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Assistive Technology for Teaching Hearing Impaired Students In Agricultural Education

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ABSTRACT
The study investigated the use of technological devices available for a wide variety of students with hearing impairment in agricultural Education. Assistive technology has increased in use in recent decades due to accessibility of ICT and computers. Digital devices like Teletypewriter, voice carry over telephone, Internet Protocols Relay Services etc., have change the educational experience for student with hearing impairment, Similarly, approaches used by teachers like Auditory method, oral method, Rochester method, neo-oralism, etc., has also given student with hearing impairment better opportunities in learning. It was recommended that teachers' in-service programmes and some professional development programmes need to be involved to understand and develop appropriate learning opportunities and curricula for the person with hearing impairment.
Keywords: Assistive Technology, Teaching, Hearing Impaired, Students, Agricultural Education

INTRODUCTION

One of the most important fields for creating human resources with practical agricultural knowledge and skills is agricultural education. According to Nnodim and Amadi (2018), the purpose of teaching and learning agricultural education is to produce citizens with skills competencies and reasoned judgment to successfully live and contribute meaningfully to the economic growth of Nigeria. Based on the aforementioned, it is clear that the focus of agricultural education is geared towards hands-on experience (Amadi and Lazarus, 2017). However, agricultural education program is plagued with numerous obstacles that have an impact on both teachers' and hearing-impaired students' performance in agriculture (Amadi and Lazarus, 2017). One of the identified obstacles is inadequate or unavailability of assistive technology for teaching hearing impaired students.

Hearing loss otherwise known as hearing impairment is one of the health problems that a lot of student experience in many

developing countries, including Nigeria. According to Amusa, Adegbenro, Ogunniyi and Olarinoye (2016), two thirds of students with hearing impairment in the world with hearing impairment live in developing nations, as evidenced by the fact that one in seven children in Nigeria and four out of every 1000 children in other developing countries are deaf and many of them have not yet learned to speak. In Nigeria, quite a most schools with children who have severe hearing loss lack the assistive technologies required to teach hearing impaired students, which has a negative impact on their academic performance (Amadi and Solomon, 2019).

Assistive technology is technology used by hearing impaired to carry out tasks that might otherwise be challenging or impossible. It ranges from talking calculator, phonetic spelling software, Braille machine to cochlear implant (Aderonke, Amos, Tawakalit and Adenike, 2020). Assistive technology is frequently promoted by educational institutions, parents, and teachers as a means of helping hearing impaired students with special needs by offering a compensatory benefit, fixing academic issues, and encouraging personal independence. More so, hearing impaired students now have the opportunity to use computers to accomplish tasks that were previously impossible for them thanks to assistive technology devices. For instance, hearing aids and cochlea implants are designed for hearing impaired students to hear sounds better and louder, which will enhance communication and learning skills. Therefore, the task of helping students with hearing impairment to reach their full potential and lead fulfilling lives is the goal of assistive technology.

Assistive Technology

Assistive technologies are tools that help hearing impaired students to learn. The term "assistive technology" (AT) refers to assistive, adaptive, and rehabilitative tools for students with hearing impairment (Parant, Schiano-Lomoriello, and Marchan, 2017). Hearing impaired students often rely on assistive technologies for receiving and communicating information. Assistive technology ranges from hearing aids, assistive listening devices to amplified telephone equipment. The use of assistive technology and devices provides hearing impaired students with various solutions to auditory communication needs by providing higher sound (for those who are hard of hearing), tactile feedback, visual cues and improved technology access. Individuals who are deaf or hard of hearing utilize a variety of assistive technologies that provide them with different access to information in numerous environments (Scherer and Stefano, 2017). Assistive technology either provides amplified sound or alternate ways to access information through vision and/or vibration. According to the World Health Organization (WHO) assistive technologies, related systems, and services were created for hearing impaired students to maintain or improve functioning and thereby promote wellbeing. Ellis (2016) viewed assistive technology as any product, instrument, equipment adapted or specially designed to improve the functioning of people with disability.

