupils using CIs, the class teacher from school E revealed during an interview adequate knowledge of cochlear implant technology. The teacher described clearly how the cochlear implantation process, how it assists deaf children to hear and the crucial requirements of pupils using it:

> In our school, many of us are well-versed in cochlear implants and how to support pupils with these devices. I know about its purpose, and I understand that it helps deaf pupils in hearing. I am also aware that it is surgically implanted beneath the skin behind the ear. My understanding of cochlear implants has been gleaned from various written sources and insights shared by parents. I can easily recognise pupils with cochlear implants by observing them wearing the device (Interview, class teacher, School E).

Teachers such as this one, who describe cochlear implants, state their functions, detail the cochlear implantation process, and differentiate cochlear implants from other hearing devices, were knowledgeable based on pre-set criteria. Such teachers with adequate knowledge of CIs from schools B and E enhanced the positive learning environment for pupils with cochlear implants relative to the limited knowledge the teachers from schools A, C and D possessed.

Teachers' limited knowledge of cochlear implants

The study found that teachers in three inclusive primary schools (A, C, and D) lacked sufficient knowledge of cochlear implants, as their descriptions of CIs failed to encompass three out of the four specified features. Across three schools, school management members were unaware of pupils using cochlear implants, their associated devices, and requirements, hence unable to fulfil the adequate knowledge possession criteria. In School A, the head teacher appeared unfamiliar with cochlear implants despite having pupils using CIs in the school:

> Unfortunately, our institution does not enrol pupils of this type. These pupils, in my opinion, attend deaf-specific special schools. The pupil in question is not deaf because she once had a hearing aid to hear, so I don't think she is in line with your study (Interview, HT, School A).

Implicitly, the head teacher at School A lacked adequate knowledge about cochlear implants. This ignorance on the part of the head teacher casts doubts about the kind of support rendered to the pupils when they were not even aware of their conditions. Moreover, inadequate knowledge of CIs captured from school management personnel occurred because of limited cooperation within the school and among the teachers, including with other personnel outside the school, such as cochlear implant experts. This limited knowledge can also be explained by insufficient information generally on cochlear implants in society:

> I see that pupil wearing that device. I know it is for hearing; in fact, I don't see how it functions. I have very little knowledge about it, which I acquired from her parents. Even when the device gets into trouble, I don't know how to assist the pupil in rectifying that trouble (Interview, Academic teacher, School A).

Similarly, as an academic teacher from school B said:

> The truth is that I have little knowledge about cochlear implants and their functions. I came into contact with pupils using cochlear implants when I was transferred to this school. I was given information by the headteacher that there were pupils with hearing impairment. Some of them use sign language. Others use hearing aids, and those using cochlear implants. However, I had no prior knowledge of cochlear implants, their uses, or their function (Interview, Academic teacher, School B).

Furthermore, an academic teacher from school C said:

> Before, I was unaware of it, but when I noticed that the pupil was wearing it, I inquired about its purpose. I learned about it at that point

> that it is a hearing device that helps the deaf pickup sound and acquire language. Previously, I was not even sure how it worked (Interview, Academic teacher, School C).

Teachers from inclusive primary schools with PCIs had limited knowledge of cochlear implant technology, with the exception of those with a background in special education from schools B and E. Implicitly, some educators working in inclusive environments without a background in special education lacked the necessary skills to manage learners utilising cochlear implants and, hence, cannot improve their teaching and learning environment.

In an interview with the head of school D, it also emerged that most of the teachers had insufficient knowledge, which was obtained from parents. During an interview, only the head teachers' description of CIs aligned with the criteria for assessing the teacher's conceptualisation:

> I have little knowledge of cochlear implants and its functioning. I got this knowledge from the pupils' parents as they frequently visit us to follow up on their children. They normally inform me about how the device works and how we can support their children in acquiring education as their peers. These parents have good cooperation with us for sure as they have a close follow-up of their child's improvement academically and in language development (Interview, HT, School D).

Also, a discipline teacher from school A said:

> I am not aware of cochlear implants. What I know is that the pupil wearing that device is a deaf person. I usually advise her parents to take her to special schools for deaf pupils so that she can be taught using sign language. There is one special school for deaf students nearby here. I insisted to her mother several times that this pupil be transferred to that school, but she always refused and insisted that her child is not deaf; she hears with aid from that device. But I don't think this pupil is supposed to be in this school (Interview, Discipline teacher School A).

