Using Assistive Technology in Teaching Children with Learning Disabilities in the 21st Century

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Abstract
This paper was written to expose the meaning, benefits, and answer why the use of assistive technology for children with learning disabilities. The paper discussed the various types of assistive technology devices that were designed and used to solve written language, reading, listening, memory and mathematic problems of children with learning disabilities. It pointed out the need for selecting the right technology tools for the children with learning disabilities, to enable achievement of the target goals, and highlighted instructional guides for the classroom teachers, that would make children with learning disabilities benefit maximally from the use of assistive technology tools, whether in the classroom or at home, in order that the technology would make the teaching – learning process enjoyable and productive. The possible challenges faced by developing nations in using assistive technology were mentioned. It concluded that there was potential for assistive technology to improve the lives and to eliminate learning difficulties for children with learning disabilities.
Keywords: Assistive Technology, Learning Disabilities, Tools, Information and Communication Technology

1   Introduction

Managing children with disabilities pose challenges to both families and professionals at homes and in schools. In an attempt to find solutions to these challenges in this contemporary world, one of the major challenges facing teachers and other professionals in meeting the social, behavioural, cognitive, perceptive and motor needs of children with learning disabilities in the classrooms is the use of technology, its appropriate use, how to select assistive technology, where to get it, use it and how to evaluate its efficiency (Liman, Adebisi, Jerry & Adewale, 2015). Assistive Technology (AT) is a derivative of Information and Communication Technology (ICT) with the history linked to computer. History of computer was dated back to 1970s with the rise of micro computers, with its basic concept traced to 20th century with the effort of Military and industries in the development of electronics, computers and information theories. Owobi (2008) and Adebisi (2014) gave account that in Nigeria, the history is not clear, as there was no documented evidence in the history of development of education, but perhaps the effect was made manifest on teaching aids and its improvisation like charts, boards, specimen, cards and collection of real objects, which later transformed to the demonstration of institutional support for the use of audio – visuals in late 1980s. Over the past decades, education sector has gained popularity of technology and expanded access to it. For a generation of young people, technology, particularly the Internet, has assumed a substantial stake in their social and educational lives (Owobi, 2008).

The gradual involvement of Nigeria in this global trend, however, is highly commendable. Adebisi (2014) maintained that Section 11, subsection 101 of the National Policy on Education has mandated the tiers of government to institute educational resource centres, which "shall provide appropriate Information and Communication Technology (ICT) facilities to ensure that the benefits of the virtual library permeate all levels of education in Nigeria" with the inclusion to "provide for the need of special education and serve as foci for educational innovation" (NPE, 2004). ICT has become a very important part of the educational delivery and management processes and to great extent facilitates the acquisition and absorption of knowledge, and therefore can provide extraordinary opportunities to developing countries for enhancing their educational systems particularly for children with special needs. To really achieve these policies, the use of ICT by children with special needs in the family and school lives has become imperative. With these, the adoption and use of Assistive Technology (AT) is becoming popular and required attention of families and professionals as a result of its potential for improving the lives of children with learning disabilities. Right from the global embrace of computers, communication devices to environmental controls; the use of technology present many children with disabilities the necessary tools to be more successful in school, at work, and at achieving independence in daily living. Certainly, opportunities now abound nowadays to some children with disabilities with the support of new and emerging technology, raising new hopes, which had in the past unavailable.

As very important as AT to the learners at all levels of education has been, the use of computer and other technologies, as extended to children with learning disabilities, have benefited and enhanced lives and given many children with learning disabilities options of intervening in their various educational and cognitive

problems, with available resources to assist both teachers and learners overcome classroom teaching – learning challenges. It is opined by Nkwoagba (2011) that technology can open doors and break down barriers for children, youth, and adults with disabilities. This could be whether in the classroom or workplace, assistive technology, including devices, software, recordings, and much more, can increase, maintain, or improve the capabilities of individuals with learning disabilities. Also, technology that is used for children with learning disabilities, such as spell check, can be principally useful to people with learning disabilities (Male, 1997).

Consequently, the variety of accessible technology, the sophistication, its dynamism, and the decisions to select the types of technology that would meet the needs of children with learning disabilities pose various questions on its usage, adaptability and availability. At the moment, much information do exist on all issues related to the choice, accessibility and purchase of any piece of technology; but much of the information is, nonetheless, of varying degrees of affordability and readability, especially in the developing or third world countries, which requires the expertise and necessary skills to use them on children with disabilities. Therefore, in today's learning environments, a wide range of technologies are creating new options for making a distinction in instruction and supporting the participation of all children, including children with learning disabilities. Learners and professionals need to be informed on the importance of providing learners with learning disabilities with the technology tools they need in order to be successful learners.

