

UTILIZING THE USE OF ASSISTIVE TECHNOLOGY DEVICES TO ENHANCE COMMUNICATION SKILLS OF CHILDREN WITH HEARING IMPAIRMENT IN SCHOOLS

By

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Abstract

Children with hearing impairment are those who have dysfunction in their sense of hearing organs. These children often have poor language and communication skills as well as fluency during communication. Children with hearing impairment require the use of Assistive Technologies (AT), both low technology and high technology devices in order to overcome their communication and interaction barriers. Inability to hear, use language to communicate verbally is a serious challenge to children with hearing impairment. These inabilities make the children to be at-risk for academic, employment and social interaction. In this paper, the writer discusses how assistive technologies can be utilized to teach children with hearing impairment. Different types of assistive technologies for use with children with hearing loss and benefits of using assistive technologies for children with hearing loss. The paper recommended that teachers and parents should ensure that sign language interpreter-video be used to improve the children's language and communication skills. Government, non-governmental organizations and school authorities should budget money to purchase assistive devices for distribution to children with hearing impairment at subsidized cost.

Key Words Assistive Technology, children with hearing impairment, communication skills, hearing impairment, Technology

Introduction

Children with hearing impairment experience different forms of exclusion, which cut them off from health, social services and limit their participation in academic, family, community and societal activities. These isolations often have serious effects on their future employment opportunities and participation in civic life. Assistive technology devices enable children with hearing impairment to take their place in society and contribute to their family and community. Assistive technologies are products and related services that help to improve the functioning of people with disabilities generally. The devices help children with disabilities to participate in various facets of life such as, communication, mobility, self-care, household tasks, family relationships, engagement in play and recreation.

Assistive technology also known as assistive device is an umbrella term for both assistive products and related services. The International Classification of Functioning, Disability and Health (ICFDH, (2014) defines assistive products and technology as any product, instrument, equipment or technology adapted or specially designed to improve the functioning of a person with a disability. Similarly, International Organization for Standardization (2011) defines assistive technology as a device or product produced specially for used by or for persons with disability to protect, support, train, measure or substitute for

body functions or structures to prevent impairments, limitations or participation restrictions. This devices according to the Convention on the Rights of Persons with Disabilities (2006) include; protective headgear for physical well-being of epileptic children, pressure relief cushion in wheelchair to protect a paralyzed child from pressure sores Ramps and handle bars to help children to access health facilities, hearing aid to help a child with a hearing impairment hears conversation around, parallel bars to help child with balance problem, communication board to support child with speech difficulties to express herself and screen reader to make a child to see and access information on the web.

Assistive technology can enhance the quality of life of both children and their families. ***For most children with hearing impairment, assistive technology makes things not only easier, but also possible for them.*** Assistive technologies include; computers, smart phones, hearing aids to mention a few. These devices help to enhance the communication ability of children with hearing impairment. However, AlShammari, Alsumait and Faisal (2018) stated that poor information about how to use the technologies to advance the communication and literacy skills of the hearing impaired children is a sign that the children will be at-risk for communication, employment and academic works in school. Their learning process will be slow and frustrating.

However, in many schools in Nigeria, most teachers are not conversant with the use of these technologies to enhance communication and learning needs of children with hearing impairment. This is because the children's language of communication is the sign language that often uses contracted signs as its vocabularies and syntax. These children often start schooling with poor communication skills and little fluency in sign language. Noon (2015) stated that approximately 90% deaf children of hearing parents are usually poor in sign language. They are usually unprepared for the literacy and communication skills in school due to language problem. Learning how to sign is a skill that children with hearing impairment must possess before they can performance well on entering school. This is because sign language is their first language.

Hearing impairment refers to a dysfunction in the sense of hearing organ. The impairment might be due to disease, exposure to loud noise, virus, disease, nerve damage or injury and aging to mention but a few. These might also be categorized into conductive or sensorineural hearing loss. Conductive hearing loss is damage in the outer or middle ear, while sensorineural hearing loss according to Milaham (2020) is damage to the cochlea, auditory nerve, brainstem or the brain. Hearing impairment therefore is an inability of the ear to receive and interpret sound or messages.

Loss of hearing organ deprives the individual access to sound. Hearing loss in children can range from mild (loss from 20-30 dB) where the child finds it hard to hear weak talk, marginal loses, (loss from 30- 40 dB) where the child has the ability to understand conversation at a distance of one meter only. to profound or hard-of-hearing to total deafness, moderate loses, (loss from 40-60 dB), hearing capacity that the individual can understand only loud conversation at a distance of one meter and severe hearing loss (loss from 60-70 dB) which is an inability to hear while profound hearing loss (75 dB and higher) is a hearing loss that the individual only hears loud noises at 1-inch gap(Puspawati&Juharoh,2021). These levels hearing loss means that it is not uniform among affected persons. Milaham (2020) expressed that the most challenging needs of children with hearing loss is communication which also affects their ability to communicate. These children always experience linguistic problems due to their inability to acquire spoken language and understand sounds utterances. Szudek, Ostevik, Dziegielewski, Robinson-Anagor, Gomaa, Hodgetts and Rosner (2012) noted that most children with hearing loss are unable to receive sounds accurately and articulate words clearly.

