WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Supporting Dyslexic Students with Assistive Technology in Reading

[1]Chukwuemeka, Chinwe Joyce, [2]Prof L. N. Abraham

[1,2]Department of Curriculum Studies and Educational Technology, University of Port Harcourt, Rivers State, Nigeria

ABSTRACT

Dyslexia is a neurobiological disorder with brain patterns (neural signatures) that reflect poor phonological and orthographic processing. Dyslexics are often misunderstood, under-diagnosed, and undermined as students throughout childhood and into adulthood. This paper generally advocated the need to support dyslexic students using assistive technologies as well as x-raying the scenarios in the educational system with regard to students with a learning disability (in this case reading disorder). The paper suggested that government should provide assistive technology free-of-charge to dyslexic students to help them participate fully in the teaching and learning process, as well as influence their performance in Reading Comprehension and parents of dyslexic students should know that early intervention with explicit and intense instruction in the sound structure of language (phonemic awareness) and how sounds relate to letters (phonics) is the key. They should provide Text-to-Speech assistive technology for their wards to enable them to gain the ability to retain what is learned extensively.

Keywords: Learning disability, dyslexia, assistive technology, reading and comprehension, language.

INTRODUCTION

Reading is the process of looking at a series of written symbols and getting meaning from them. When we read, we use our eyes to receive written symbols (letters, punctuation marks and spaces) and we use our brain to convert them into words, sentences and paragraphs that communicate something to us. Reading does not constitute a skill that occurs naturally in an individual. Rather, it is one of the most difficult and complex skills acquired in human life. Although, anyone without a neurological disability can speak, not everyone can read. This is because reading requires more sensitive visual, auditory and mental activities compared to the speaking. Learning to read is a cognitive and linguistic skill, and can usually be acquired through external support. It is linguistic since it is learnt using certain areas of the brain during the processing of language. It is also cognitive for as much as the existing cognitive reserves of the brain are used during learning to read. Therefore, learning to read has a cognitive-linguistic structure. Those with developmental dyslexia usually spend more time in the acquisition of phonemes and in the development of phonological skills (Balc & Çayır, 2017). Reading is a receptive skill and through it we receive information. Although the complex process of reading also requires the skill of speaking, so that we can pronounce the words that we read. In this sense, reading is also a productive skill in that we are both receiving information and transmitting it.

Students with dyslexia do not read as well as their peers despite having comparable intelligence and instructional opportunities to learn to read. This can present a challenge for teachers because students with dyslexia cannot often comprehend material more advanced than their reading achievement allows them to access. Hence, they need technology that will provide options for them to access content and information in different ways. Text-to-speech software, Read-Out- Loud and Text -to-Speech software for examples of these technologies that can be beneficial for students with dyslexia who exhibit weakness decoding skills, low levels of fluency, and strong listening comprehension skills (Parr, 2018; Wood, Moxley, Tighe, & Wagner, 2017). Although dyslexia is not associated with visual acuity, shorter lines and highlighting can help dyslexic students focus their attention in appropriate places during reading. Combining on-screen text and spoken text may also facilitate more fluent reading for students with dyslexia (Schneps, Chen, Pomplun, Wang, Crosby & Kent 2016).

Dyslexia in a nutshell, is a neurobiological disorder with brain patterns (neural signatures) that reflect poor phonological and orthographic processing. These signatures are but not limited to function and structures of the left hemisphere language regions such as the left temporal-parietal region related to phonological processing, and left occipital temporal region related to orthographic processing. The Dyslexia International (2018) reported that nearly 10 percent of the global population (over seven million) has some form of dyslexia. In other findings, it is estimated that between 70 and 80 percent of learning disabilities around the world emanate from dyslexia, making the condition the most prevalent form of learning disabilities. An estimated 15–20% of people are dyslexic (Dyslexia Research Institute, 2017). According to the Yale Center for Dyslexia and Creativity (2018), “It differs from other learning disabilities in its specificity and scientific validation. While those with dyslexia are slow readers, they also, paradoxically, are often very fast and creative thinkers with excellent reasoning skills”. Furthermore, 40% of individuals with dyslexia can cite a family member (or more) with similar characteristics (Understood.org, 2017).

Dyslexia as a neurological learning disorder is usually caused by cerebella abnormalities in brain development during gestation, leading to problems in acquisition and automatization of skills. Dyslexia causes impaired functioning of the language-based circuits involving the cerebellum. Brain disruption creates difficulties in coding tasks requiring language skills. There is a disruption of left hemisphere posterior neural systems in child and adult dyslexic

readers when they perform reading tasks. There are different types of dyslexia and related learning issues that affect individuals with dyslexia. Eide and Eide (2019) suggested that the same brain differences that create challenges in literacy, language, and learning may also create strengths in conceptual, visual, and visionary thinking. Dyslexic individuals can struggle as students. According to Alexander-Passe (2016), "dyslexics commonly experience adversity as children, both socially and educationally in school through exclusion and bullying by peers due to their learning differences". Too early challenges can result in "post-traumatic stress disorders", creating anxiety and low self-esteem. However, early intervention can help individuals with dyslexia learn to read better and help rewire key connections in the brain.