More so, assistive technologies promote greater independence by enabling students with disabilities to perform tasks they were previously unable to accomplish, or had great difficulty accomplishing, by providing enhancements to, or changing methods of interacting with, the technology needed to accomplish such tasks. For example, screen reader provides hearing impaired students access to electronic information (Sivan, Weightman, and Andrew, 2016). Due to assistive technology, disabled students have an opportunity of a more positive and easygoing lifestyle, with an increase in "social participation," "security and control,"

and a greater chance to "reduce institutional costs without significantly increasing household expenses. Assistive technologies assist students who are recovering from strokes and those having abstained injuries that affect their daily tasks (Calabrò, Naro, Antonino and Bramanti, 2016). Assistive technology in this study means any product, instrument, equipment adapted or specially design to improve functioning of people with hearing impairment for better teaching in Agricultural science.

Assistive technologies can be grouped into three general categories: Hearing Technology, alerting devices, and communication support.

- **Hearing Technology**:

Hearing technology can broadly be defined as any device utilized for improving the level of sound available to a listener. Hearing technology can further be divided into two general subcategories of Assistive Listening Devices or Personal Amplification. Assistive listening devices (ALD) can be utilized by a student or large groups of students and can typically be accessed without the support of specific personnel. These devices typically are used to improve the signal-to-noise ratio (SNR) in any given situation. All ALDs utilize a transmitter that sends a person's voice or other sound source to a receiver that distributes the sound evenly throughout a room such as in theaters and churches or directly to an individual. More so, Personal amplification is chosen specific to the needs of individual student based on their level of hearing and requires the support of an audiologist to determine candidacy for different devices and appropriately fit and adjust the chosen device (Barrué, 2012).

- **Communication Support Technology**:

Communication supporting technologies employed for hearing impaired students include:

Teletype writers: Telecommunication Device for the Deaf (TDD), previously known as teletype machine (TTY), allows the user to place phone calls using text through a regular phone line. Each TDD has a keyboard with a text screen. A user either needs to connect with another person that has a TDD or use a relay service that can convert the text into voice for the hearing listener to receiving the call. With the improvements in technology for phones, pagers, text devices and computer services, the use of the TDD has declined (Hornby, David and Donielle, 2013).

Voice Carry Over Telephone: The Voice Carry Over Telephone (VCO) is used by those people who are unable to hear over the telephone but prefer to use their voice to communicate. VCO telephone calls must be made through a relay service. There is also a portable VCO device, which can be attached to cell phones, pay phones, or cordless phones. Varying state to state, this service may be free to the consumer—paid for but the government. This was a provision of the Americans with Disabilities Act. The relay service companies pick a date that works for the consumer, sets up the telecommunication system, and teaches them how to use it. A third-party employee translates the incoming speech in real time for the consumer to read the message (Hermansson and Turner, 2017).

Internet Protocol Relay Services: Like Voice Carry Over Telephone (VCO), The Internet Protocol (IP) Relay Service is used by Deaf or Hard of Hearing people who use the phone, but sometimes they cannot hear and don't understand voices on the phone. IP relay is accessible through the internet and allows the person to communicate by text. The communication assistant will type to the deaf/hard of hearing person, who will in turn respond, and then the communication assistant will pass along the information to

the person on the other end of the line (Rodby-Bousquet and Agustsson, 2021).

Video Relay Services: Video relay service (VRS) or Video remote interpreting (VRI) is a type of video telecommunication service, which use communication devices such as webcams or videophones to provide sign-language and/or spoken language interpretation services. In many cases, getting an interpreter may take some time and they may not be immediately available. The VRI will provide an interpreter on the spot. The VRI has two parties, the deaf/hard of hearing person who is using the VRI, and the interpreter who is on the screen. The interpreter can be on a videophone, web camera, or computer screen (Rony, 2019)

Real – Time Text: Real-time text (RTT) is transmitting text which the reader can automatically read even before the sender finishes the sentence. The Deaf community uses RTT to have a continuous conversation. TDD devices, sometimes called TTY devices, are commonly used for RTT via a regular phone call. Text over IP (capital) is a type of RTT that uses IP networks natively (Pardes, 2017). All the various equipment or materials mentioned above can be used in teaching hearing agricultural education classes

Real Time Captioning: Real time captioning provides a typewritten account of all verbal information presented within a lecture, meeting, discussion, or presentation. All these systems require the skills of a trained captioner and specialized software or equipment such as a computer (Van der Roest, Wenborn and Orrell, 2017).