This paper therefore will answer why the use of assistive technology for children with learning disabilities; discuss various types of assistive technology: written language, reading, listening, memory and mathematic technologies; the need of selecting the right technology for the children with learning disabilities will be pointed out; and highlight instructional guides for the classroom teachers.

2   Why Using Assistive Technology for Children with Learning Disabilities

A learning disability, according to the Individuals with Disabilities Act (IDEA), is a disorder in one or more of the basic cognitive abilities involved in understanding or using spoken or written language. This could lead to an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, reading disabilities, and developmental aphasia. The term does not include children who have learning problems that are primarily the result of visual, hearing, or motor handicaps; mental retardation; emotional disturbance; or environmental, cultural, or economic disadvantage. Learning disabilities cannot be cured, but children with learning disabilities grow up with learning differences, and with persistence of proper instructions and assistive tools, they could greatly improve and attain their potentials (Raskind, 2000). Such tool is assistive technology (AT).

Assistive technology (AT) is any device that helps a learner with a disability completes an everyday task. An assistive technology (AT) tool is any item that is used to maintain or improve the functioning of a child with a disability. The tool can be complex (such as a complimentary communication device).The tool can be an adapted, like a tape recorder. Likewise, if one is physically handicapped, a remote control for the TV can be assistive technology. If someone has poor eyesight, a pair of glasses or a magnifier is assistive technology. Quenneville (2002) maintained that the potential for assistive technology children with learning disabilities is great, and that its benefits include enhancing academic achievement in written expression, reading, mathematics, and spelling; improving organization; and fostering social acceptance. It was viewed that support (assistive) technology provides many benefits by facilitating writing for children with learning disabilities (LD) who often find the writing process frustrating (MacArthur, 1996). It is therefore means that when children have the chance to accommodate writing challenges, they are more excellent in the classroom. An essential element of this attempt is partnership between classroom teachers and assistive technology specialists. The use of assistive technology must be a joint effort.

To achieve this laudable feat in improving the learning of children with learning disabilities, Allan (2015) identified the principles behind the introduction of this technology into the teaching – learning process. He identified that:

- Assistive technology can only enhance basic skills, and not replacing them. It should be used as part of the educational process, and can be used to teach basic skills.
- Assistive technology for children with disabilities is more than an educational tool; it is a fundamental work tool that is comparable to pencil and paper for non-disabled children.
- Children with disabilities use assistive technology to access and use standard tools, complete educational tasks, and participate on an equal basis with their developing peers in the regular educational environment.
- The use of assistive technology does not automatically make educational and commercial software/tools accessible or usable.
- An assistive technology evaluation conducted by a professional, knowledgeable in regular and assistive technology, is needed to determine whether a child requires assistive technology devices and services and should be specified in the children's instructional plans.

- Assistive technology evaluation must address the alternative and augmentative communication needs, that is, ability to communicate needs and change the environment for children with disabilities.
- To be effective, an assistive technology evaluation should be ongoing process.

It was maintained that sticking to these principles, assistive technology assists to enhance the independence of children with learning disabilities, because oftentimes, these children bank on parents, siblings, friends and teachers for assistance (Raskind, 2000). Relying on others may slow the transition into adulthood, and may also lower self-esteem, as it demands children with learning disabilities to depend on others, rather than themselves, to solve a problem. Assistive technology moreover, provides a way for children with learning disabilities to achieve specific tasks on their own.

3   Various Types of Assistive Technology for Children with Learning Disabilities

Assistive Technology (AT) is capable of addressing many types of learning difficulties. Higgins and Raskind (2000) stated that a child who has difficulty writing can compose a school report by dictating it and having it converted to text by special software. Moreso, a child who struggles with arithmetic problem can use a hand-held calculator to keep score while playing a game with a friend. Also, a teenager with dyslexia may benefit from AT that will read aloud from the textbook guide. A child who cannot speak may need a communication device such as a language board or a device with a speech synthesizer to participate in class. Additionally, a child with a learning disability may need a computer programmes to learn to read. AT has usually been applied to computer hardware and software and electronic tools. The AT tools help children with learning disabilities, who struggle with listening, mathematics, organization and memory, reading and writing skills. Each of the skills is listed and how AT could help to solve the learning skills.