Dyslexics can often be misunderstood, under diagnosed, and undermined as students throughout childhood and into adulthood. It can also be argued that dyslexics can be resilient and transform their life experiences in positive, successful, and meaningful ways. "Post-traumatic growth" according to Alexander-Passe (2016) develops when dyslexic individuals are motivated to create positive experiences as a response to earlier traumatic ones. It is important to remember that dyslexia have a neurological basis. One individual's coping response may be different from another's. Dyslexics are good with visual thinking and very creative. Their problem is in reading, writing and remembering things. For them written letters or words often present themselves in the wrong order. It is also important to recognize that many dyslexics focus on their areas of strength and talent rather than primarily on coping in areas that are challenging to their neurological deficits. Dyslexics can "craft an environment towards success building on signature strengths" (Nicholson, 2015, as cited by Alexander-Passe, 2016). Students with dyslexia carry forward their early academic challenges with learning into their adult life. Their responses to early life experiences as dyslexic learners shape their personal and professional lives. There are creative individuals with high conceptual thinking and other traits, who have career success and are not dyslexics. But there are differences in the brain orientations of dyslexics themselves. Each brain can be considered unique, but there are some common attributes shared by dyslexics. "Dyslexic processing is not caused by a single gene, so different individuals with dyslexia will show different patterns of strengths and challenges" (Eide & Eide, 2019). These patterns involve material reasoning, interconnected reasoning, narrative reasoning, and dynamic reasoning.

The world of education is currently undergoing a massive transformation as a result of the digital revolution" (Collins & Halverson, 2019). Because of this "digital revolution," it is important and practical to make use of the availability and accessibility of technology in designing educational or training programs. Technology has the potential to contribute to a better quality of life for students with intellectual disabilities, which is more than just a matter of convenience (Wehmeyer, Palmer, Smith, Davies & Stock, 2018). The use of technology in education is inevitable; it is only a matter of time before schools will fall behind unless they try to catch up. Students spend long hours of their day outside school using technology, is it reasonable to expect them to come to school and find themselves in the world of no technology and feel attracted to this world. In addition to the factor of attractiveness, there is also the effectiveness of using technology, which has been proven through some studies. For instance, Patton and Roschelle (2018) argued that digital textbooks offer a better alternative than traditional textbooks because they can provide instant feedback, interactive representations, and the system of universal design for learning (UDL). The introduction of these technologies in education can also help students with learning disabilities such as autism, visual impairment and dyslexia. Technology can help students of all ages work around their reading challenges. The type of technology is generally termed assistive technology. Assistive technology may be referred to as any tool, device or items designed to help people with learning disabilities perform better and encourage them to become more independent and self-reliant such as: Reading, taking notes, Mathematics, organizing ideas, managing time, Writing, Spelling etc. Many assistive technological tools work on digital devices but some of the most useful tools are not digital.

RATIONALE FOR THIS STUDY

This study generally aims at advocating the need to support dyslexic students using assistive technologies as well as x-raying the scenarios in educational system with regards to students with learning disability (in this case reading disorder). Specifically, the paper sought to expatiate on the following:

a. Concept of Learning Disabilities

b. Concept of Dyslexia

c. Assistive technology

LITERATURE REVIEW

Concept of Learning Disabilities

Learning disabilities are neurologically based processing challenges. These processing problems can interfere with learning basic skills such as reading, writing and mathematics. They can also interfere with higher level skills such as organization, time planning, abstract reasoning, long or short-term memory, and attention. Dyslexia is one of such specific learning disability (SpLD), involving challenges with reading, and is the most common and widely researched learning disability. Disability is an umbrella term for impairments, activity, limitations, and participation restrictions. It denotes the negative aspects of the interaction between an individual (with a health condition) and the individual's contextual factors which are environmental and personal factors (WHO, 2021). More so, these definitions are also evoked within the Convention on the Rights of Persons with Disabilities (UN, 2021-2030), which puts emphasis on the possibility of participation for each individual. Recognizing that disability is an evolving concept that results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others (Convention on the Rights of Persons with Disabilities, Preamble, Art.).

Types of Learning Disabilities

Based on the view on IvyPanda (2019), the most common learning disabilities are neurologically based processing problems which might interfere with learning basic skills. These processing problems can also interfere with higher level skills. It is important to understand that learning disabilities affect people in more ways than just at school; family life and work life can also be severely impacted. The signs and symptoms of learning disabilities are often identified during the school years when a person has trouble with reading, writing or mathematics. However, some people are not identified until they are adults. Still others were not identified and never knew why they have such difficulties.