Meaning of Agricultural Education

Education is an indispensable tool for any meaningful national development. For education to be useful for positive development, it must be a functional type which is the one that allows the learner to be able to put into practice what was learnt and use it to produce something useful (Ayodele, Obafemi and Ebong, 2013). Education allows one to acquire functional skills for identity, knowledge, power, as well as freedom from economic exploitation. More so, education is a means through which the developing countries can meet the challenges posed by technological development of the present century and beyond. The whole hope of human progress is dependent upon the growing influence of education, science, and technology. However, agricultural education which is vocational has been viewed as a productive means of dealing with rapid change in the social and economic context; securing employment, developing new skills and creating viable enterprises, which can play role in Nigerian economy (Ayodele et al., 2013).

Agricultural education is defined as the teaching of agriculture, natural resources, and land management through hands on experience and guidance to prepare students for entry level jobs of to further education to prepare them for advanced agricultural jobs (Gignac and Szodorai, 2016). Agricultural education has been an essential factor in the success of agricultural development in Nigeria. The researcher views agricultural education as that part of the total educational process that provides knowledge, develops skills, and inculcates the attitude necessary for entry and progress in an agri-business. It gets people into jobs that require specialized training in agriculture (Gignac and Szodorai, 2016). The major aim of agricultural education for all citizens and particularly for the youth in schools is to expose them to various occupations in agriculture and prepare them for the different opportunities in agriculture. This calls for vocational course content aimed at the development of skills and competencies in agricultural practices (Adeosun and Ndu, 2019). Agricultural education curriculum developers should start

thinking of redesigning both the process and the content that drives the education in line with sustainability of the vision's achievements. Integrating aspects of sustainability can be realized with well thought adjustment in the educational process. The following adjustments in education are what Nigeria need beyond year 2020 which were observed as:

- Adjustment from consumptive learning to discovery learning.
- Adjustment from teacher-centred to learner-centred arrangements.
- Adjustment from individual learning to collaborative learning.
- Adjustment from theory dominated learning to practice-oriented learning.
- Adjustment from sheer knowledge accumulation to problematic issue orientation.

Nigeria's visionary achievements in the national development plan can be sustained beyond 2020 if the education of the farmers and other citizens is well adjusted to meet the challenges of time. No society can rise above the level of its education; therefore, it is obvious that the higher the level of education of the nation the higher the level of its productivity. In Nigeria where more than half of the population is engaged in farming, provision of quality and sustainable agricultural education can transform the nation in general. Issues of funding must be looked into since all are aware of the nature of agricultural education which is vocational hence, the need for adequate funding for it to consolidate on the achievements. Investing in agricultural education becomes necessary with the current uncertainties in global oil prices, not only the price, but also the reserve which will dry in not far future unlike agriculture which is more permanent in nature. Due to the importance of agricultural education. It becomes very paramount to include hearing impaired person in its teaching.

Meaning of Hearing Impaired

Hearing impaired is a condition which an individual hears nothing around him, no matter how loud the sound is it should be seen as having ear problem. Hearing impaired includes both the hard-of-hearing (partially hearing) and the deaf. The two describe the degree of impairment (Nwadinobi, 2019). The hard of hearing refers to hearing loss in the pre-lingual period or later is not of sufficient severity to preclude the development of some spoken language, and those who have normal hearing in the pre-lingual period but acquire hearing loss later. The category of their impairment is not as severe as that of the deaf. (Ajunwa, 2014) observed that it is well documented that deaf children are worse than hard-of-hearing and normal hearing children in arithmetic problems involving reading skills. Proper diagnosis is therefore important for proper categorization and eventual realization of the fullest potentials of hearing-impaired children.

Hearing impairment could also be seen as a disability that can affect the effective functioning of the total personality no matter the period of onset (Brighton and Kenneth, 2021). According to them also, hard-of-hearing can be defined as those in whom the sense of hearing although defective is functional with or without a hearing aid. The committee went on to categorize the deaf into two, thus:

- The congenially deaf (people that become deaf from birth)
- The adventurously deaf (people who though were not born deaf, still became deaf later in life, due to some accident or illness).

Abodey and Ansah (2017) expressed that hearing impaired is the generic term that include both the hard of hearing (partially hearing) and deaf.