In this paper, the writer discusses the use of assistive technologies in teaching children with hearing impairment, types of assistive technologies for children with hearing loss, benefit of assistive technology and barriers to assistive technology for children with hearing loss.

Uses of Hearing Assistive Technologies

The use of assistive technologies to enhance the communication and academic skills of children with hearing impairment cannot be overemphasized. These technologies help children to hear and communicate thereby easing their interaction with others using language. Puspawati and Juharoh (2021) stated that AT devices when use in the classroom helps children with hearing impairment to learn effectively. For example, technologies like word processor, internet, e-games computers and multimedia software can be used to give visual feedback to children. These makes communication and understanding auditory input easier for the children. Williams, Jamaliand Nicholas (2006) suggested that the best AT devices that can be used to teach children with hearing loss are; internet, virtual Learning Environments (VLE), Augmentative and Alternative Communication (AAC) and adaptive devices such as white cane. Kennewell (2013) also argued that AT can be used to provide children with hearing impairment with visual and signs or texts on screen. Using these help learners to expand their general knowledge and use of language without depending on spoken word. Besides, the use of AT devices enables group of deaf children to have more concepts as they plan and carry out given work within their social environment.

Word processing and other multimedia software help children with hearing impairment to develop writing skills. Advanced speech synthesizers when use can act as substitute voice to the child with hearing loss. It serves a compensatory tool for children who cannot communicate verbally. Adapted e-game computers have audible speaking voices for children with mild to moderate hearing loss. These children can also use recorded tapes, speech trainers, photo albums, articulation charts, concrete objects and other visual cues for language learning, speech training, and speech correction in and outside the classroom. Others might include text-telephones which allow phone conversations to be typed and read rather than spoken and heard. Computerized speech recognition's software allows the computer to change a spoken message into a readable text document that can be easily be read by the hearing impaired child (Ahmad, 2015).

Types of Assistive Technologies for Hearing Impaired

There are several assistive technologies that can be used to enhance the communication and educational barriers of children with hearing impairment. These devices according to Seok and DaCosta (2013) include;

Hearing Aid

This is a device that helps to improve sound level of a listener. This includes; assistive listening devices (ALD) and personal amplification. Assistive listening devices can be utilized by individuals or large groups of people, while personal amplification is use based on the needs and level of hearing of the individual. Hearing aids require the support of an audiologist to determine candidates for the different devices that can appropriately benefit from it. Assistive listening devices help to improve the signal-to-noise ratio in any given situation. In addition, it provides the listener with direct connection to the sound source, minimizes the effects of background noise, distance and room acoustics. It utilizes transmitter that sends a person's voice or other sound source to the receiver. It distributes the sound evenly throughout the environment or directly to individuals. Bankaitis (2007) stated that sound is usually transmitted in these ways: Frequency Modulation System (FM); Infrared (light); Induction Loop (electromagnetic); or through a direct connection. Some hearing aids have special connection

option called Direct Audio Input (DAI) that allows the user to connect directly to an FM system or Induction Loop receiver. In many instances, one can even connect directly to other devices such as a computer, TV, MP3, iPod, or radio. It helps to enhance the frequencies of sound and makes it much clearer to the hearer.

Behind The Ear Hearing Aid (BTE): This is an aid that is put behind the ear and is attached to either a custom ear mould or a universal ear tip that directs sound from the instrument into the ear. Its body rests on the postero-superior part of the auricle. BTE hearing aids are used by children and adults with severe to profound hearing loss.

In The Ear (ITE) aid: This is custom-made to fit within the external ear. The ITE hearing aids are the largest of the custom made hearing aids. They can be fitted in a wide range of patients, with mild to severe hearing loss.

In The Canal (ITC) aid: This is also a custom made and is small enough to fit almost entirely in the ear canal such that it is hardly noticeable.

Frequency Modulation (FM) System: FM systems work in the same way as the commercial FM radio. The system sends the auditory message through FM radio waves from a wireless transmitter directly to a small receiver worn by the listener. FM systems are equally effective for indoors or outdoors use. They can be portable or permanently installed. FM signals travel through walls, so the systems are not appropriate for confidential communication.

Infrared Systems - This uses radio waves that travel through barriers which makes them unusable in courtrooms and other situations in with confidentiality. Infrared systems use light waves to transmit sounds.