Furthermore, a discipline teacher from school B said:

> The cochlear implant is a new thing to me. I know a little bit about it, and this is because there are pupils in our school using it. I got the idea about it from their class teacher as they learned about it in their studies. What I know is that these pupils were deaf, so these machines helped them to hear. Concerning how they function, I don't remember (Interview, Discipline teacher, School. B).

Impliedly, members of school management are unaware of cochlear implant technology and its uses due to a lack of information about cochlear implant technology. Some contributory factors include limited collaboration between school management and cochlear implant experts, which has translated into poor teaching and learning environments for pupils with cochlear implants in inclusive schools. This finding aligned with Melton and Higbee's (2013) study that demonstrated a lack of general understanding of the educational system of cochlear implant technology and awareness of pupils with cochlear implants. Davenport and Alber-morgan (2016) also found inadequate knowledge among teachers dealing with children using cochlear implants. In fact, teachers lacked awareness of this technology, its uses, and its functions despite the rapid advancement of cochlear implant technology worldwide.

Limited knowledge of CIs to teachers from inclusive schools inevitably affected the learning environment for pupils using cochlear implants, in line with Davenport and Alber-morgan (2016), who found that outcomes for children with cochlear implants are highly variable, with this variability caused by partial understanding of the cochlear implant by those around them. In the same vein, Krijger et al. (2020) revealed that teachers in inclusive schools lacked awareness and training on learners with cochlear implants and how to educate them on their hearing problems. Implicitly, this variability in pupils with cochlear implants can either be positive or negative depending on the people surrounding them. In the school context, good knowledge of cochlear implants and their functions among those surrounding them could enhance the teaching and learning environment for the pupils with CI.

Teachers' conceptualisation of the learning needs of pupils with cochlear implants

The study also assessed teachers' awareness of the learning needs of PCIs in accordance with its second research objectives. Interviews held with teachers revealed that teachers mostly had limited knowledge of the learning needs of pupils with cochlear implants. However, four out of 20 teachers demonstrated an adequate understanding of the learning needs of pupils with cochlear implants. These four teachers stated some of the requirements of the learners with cochlear implants based on Melton and Higbee's (2013) criteria, as initiated by the United States IDEA of 2004. For the teachers to qualify as having adequate knowledge of the learning needs of learners using cochlear implants, they needed to articulate at least four learning needs of PCIs out of six; otherwise, they had inadequate knowledge. The following learning needs guided the assessment:

i. Provision of extra time in examinations to PCIs,
ii. Provision of extra time during the teaching and learning process for the teacher to elaborate on the concepts covered during normal classroom

sessions,
iii. Provision of preferential seating (in front of the classroom),
iv. Close follow-up, care and love from teachers, parents, audiologists, speech pathologists and educational officers,
v. Technical support from trained personnel on cochlear implant technology to assist PCIs in the school when they experience any difficult and
vi. Acoustic learning environment.

Teachers' adequate knowledge of the learning needs of pupils with cochlear implants

The results show that most teachers demonstrated limited knowledge of the learning needs of PCIs. Nevertheless, only four teachers were found to have adequate knowledge based on the set criteria. One of these teachers with ample knowledge said:

> Like other pupils with hearing impairments, pupils with cochlear implants have special learning needs. These needs include sitting in the first column in the classroom. This assists their hearing to be more effective during the teaching and learning process. They also need extra time for a subject teacher to elaborate clearly on the covered concept if the pupil and extra time in examinations did not understand it well. They also need a quiet learning environment as too much noise is an obstacle to their proper hearing (Interview, HT, School B).

A class teacher from school B similar said:

> Pupils with cochlear implants need to sit in the front column of the classroom, where they can have good access to the teacher while teaching. This assists the pupil in clearly capturing the words spoken by the teacher. It helps the pupil hear some words directly from the teacher. A subject teacher has to move with the learning pace of the pupil. They need a slow pace, especially in elaboration from the subject teacher, and close follow-up from teachers, parents, educational stakeholders, and cochlear implant experts is needed. Also, they require much care, love and extra time to assist them (Interview, Class teacher, School B).

These two narratives from school B justify an appropriate understanding of the learning needs of pupils with cochlear implants compared to their academic and discipline teachers. Their ability to describe more than four requirements for pupils using cochlear implants in inclusive settings makes them meet the criteria. Also, sufficient knowledge of the learning needs of PCIs was evident in schools D and E. During an interview, the headteacher of school D said:

> Pupils with cochlear implants require a supportive learning environment. Their classrooms must have a limited number of pupils so that the teachers can spend time educating pupils, especially those with special needs. A small number of pupils in the classroom assists in reducing pupils' noises, as a large classroom makes it hard for the teacher to control them. For pupils with CIs to pick up sounds clearly from teachers when teaching, they need to be seated in front of the classroom. They require close follow-up and extra time during classroom sessions (Interview, HT, School D).