Characteristics of Hearing-Impaired Students

The effect of a mild hearing loss on educational achievement and found out that the mild hearing impaired subject did not achieve at the same level as their normal hearing students (Ajunwa 2014). He identified the observable signs by which the hearing impaired could be identified and they include:

- Articulation of certain speech sounds correctly often eludes the students.
- The students finds it difficult to write down dictations.
- The students fails to respond to or confuse verbal directions.
- The Students complains of a buzzing or ringing sound in the ear.
- The student fails to respond when called from a distance.
- The student complains of discharge from the ears.
- The student speaks in an abnormally low, high or loud voice. Awareness of their characteristics alone cannot solve the problems but being abreast with the classification of hearing impairment will improve lecturers efficiency in agricultural education classroom

Classification of Hearing Impaired

The ear is divided into three major parts - the outer, the middle and inner ear (Ahmad, 2015). The outer ear picks or collects energy; the middle ear transmits the energy which is then converted into nerve impulses in the inner ear.

Generally, we have the following classes of hearing impairments thus:

The conductive hearing impairment: The conductive hearing impairment occurs as a result of obstruction to the passage of sound waves through the external canal or by way of the ossicular chain through the middle ear. It does not affect the inner ear. In this case therefore if sound vibrations can be transmitted in anyway directly to the inner ear without having to pass through the middle ear, the child hears. The person suffering from conductive hearing loss can be helped through surgery or through wearing bone conduction hearing aids behind the ears (Banja and Mandyata, 2018).

Sensori-nueral hearing impairment: Sensori-nueral hearing impairment is prevalent among students. This is associated with the inner ear because it is damage or degeneration of the sensory structure of the inner ear that causes it. Students who suffer from this hearing loss are unable to hear most frequencies in the human voice in most cases.

Central hearing impairment: Cerebral cortex is the part of the brain where the sensation of sound is produced and interpreted meaningfully. Therefore, if there is interference with the pathway through which nerve fibres proceed from the brain stem to the temporal lobes of the cerebral cortex it results to central hearing loss. In other words an error in the auditory center in the brain causes central deafness (Cawthon and Wurtz, 2015).

Mixed hearing impairment: Mixed, hearing impairment is the combination of conductive and sensorinueral hearing loss. An individual here has outer-or middle and inner ear problem combined. Mixed hearing deafness; are often difficult to diagnose and treat because there are problems of both conduction and processing of sound. Again knowing the classification of hearing impairment is good, but the knowledge of how to communicate with hearing impaired person will help to improve their learning in agricultural education classes by agricultural education lecturers (Chifinda, 2017).

Communication Approach for Teaching Hearing Impaired Students in Agricultural Education

It is often difficult to mainstream the hearing impaired but when they are mainstreamed, such students need sign language interpreters in the classroom as well as supplementary resources assistance. Teaching the hearing impaired will definitely pose a problem to the teacher because deafness being a serious sensory deprivation is noted to hinder the afflicted person's development generally and their academic achievement in particular. Thus Amadi and Solomon (2019) found out that hearing impairment has adverse effects on academic achievement but the magnitude of such adverse effects depends on the degree of hearing loss. For effective teaching and learning, the hearing impaired needs appropriate methods that co0uld facilitate the acquisition of language as well as social and emotional adjustment. These methods include:

Auditory method: Auditory method involves teaching hearing impaired children to recognize sounds. It emphasizes the development of listening skills. It is a situation whereby the hearing impaired is constantly exposed to sound and language in their environment together with the provision of some kind of hearing aids for amplification.

The oral method: Under oral method, gestures and signs are not allowed. The oral method rather uses speech, lip reading and auditory training to teach. Stressing assisting the hearing impaired to acquire communication skills and de-emphasizing gestures and signs is necessary and central in the education of hearing impaired. Special educators also place emphasis in the development of early meaningful communication in the management of hearing impaired individuals.

Rochester method: This method emphasizes reading and writing. Rochester method combines the oral method and finger spelling or writing in the air technique.

Neo-Oralism: The central task of this method is to give tools of communication especially expressive communication at an early to change youngster who are passive into being active and therefore develop an initiative in learning. The method, like Rochester method makes use of finger spelling. If the young deaf student masters finger spelling, the language mastery process becomes easy like that of the hard-of-hearing student (Farooq, Aasma and Iftikhar, 2015).