3.1 Written Language Assistive Technologies

Some of the written language AT tools that help children with learning disabilities include:
   a. *Spell Checkers*: They are part of word processing programmes with vary sizes which could be portable or stationed. They could be attached to word processors to scan written documents and display to the user or children the misspelled words and speak the words by ways of speech synthesizer. The disadvantage of these tools is that when two words sound the same (there, their), the child find it difficult to choose the correct word suitable for the sentence, as the tool do not recognize and offer suggestions for correct spellings.
   b. *Proofreading:* otherwise called "grammar checkers". They check for errors in grammar, capitalization and word usage. The errors are identified on the computer screen and the child corrects.
   c. *Speech Synthesizers:* These tools give the children the opportunity to hear spoken text on the computer monitor. The child can review the text already written down and read it from the monitor and at the same time hears the spoken words from the computer. This is to enable the child to know if the text he or she writes down makes sense. These tools allow children to spell words and hear them pronounced correctly rather than phonetically (Beukelman, Hunt-Berg & Rankin, 1994).
   d. *Speech Recognition:* This system allows the child to speak to the computer through microphone, and the spoken words show as texts on the computer monitor. If this system recognizes words incorrectly, the child can have the opportunity to choose from the list of similar sounding words shown on the monitor. The speech recognition tool is most useful to children who have better oral language abilities than written language.

3.2 Reading Assistive Technologies

Some of the reading AT tools that help children with learning disabilities includes:
   a. *Microsoft Word:* One of the easiest differentiation tools for a reading passage is a software programme that most teachers have readily at hand — Microsoft Word. Smaller reading passages copied and pasted into Microsoft Word, can be easily enhanced to aid comprehension using standard formatting features within the programme. Using the highlighting feature can help students focus on particular aspects of a text like parts of speech, literary devices, or key elements of a paragraph.
   b. *Tape Recorders:* These tools are used to play audio taped text by children with reading disabilities. The child listens to the recorded texts in books or printed materials rather than reading it.
   c. *Speech Synthesis:* This tool can serve the purpose of reading engine. It could be available on computer disc loaded to the computer and then the child read back by the speech synthesizer.
   d. *Optical Character Recognition (OCR)*: This tool could be connected with speech synthesis. It enables the child to type printed text to the computer, while the speech synthesizer reads the text back and aloud for the child to hear and alongside see the text. This device also works with scanner that reads images and text from the written or printed materials. Texts or words are inputted data into the computer file shown on the screen, and thereafter change the printed text from the scanner to computer text. This tool

therefore is useful for children with reading disabilities to read printed words, and also those children who understand better what they hear than what they could see (Raskind, 2000). Also, the software makes the resulting computer file capable of being edited.

e. *Variable Speech Control (VSC):* This tool is in form of tape recorder, which enable the child to play the texts recorded in audio tape very fast than the originally recorded, with all the sounds of the words still intact. This is very useful for children who better understand when texts are presented at a slow rate.

3.3 Mathematics Assistive Technologies
Some of the mathematics AT tools that help children with learning disabilities includes:

a. *Electronic Mathematics Worksheets:* These worksheets could assist children with arithmetic problems to arrange, ally and route through the basic mathematical sums with the use of computer. The basic mathematical problem like addition, subtraction, division and multiplication are inputted into the computer through keyboard or mouse. The tool will automatically align itself to correct vertical format. The inputted numbers will be read aloud by the child through the use of speech synthesizer. This is beneficial to children with arithmetic problems, in that, it helps to align or arrange math problems with pencil and paper.

b. *Talking Calculators***:** This tool is used to speak number, symbols and other operation keys, with the use of speech synthesizer, whenever a child presses the keys. When completed, the child could read back the answers from the completed calculations. By listening to it, the child could find the inputted errors, when wrong keys are pressed. It could also help the child to double check for errors, when copying numbers or symbols.

3.4 Listening Assistive Technologies
Some of the listening AT tools that help children with learning disabilities includes:

a. *FM Listening Systems:* These tools are used with the help of a small-sized transmitter unit, together with the microphone. The tool redirects child's voice straight to his or her ear. This makes the child/ speaker's voice louder. The advantage of these tools to the children with listening problem is, it enables them to hear what the teacher or the speaker is saying.

b. *Tape Recorders:* These tools are used by children with listening problems to capture spoke information of the speaker or teacher's lesson. These recorders allow children to the oral presentation again and again, especially for those children who have problems processing, understanding or remembering what they hear.