The class teacher from school E also similarly reported:

> Pupils using cochlear implants have special learning needs. They need close follow-up in their studies and their language development. In classroom arrangement, they are supposed to sit at a place where the subject teacher can be well accessed in terms of hearing and seeing. Classrooms for pupils with cochlear implants must have noise reductions. Pupils with CIs are anti-noise, so teachers have to control their peers and outside noises for their proper hearing (Interview, Class teacher, School E).

Teachers' adequate knowledge of the learning needs of PCIs had the potential to influence a conducive learning environment for learners with cochlear implants to enhance their active participation in the curriculum and, specifically, in the teaching and learning process in accordance with the National Strategy on Inclusive Education (NSIE, 2022). One pupil with a cochlear implant said:

> Teachers take good care of me. I normally sit in front of the classroom. This assists me in hearing and understanding. Some teachers teach me after classroom sessions. Teachers of Social Studies, English and Kiswahili teach me after class hours, for example. Also, some of my friends gave me extra lessons in Mathematics and Science if I did not understand during class teaching. I asked them to teach me, but the teachers also told them to help me (Interview, Pupil 2, School D).

A similar sentiment was shared by another pupil from school E, who said:

> Teachers are doing their best. During the teaching and learning process, I normally sit close to the teachers, and some of my teachers spare me extra time to explain to me the subject matter when difficulties arise. During examinations, they always make sure that I complete the examination by giving me extra time over the regular time allocated to other pupils without special needs. (Interview, Pupil 3, School E).

Implicitly, a conducive learning environment for pupils with a cochlear implant in inclusive schools is highly influenced by adequate knowledge of the learning needs of PCIs on the part of management and classroom teachers. Similarly, Krijger et al. (2020) found that the acoustical environment has a significant impact on the school functioning of pupils with cochlear implants. Activities in mainstream schools are predominantly auditory-oral resulting.

Findings from classroom observation also indicate some measures school management has undertaken to enhance the acoustic learning environment for pupils with cochlear implants. Some of the classes that pupils with CIs attend have mechanisms aimed at reducing inside noise. This classroom intervention confirms the teachers' awareness of the learning needs of PCIs. Nevertheless, the researchers still needed to control background noise from outside the classrooms, which persisted regardless of the steps taken, suggesting the need for soundproof classrooms. These noises affected the learning environment of learners with cochlear implants. Children who use cochlear implants should be in classrooms with acoustic walls, ceiling boards, and windows with curtains (Krijger et al., 2020). The findings corroborate Kisanga's (2019) claim that deaf and hard-of-hearing pupils learn effectively in acoustically sound environments with noise reduction strategies in place to prevent distractions from within and outside. Indeed, managing the auditory obstacles enhances learning for pupils with cochlear implants. Good cooperation between school management and other education stakeholders in the school system is necessary for this to become a reality (Mwangeka, 2020). Thus, school management's cooperation with teachers, educational officers, audiologists, speech pathologists and parents can guarantee an auditory learning environment that promotes advancement and success for pupils with cochlear implants.

Teachers' inadequate knowledge of the learning needs of pupils with Cochlear implants

The study also found that 16 teachers out of 20 study participants had limited knowledge of the learning needs of pupils with cochlear implants. Based on the criteria used to assess teachers' conceptualisations, teachers demonstrated a general understanding of the learning needs of PCIs that they require close monitoring and pupils to sit in the front classroom row:

> Normally, pupils with cochlear implants, like those using hearing aids, require a quiet environment for effective teaching and learning processes, including seating in the front of the classroom where they can have good access to the subject teacher. Also, they can ask their peers without cochlear implants to teach them after lessons if they do not understand the concepts taught. Furthermore, they need close follow-up and assurance that all their requirements are met (Interview,

> HT, School A).

In this regard, a discipline teacher from school A similarly affirmed:

> Academic-wise, they need close follow-up. They are also supposed to sit in the first column of the classroom. This seating arrangement also assists them in having proper access to the teacher during classroom instruction. Additionally, they need more clarification after the classroom session, as they might not understand the concept taught well. That's all I know about pupils using cochlear implants (Interview, Discipline teacher, School A).