Total communication method: This approach involves using oral communication audition, finger spelling, signs, gestures, dramatization reading, pencil and pen writing and drawing. All the sense modalities are used in this method. Idowu (2014) writing on what the teacher should do to educate the hearing impaired or the deaf stated the following:

Learning by deaf student is visually oriented. What they can see is important to them and not what they are supposed to hear. So, the teacher should therefore make use of the black board, pictures, diagrams etc.

- The concept of over-learning is very important in working with deaf children. A single idea or concept should be presented in a variety of ways, and by using more than one sense modality.
- Every subject on the time - table could provide an opportunity for teaching language, or some form of communication skills. He added that teachers should seek co-operation of the home of the child and ensure that he/she is accepted, loved and encouraged by his/her parents /guardians (Gárate, Batamula and Kite, 2016).This approaches are meant to help advance in their roles in teaching the impaired students in Agricultural education in schools. The Lecturers have roles to play in

helping hearing impaired students to learn effectively,

Roles of Teachers in Helping Hearing-Impaired Students in Agricultural Science

Students with hearing impairments often rely on sight to obtain classroom information. One of the best strategies teachers can apply when working with students who are hearing impaired is to provide written information whenever possible. In fact, according to the Americans with Disabilities Act (ADA), information must be available in alternative formats when reasonable (UNESCO, 2018). Information such as directions or notes can be given as a hand-out or can be written on the whiteboard when discussed.

Hand written material should be legible and of large enough size to be seen at a distance. It may be advantageous for the teacher to position the student's desk at close proximity to written material. Furthermore, students with hearing impairments often rely on lip reading and facial gestures to gather information. Teachers should write material on the board first and then face students while speaking, making sure not to cover their face while speaking. Speaking in a lighted room with minimum background noise is important. Additional measures, such as using a microphone or audio-recording system, may be necessary depending on the needs of the student with the hearing impairment. If showing videotapes or DVDs, providing on-screen captioning or translating audio to print format may be helpful (Parent Information Network, 2008).

More so, the agricultural education laboratory environment presents a unique set of learning challenges for students with a hearing impairment.

Participating in the general learning environment is often challenging for students who are deaf. However, many strategies can be used by the teacher to compensate for communication barriers and allow students who are deaf to excel in the general classroom. A classroom aid that translates oral communication into sign language is one of the most effective methods of ensuring that the student has access to all verbal information. Providing a designated note-taker or providing detailed printed notes are important because the student must focus eye contact on the speaker or interpreter during class, making it difficult to take notes (Hearing Loss Association of America, 2015).

The student's position in the classroom environment is vital to ensure that students who are deaf have access to instruction. Students who use an interpreter must be positioned so they are able to clearly see the interpreter and instructor. Likewise, the interpreter must be able to clearly see the student and instructor. Students who lip read should be positioned as closely as possible to the instructor. Students should be able to clearly see the instructor's lips, facial expressions, and gestures. If participating in classroom discussion, a circular seating arrangement is helpful so the student will be able see all other class participants.

CONCLUSION

This assignment was given on assistive technologies for teaching hearing impaired students in Agricultural Education. Assistive technology (AT) refers to assistive, adaptive, and rehabilitative tools for students with hearing impairment. Assistive technology ranges from hearing aids, assistive listening devices to amplified telephone equipment. Agricultural education is defined as the teaching of agriculture, natural resources, and land management through hands on experience and guidance to prepare students for entry level jobs of to further education to prepare them for advanced agricultural jobs. Hearing impaired is a condition which an individual hears nothing around him, no matter how loud the sound is should be seen as having ear problem. Hearing impaired includes both the hard-of-hearing (partially

hearing) and the deaf. The communication approach for teaching hearing impaired include: auditory method; the oral method; Rochester method; Neo-Oralism and simultaneous total communication method. One of the best strategies teachers can apply when working with students who are hearing impaired is to provide written information whenever possible

RECOMMENDATIONS

- Parents and teachers should be enlightened about assistive technologies and assist hearing impaired students in the usage for effective learning
- The teachers teaching hearing impaired students should be given training in the education of learners with hearing impairment. They should also attend short courses in modes of teaching hearing impaired students in order for them to be proficient.
- The Ministry of Education could also consider provision of in-service training for teachers in special education needs to capacitate them to effectively work with students with hearing impairment in schools.
- Government and Philanthropist should also help to fund provision of assistive technology facilities for hearing impaired students.

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