3.5 Memory/ Organization Assistive Technologies
Some of the listening AT tools that help children with learning disabilities includes:

a. *Personal Data Managers*: These data managers could be in form of software packages, which could be used for a computer or as electronic devices. They are useful for children with memory or organizational problems to store and retrieve large information from the system, as in saving phone numbers, keeping memorable dates and appointments; forming a reminder for the users.

b. *Free-form databases*: These databases allow children with memory problems to type or enter notes or pieces of information into the computer, rather than or as written down in a piece of paper. The child can retrieve the information from the screen of the computer whenever he or she needs them, and serve as reminders to the child.

c. *Prewriting organizers:* The writing process involves a number of stages. Many children have difficulty with the preparation stage, which integrates brainstorming, clustering, and listing ideas, themes, or keywords. Some children with memory problems find graphic organizers helpful in mapping ideas during the planning stage. Graphic organizers such as Inspiration provide organizational frameworks to help children generate topics and content for writing projects. Inspiration shows ideas in graphic "bubbles" that can be moved and then converted into a standard outline (Male, 1997).

4.   Choosing the Right Technology for Children with Learning Disabilities
In today's learning environments, a wide range of technologies are creating new alternatives for differentiating instruction and supporting the contribution of children with learning disabilities. With array of assistive technologies available in the stores and on the internet for teachers and parents to select, there is no fast rule in choosing the right ones for children with learning disabilities. Even though, the availability of these tools poses problems for teachers and parents in the developing world like Nigeria, as the tools are scarce and not provided for in schools, and not available in most of the local shops and markets, for them to choose and purchase (Liman, Adebisi, Jerry & Adewale, 2015). However, the few stores and markets found the cities and metropolis sell at

high cost for parents and schools. This places children with disabilities in these areas the choice of wrong AT that would enable adequate supports. It is also important to note that, the developing countries lack experts to manage and apply these devices, as teachers managing children instructions are ill – trained on the use of assistive technology. This leads the teachers with learning disabilities to improvise or source for local tools in lieu of low – tech devices.

Nevertheless, the choice of the appropriate use of AT, whether available or improvised, the right selection depends on the individual child, the skills problems, the setting and the particular tasks the child wants to achieve. This implies that one tool used for a child may not be useful for another child in different setting. Raskind (2000) presented guidelines that may assist children with learning disabilities achieve amidst the array of assistive technologies. Some of them are discussed below:

4.1 Determine the Child's Specific Problem.
The use of assistive technology tools should depend on the identified problems of the child with learning disabilities. For instance, AT could help solve the problem of writing difficulty, such as problems with grammar or compensate for a memory problem should be selected to meet or support the child's specific problems.

4.2 Identify the Child's Strengths.
Assistive technology could work best when it is used to develop the potential of children with learning disabilities. For instance, a child who has problem reading printed words, other than who easily understands spoken words, might benefit from an OCR/speech synthesis system that changes printed words to computerized speech.

4.3 Involve the child in the selection process.
The interest of the child in the assistive technology tools is paramount to the selection of the tools. This will enable the child to easily learn how to use the tools that will translate to change in the teaching – learning process. The parents or teachers should therefore consider this in the selection and purchase of tools, as well as in the developing the child's interest on the tools.

4.4 Choose the types of technology that are helpful and based on the child's strengths and weaknesses.
Always consider that the technologies that are useful to your child's needs are important to him or her, than just purchasing and using the ones that would not meet the identified needs or problems. Technology can be quite impressive, with all its shapes and designs, but not necessarily helpful to the child.

4.5 Determine the specific settings for the technology
The location of the technology for the child could be at home, school, playing ground, open space or in a social setting. Placing the one that supposed to be used at home, in the school could be a wrong choice, and would not serve the right purpose for the child. The setting for the technology could include where they could be stored or kept and the right furniture to place them.

4.6 Choose technologies that work together.
Imagine a speech recognition system that would not work or incompatible with the current computer window system could pose a problem and could be frustrating.

4.7 Choose technologies that are easy to learn and operate.
Consider a child or learner with learning disabilities that has difficulties in memory and other cognitive problems, finding it difficult to use and operate most of the assistive technologies; this may not benefit them if they found it hard to manipulate the tools. They may as well lose interest in such tools. Therefore, choosing the easy – to – operate devices will be helpful and develop interest in the child.