Audio Loop Systems - An audio or induction loop system transmits sound through a wire loop that surrounds the listening area. The electric current that flows through the loop creates an electromagnetic field that can be received and amplified by the hearing aid or cochlear implant equipped with a t-coil. Audio loop systems can be permanently installed in the classroom.

Amplified Phones: This phone has an in build amplifier and can be connected to an external amplifier to allows the user to increase the overall volume to their comfort level. This aid is mostly found in regular cell phones, but there are also specialized phones or external attachments designed specifically for users with hearing loss that provide even greater output levels.

Amplified Stethoscopes: This is an instrument that is used by hearing-impaired medical professionals and students. The stethoscope electronically amplifies sounds so that the person who is using it can hear more easily while performing an examination. The sound can be adjusted to reduce background noises. Many amplified stethoscopes are designed in such a way that the frequency of the sound can be adjusted from a low (bell) to a high (diaphragm) mode during examinations. It is use for listening to lower frequency sounds, such as sounds of the heart, while higher frequency sounds, like the lungs, can be heard using the diaphragm mode. Amplified stethoscopes are electronic and use batteries.

Alerting Device: This device is an amplified and/or visual signal or vibration use to assist persons with hard of hearing and the deaf. Alerting device uses sound and visual amplification or vibration techniques to alert the individuals with hearing impairment. Hersh and Johnson (2003) expressed that these devices help to alerts the child during emergency such as; fire outbreak, sound of the telephone ringing or a baby crying. Some of the alerting devices include:

- (a) **Alarm Clocks;** these are in form flash lights or vibrating units.
- (b) **Door Knock Light:** This makes use of light that flashes to alert people with hearing loss that somebody is at the door since they may not hear the knock.
- (c) **Weather Alert:** Weather alert monitor has a special screen which alerts the user visually as to the nature of the alert; Tornado, storm, flood, etc. It also has a special kit

that fits many brands of weather radios that will alert the user via a strobe light or vibrator when an alarm is sounded.

- (d) **Wrist Watches:** These wrist watches are specially made with visual alarms.
- (e) **Call Alerts:** This is a telephone signal indicator designed for use by individuals with hearing disabilities. The device alerts the user on incoming call by flashing the lamp (Rekkedal 2012)

Communication Supportive Aid

This device helps the child to share thoughts with the external world. Communication supportive aid according to Hersh and Johnson (2003) are categorized as:

- (a) **Telecommunication Device for Deaf (TDD)**, formerly known as teletype machine (TTY). This device allows the user to place phone calls using text through a regular phone line. Each TDD has a keyboard with a text screen. The user either connects it with another person that has a TDD or uses a relay service that converts the text into voice for the listener receiving the call.
- (b) **Captioned/Text Telephones:** Like amplified phones or TDD, captioned telephones allow the user to see text from their telephone conversation as well as access relay services.
- (c) **Computers with Web Cameras:** Children with hearing loss utilize combination of web, camera and computer Internet service to be able to visually connect with others people. This technology utilizes IP relay service using sign language instead of text.
- (d) **The Communicator** - This device converts speech into text, speech to video sign language or computer-generated voice, text to computer-generated voice or video sign language providing access to acoustic information in real-time. With communicator, a hearing person can speak normally. The software in it converts spoken words into text. The user can type a response in which the computer then delivers it as text or say aloud using text-to-speech. Communicator was developed to help enhance the literacy levels of children with impairment, promote independent communication thereby boosting self-confidence. It serves as communication aid in the learning environment where sign-language interpreters are not available.
- (f) **Mobile Phones:** The integration of mobile phones in learning in school is no longer a foreign strategy nowadays. Mobile phones are portable devices that can be moved from one place to another. These technologies help children to learn in different settings. These include Video Call (VC), WhatsApp video call, Google Meet, Zoom, Line and Skype. One of the elements of mobile technologies which is connectivity permits the online activities to happen via; smart phones, personal digital assistant PDAs, tablets, wireless laptop personal computer PCs, mini notebooks or net books and handheld gaming devices.

Benefit of Assistive Technologies to the Hearing Impaired

Harnessing assistive technology devices for the purpose of communication and education with and by children with hearing impairment is a viable and achievable means that can be used to fulfill the many obligations under the Convention on the Rights of the Child (CRC, 2006). Borg (2013) stated that for many children irrespective of disabilities, assistive

technology means the difference between inclusion and exclusion, between rights enjoyment and rights deprivation.

Effective utilization of assistive technology devices helps to enhance the academic performance and communication ability of children with hearing impairment. The children's language is enhanced making them to have confidence in themselves and in what they do within their social environment. Baglama, Haksiz and Uzunboylu (2018) expressed that AT increases the students' motivation level to learn. It has positive effects on literacy skills of children with hearing impairment. Furthermore, Lidström and Hemmingsson (2014) stated that soft and hardware technologies are good in text-generation and speech. They ease the children's communication skills. Students are motivated towards academic activities and social interaction.