Also, an academic teacher from school B said:

> The needs of pupils with cochlear implants are just the same as those of other learners with hearing impairment. These pupils need to be loved and cared for. They require close follow-up. Also, in the classroom arrangement, pupils with cochlear implants are supposed to be seated in front of the classroom so they can hear well when the teacher is teaching (Interview, Academic teacher, School B).

In other words, school management personnel with adequate knowledge of the learning needs of PCIs were more likely to ensure the availability of resources they need than their counterparts with general knowledge who could overlook their specific needs. The school management had insufficient knowledge of the learning needs of pupils with cochlear implants as they were unable to state at least four of these requirements and instead only mentioned three general needs—they overlooked extra time in examinations and after-classroom sessions, availability of trained personnel, and an acoustic environment.

Other teachers from schools C and D also demonstrated limited knowledge of the learning needs of pupils with cochlear implants since they listed only three general issues out of six criteria used during the assessment. An academic teacher from school C said:

> Pupils with cochlear implants require more consideration and patience. Their learning environments should be quiet, that is, free from excessive noise, as this hinders their ability to listen. Pupils with CI need to be cared for and loved, and they require close follow-up (Interview, Academic teacher, Sch. C).

Similarly, a discipline teacher from the same school said:

> Pupils with cochlear implants need much more care than their peers. They need love and to deal with them patiently, especially when they

> have discipline cases. Academics need broad clarification from the subject teacher after teaching. Subject teachers, their peers or someone else who is responsible can do this. For instance, the one we have here had his teacher employed by his parents to assist him. His friends also play a great part in helping him in the learning process (Interview, Discipline teacher, Sch. C).

Impliedly, there was inadequate knowledge from school management personnel, as well as class and discipline teachers in inclusive primary schools. Most (16) of them were familiar with the general consideration that any pupil with special needs may require rather than specific requirements based on the nature of the disability and the assistive devices. They were oblivious to the fundamental requirements for PCIs, including an acoustic learning environment to reduce inside and outside noise, for example, cushioning or padding the legs of classroom furniture to muffle noises when moving and keeping classroom doors shut during an active lesson. Yet, the school management and teachers in question failed to capture this crucial requirement. This result concurs with Davenport and Alber-morgan (2016), who found that though cochlear implant technology is advancing, the lack of capacity at the school level to meet the learning needs of children using these devices persists. Nonetheless, teachers' knowledge of the learning requirements of pupils with cochlear implants is frequently influenced by the manner in which school management supports them. Therefore, the school management should work with teachers, parents, and other stakeholders in education to determine the best strategies for supporting PCIs to enhance their inclusivity in the curriculum.

A general assessment of the teachers' conceptualisation of the term 'cochlear implants and the learning needs of PCIs suggest limited teachers' knowledge on this matter. Most of them were not even aware of how cochlear implants function and how they can support pupils with cochlear implants to achieve better education. The findings further demonstrate differences in the conceptualisation between teachers with a background in special education and those without it. This difference can be attributable to the teacher education curriculum for teachers teaching in inclusive schools having limited content on learners with special needs, particularly PCIs. Melton and Higbee (2013) claimed that cochlear-implanted children are not well-understood by many educational systems because these implants are not frequently covered in the curriculum of many undergraduate teacher training programmes, leaving many experienced teachers and recent graduates out of touch with this technology. As such, collaboration among school management, teachers and cochlear implant professionals could further strengthen the knowledge of cochlear implants at the disposal of school management, teachers and pupils without cochlear implants. Such widespread knowledge could create an amenable and accessible learning environment for learners using cochlear implants in inclusive schools.

Conclusion and recommendations

The majority of teachers in inclusive primary schools exhibited limited knowledge of cochlear implants and the specific learning needs of pupils with cochlear implants (PCIs). Among the teachers, 16 out of 20 demonstrated inadequate knowledge, while only 4 out of 20 displayed adequate knowledge. Insufficient knowledge of teachers' conceptualisation of cochlear implants and the learning needs of PCIs stemmed from limited collaboration within and among teachers and other stakeholders such as experts in the area, limited in-service training and limited content addressing the teaching of pupils with CIs in teacher education curricula. There were also differences in the teachers' conceptualisation between those with a background in special education and those without it, with the former having adequate knowledge compared to the latter from inclusive schools. The study found that the teachers' conceptualisation of cochlear implants and pupils' learning needs enhanced the teachers' readiness to support learning and create a learner-friendly acoustic environment for PCIs. To strengthen teachers' conceptualisation, the Ministry of Education, Science and Technology (MoEST), in collaboration with the Tanzania Institute of Education (TIE), should, therefore, integrate cochlear implant education into the teachers' education curriculum. Moreover, school heads should collaborate with cochlear implant experts to introduce in-service training through school-based continuous professional development aimed at addressing the teaching of PCIs. Furthermore, school management should establish strong links with relevant stakeholders, such as parents, educational officials, and cochlear implant experts. These partnerships are essential for building the capacity of teachers working with pupils with cochlear implants (PCIs) and for creating a more inclusive and supportive learning environment.