5.   Instructional Guidelines for the Teachers
For children with learning disabilities to benefit maximally from the use of assistive technology tools, whether in the classroom or at home, teacher should follow some basic guidelines that will enable the use of AT worthwhile and making the teaching – learning process enjoyable and productive. The following basic guidelines should be followed and adhered to by the classroom teachers:

- Teachers should know that every child's assistive technology needs are distinctive. Children's needs should be matched with necessary technology rather than matching available tools to student needs.
- Teachers should teach needed technology skills before they are required. Thus, the children can then pay attention on regular classroom instruction rather than simultaneously learning the curriculum and the new assistive technology skills.
- It is very important that technology training for teachers make children better users of AT and maximizes the impact of efforts and finances expended. Teachers should be up – to – date in the AT skills acquisition. This training should include making teachers spend time researching and reading the recommended books and be current in the global use of assistive technologies.
- It is also important that teachers should have access to technical supports that might help in case of any system's crash or breakdown.

- The global trend now is collaboration and partnership among the multidisciplinary team that may include assistive technology teacher, computer teacher, and computer maintenance professionals. This will help to ensure a functional/faultless assistive technology environment.

6. Challenges of Using Assistive Technology for Children with Learning Disabilities

The reading, listening, mathematics, writing and memory/ organizational deficits in children with learning disabilities may pose delay in the use and application of AT at home and in the school. In many of the developing countries, including Nigeria, the problems may be as a result of the following as enumerated by Mishra, Sharma and Tripathi (2010):

- Lack of specialized ICT teachers for the children with learning disabilities
- Limited flexibility in training options for children with learning disabilities
- Limited availability of specialized disabled friendly hardware and software resources in developing countries.
- Lack of formal involvement of the government organizations and support structure for ICT for the persons with learning disabilities
- Attitude barriers towards children with disabilities
- Lack of appropriate disabled legislation and policies and their implementation
- Limitation of finances

7. Conclusion

We now live in a global village where many useful tools available to assist children with learning disabilities. Studies have investigated how information and communications technologies (ICT) cum assistive technology (AT) can influence the education of students with special needs and have shown that this technology can play an important and useful role (Pillay, 2000; Quinn, 1996). Specifically, technology assists students with learning disabilities to: (1) develop independence in academic and employment tasks (2) participate in classroom discussion (3) gain access to peers and teachers (4) gain access to the full variety of educational options (5) secure high levels of independent learning (6) work side-by-side with peers (7) master academic tasks that they find difficult (8) participate in community and recreational activities (Burgstahler, 2003). However, choosing the right and best technology for a child requires caution, time and patience. Assistive technology cannot fix or eliminate learning difficulties. However, learning to develop their strengths and attempt to eliminate their weaknesses, individuals with learning disabilities can lead rewarding and successful lives.

It has therefore become imperative to emphasise that using technology promotes sense of belonging and interactive participation in the classrooms for children with learning disabilities (Bryant & Bryant, 1998). Technology enhances the rate of assignment completion and contributes to improved motivation (Bahr, Nelson, and VanMeter, 1996). Adebisi (2015) opined that AT can act as a support to the teaching of instruction to the children with special needs, thereby reducing the workload and stress of teachers. AT can be a powerful tool in supporting education and inclusiveness of the learners with learning disabilities. Much of the power of the Internet lies in its ability to foster virtual learning communities, and children with learning disabilities are no exception to this. AT certainly offers students the capacity to construct their own learning experiences. This endeavour therefore supports few of the basic objectives of involving children with learning disabilities in classroom activities as enjoyed by their developing peers, promising a sense of belonging, shared activities with individual outcomes, and an objective educational experience. Assistive technology brings about adaptations for children with learning disabilities. Adaptations that have been widely used to recompense for barriers associated with problems in reading, writing, mathematical reasoning, and problem solving (Bryant & Bryant, 1998).

Moreover, technology can help children with learning disabilities recompense for challenges in learning, especially in the area of writing, providing computer-supported tools. In addition, this technology can also lessen frustration, increase motivation, foster a sense of peer acceptance, and improve productivity in the classroom and at home. Collaborative planning teams must increase an idea of technology for individual children in the classrooms. Team members are expected to decide the efficiency of current technology and directly supervise children to make sure that the needed modifications are made to reflect the changing abilities of the children. The potential of assistive technology for children has not been realized; the future is in doubt but holds much prospect. For every child with learning disabilities, this assistive technology could be one way to eliminate difficulty to learning.

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