Compact Disc Read-Only-Memory (CD-ROM) and Multimedia if use effectively, can also provide children with hearing impairment access to information in a more convenient and visual form (Kennewell, 2013) Becta (2004) also noted that in developed countries such as Britain, the use of multimedia presentations, which combine text, pictures and sound enables hearing impaired children to experiment different methods of learning sounds. Additionally, teachers can use control software, data logging software and logo or turtle graphics to help children with hearing impairment improve their communication skills. Lidstrom and Hemmingson (2014) and Waseem, Ali and Tariq (2019) stated that AT benefit children with hearing impairment thus:

1. Creates a more simulating learning environment for learning
2. Improve the children's motivational and attitudinal level.
3. Creates awareness and help the children develop high order thinking skills
4. Create access to the children to participate in the teaching and learning process.
5. Increase the children's level of communication and literacy skills
6. Increase the children's memory capacity and problem solving skills.

BARRIERS TO ACQUISITION OF ASSISTIVE TECHNOLOGY

Disability is the outcome of the interaction between a child with impairment and an environment with barriers that hinder his or her participation on an equal basis with others. Assistive technology can be used to reduce or eliminate such barriers. However, obtaining such technology is not always possible due to product and service related barriers.

Lack of awareness: Many children with hearing impairment and their families have limited awareness of assistive products and services that can be used to enhance the communication needs of the child (Kamaleri, & Eide, 2011). This makes it difficult for children and their families to know what assistive technologies are available or suitable and how they can be beneficial. Limited awareness of assistive technology or purchasing capacity always leads to limited demand. Local productions are not being patronized.

Lack of governance, legislation, policies and national programmes: The 2005 Global survey on government action on the implementation of the Standard Rules on the Equalization of Opportunities for Persons with Disabilities found that of the 114 responding countries, 50% had not passed relevant legislation and 48% did not have policies in place relating to the provision of assistive technology (Development S-NCfDa, 2005). This indicates that for many States the provision of assistive technology is a relatively low area of priority.

Lack of services: Assistive technology services are often in short supply and located far away from where children with disabilities live, particularly children with hearing impairment (WHO, 2011). In this global survey, 53% of the 114 responding countries had not initiated programmes relating to the provision of assistive technology (Development S-NCfDa, 2005). Non-governmental organizations rarely have the financial means or capacity to develop and sustain service delivery systems for children with disabilities.

Lack of products: In Nigeria, production of assistive products occurs on a small scale and mostly limited to wheel chairs and tricycle and are costly such that persons with disabilities have Limited or no access to such materials.

Inaccessible environments: Physically or cognitively, inaccessible environments act as barriers to assistive technology. For example, inaccessible transport systems or service centres prevent children with hearing impairment from having easy access to the services and products they need. Physical barriers include language, stairs or poor lighting, while cognitive barriers include texts that are not clear or symbols that are difficult to understand. The cost or availability of a hearing aid may prevent a child from having access to discussion around.

Lack of human resources: Lack of properly trained personnel in manufacturing or adapting products, or delivering services. In Nigeria, there are inadequate numbers of schools for the hearing impaired (Magnusson & Ramstrand, 2009).

Financial barriers: The costs of purchasing, maintaining and replacing assistive products and associated services and traveling costs constitute a major barrier. Costs can be especially prohibitive in the case of children, as they need their assistive products replaced or adjusted as they grow. Under the Universal Basic Education Programme in Nigeria, every child who needs assistive technology is entitled to it, regardless of the ability to pay. The funding mechanisms should be done by Government, insurance, donor or charity funding or Contributions from families, families, social organization such as the church and mosques.

Conclusion

Assistive *technology plays an important useful roles in children with hearing impairments ability to learn, develop independence in academic tasks and employment tasks, participate actively in discussion, community and recreational activities and gain access to peers and teachers within the school environment. With the* advances in hearing technology devices and proper use of it can help children with hearing impairment to have adequate auditory access to spoken language and participation in health, cultural and family life in their societies. Different assistive technology devices such as; hearing aids, behind the ear hearing aid, in the ear hearing aid, amplified phones, amplified stethoscopes and so forth are common assistive devices teachers can use for their children *These technologies help children to learn to develop their strengths and eliminate their weaknesses as well as promoting their sense of belonging and interactive participation in life's activities.*

Recommendations

1. Government, non-governmental organizations and school authorities should budget money to purchase assistive devices for distribution to children with hearing impairment at subsidized cost.

2. Parent-Teacher Associations (PTAs) should take the lead to seek for financial help with the locality to provide suitable devices for the use of children with hearing impairment.

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