References

Armstrong, F., (2016). Inclusive education school cultures, teaching and learning. In: Richards. G & Armstrong. F. (Eds), *Teaching and Learning in Diverse and Inclusive Classrooms: Key Issues for New Teachers.* Routledge, 2016, pp.7-18.

Avramidis, E., & Norwich, B. (2002). Teachers' attitudes towards integration/ inclusion: a review of the literature. *European Journal of Special Needs Education,* 17, pp.129-147.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101.

Alshuaib, W., Kandori, J., & Hasan, S. (2015). Classification of hearing loss. *The Official Journal of the American Auditory Society*, *22*(4), 426-432. https:// doi.org/10.5772/61835.

Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Creswell, J., & Creswell, J. (2018). *Research design: Qualitative, quantitative and mixed methods approach* (5th ed.). Sage Publications.

Davenport, C. A., & Alber-morgan, S. R. (2016). I have a child with a cochlear implant in my classroom. Now what? *Teaching Exceptional Children*, *49*(1), 41-48.

Deep, N. L., Dowling, E. M., Jethanamest, D., & Carlson, M. L. (2019). Cochlear implantation: an overview. *Journal of Neurological Surgery Part B: Skull Base*, *80*(02), 169-177.

Fitzpatric, E. M., Julia, H., & Joanne, W. (2015). Paediatric cochlear implantation: why do children receive implants late? *The Official Journal of the American Auditory Society, 36*(6), 688-694.

Hallahan, D., Kauffman, J., & Pullen, P. (2019). *Exceptional learners: an introduction to special education* (14th ed.). Pearson.

Heward, W. (2014). *Exceptional children: An introduction to special education* (10th ed.). Pearson.

Jaffer, F. (2017). Rehabilitation outcome for children with a cochlear implant in Tanzania. *Global Journal of Otolaryngology*, *10*(3), 35-58. https://doi. org/10.19080/GJO.2017.10.555786.

Kahinga, A., & Jaffer, A. (2021). Cochlear implantation in Tanzania: The journey and the outcomes. *Proceedings Journal of Global Health*, *30*(3), 1-5. https://www.entandaudiologynew.com.

Kisanga, S. E. (2019). Barriers to learning faced by students who are deaf and hard of hearing in higher education institutions in Tanzania. *Papers in Education and Development, 37*(2), 201-218.

Krijger, S., Coene, M., Govaerts, P., & Dhooge, I. (2020). Listening difficulties of children with cochlear implants in mainstream secondary education. *Ear and Hearing*, *41*(5), 1172-1186.

Mauldin, L. (2016). *Made to hear: Cochlear implants and raising deaf children*. University of Minnesota Press. Retrieved from http://quadrant.umn.edu.

Medel. (2021). *Hearing Africa: transforming lives through sound solutions.* Medical Device Company.

Melton, J., & Higbee, R. (2013). Educational interpreters: Meeting the education and communication needs of children with cochlear implants. *Odyssey: New Directions in Deaf Education*, *14*, 60-62.

Muller, L., & Wagenveld, D. (2020). *About us – cochlear implant unit.* New World Printers. Retrieved from https://www.cochlearimplants.com.za/about-us/.

Mwangeka, R. M. (2020). Application of system theory in education. *African Journal of Cooperative Development and Technology*, *3*(6), 36-48. https:// doi.org/10.13140/RG.2.2.22063.07844.

Robson, C., & McCartan, K. (2016). *Real-world research: a resource for users of social research methods in applied settings (*4th Ed). John Wiley and Sons Ltd.

Stith, J. L., & Drasgow, E. (2015). Including children with cochlear implants in general education elementary classrooms. *Teaching Exceptional Children Plus*, *2(*1), 1-13. Retrieved from http://escholarship.bc.edu/education/ tecplus/vol2/iss1/.

UNESCO. (1994). *The Salamanca statement on principles, policy, and practice in special needs education.* http://www.csie.org.uk/inclusion/unesco-salamanca.shtml.

United Nations. (2006). *Convention on the rights of persons with disabilities.* Author.

Yin, R. K. (2016). *Qualitative research from start to finish* (2nd Ed.). Guilford Publications.