Most learning disabilities are not the same as learning problems, which are usually the result of motor, hearing or visual handicaps; emotional disturbances; intellectual disabilities; or disadvantages due to culture, environment, or economy. Usually, people with learning disabilities are of average or above-average intelligence. While they might look like any ordinary person, they may not be able to perform at the skill level you might expect. Learning disabilities cannot be fixed or cured, but with the right kind of support, people with learning disability can be successful in relationships, at work, in school, and in the community. Below are the most common learning disabilities and related disorders. However, this paper will confine itself to dyslexia

i. Dyslexia
ii. Dysgraphia
iii. Dyspraxia
iv. Dyscalculia
v. Auditory Processing Disorder (APD)
vi. Language Processing Disorder (LPD)
vii. Visual perceptual/visual motor deficit
viii. Executive Functioning
ix. Attention Deficit Hyperactivity Disorder (ADHD)

Concept of Dyslexia

Dyslexia is generally defined as a disorder that involves difficulty learning to read associated with specific problems in word identification. It often runs in families and does not affect general intelligence. Although estimates vary, approximately 15 percent to 20 percent of the population will experience difficulties related to dyslexia. The word dyslexia is derived from the Greek word ‘dys’ (meaning difficult) plus ‘lexis’ (words or language). Originally, dyslexia was called reading blindness. Today, we know that dyslexia is a brain-based, hereditary difficulty manipulating the sounds and letters of the language.

Dyslexia is a language-based learning disability in which individuals experience difficulty in performing language-related tasks such as word recognition or reading, writing, spelling, comprehension and sometimes speaking. According to Eide and Eide (2019), individuals with dyslexia often can have the following capabilities: (1) Three-dimensional spatial reasoning and mechanical ability. (2) The ability to perceive relationships like analogies, metaphors, paradoxes, similarities, differences, implications, gaps, and imbalances. (3) The ability to remember important personal experiences and to understand the abstract information in terms of specific examples. (4) The ability to perceive and take advantage of subtle patterns in complex and constantly shifting systems or data sets. The study suggested that 21st-century employers in a “conceptual” (Pink, 2016) economy may benefit from the skills and talents of many dyslexics who can think differently about problems and create innovative solutions. The emergence of functional magnetic resonance imaging (fMRI) offered a deeper and more detailed understanding of how the brain works in individuals with dyslexia. The fMRI scan measures brain activity from blood flow. “Scientists can infer the location and amount of brain activity that is associated with a task, such as reading single words” (International Dyslexia Association, 2018). An fMRI of individuals with dyslexia often indicates strengths in the right hemisphere, such as visual, conceptual, and big-picture thinking (Eide and Eide, 2019). The study suggested that fMRI research offered a significant view into the brain activities of individuals with dyslexia. The figure below shows how the brain of a dyslexic functions.

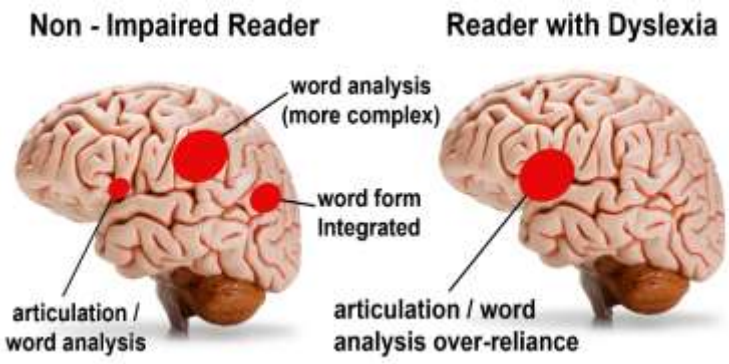

Figure 1: Dyslexic Brain

Source: **https://www.bing.com/images/of/**dyslexic/brain/view=detailV2&ccid/

Students with dyslexia can overcome many challenges in secondary school based on the support of caring teachers and the use of assistive technology, more students with dyslexia are attending and graduating from colleges in the United States (Bell, 2013). When students with dyslexia enter secondary school, they may not be aware of available resources or apply for assistance because they fear being ridiculed by other students, according to the district's special education director. Secondary school students with dyslexia are offered support from the student service center, but they are not required to accept such support.

Most colleges in the United States offer tutoring, mentoring, and various reading and writing centers to assist students (Bell, 2018), but students with dyslexia might be reluctant to use these resources because they do not want to share the fact that they have a disability.

Although, previous researchers have acknowledged that dyslexia is a learning disability, more research is needed to investigate strategies used by dyslexic students to overcome their barriers while attending college (Pino & Mortan, 2020).

Other activities may also be affected, including spoken language, mathematics, memory and organization. There can also be difficulties with auditory or visual perception. Dyslexic individuals often have enhanced problem-solving skills, excellent spatial awareness and high levels of creativity. A BBC survey highlighted some strong links with entrepreneurial success, with 40% of the 300 self-made millionaires interviewed for the programme reported as dyslexic. Dyslexia is described as being on a continuum or spectrum, meaning that it can impact people differently. The kind of challenges to education and work can include: (1) Reading and understanding new terminology, (2) Taking notes in meetings, seminars and presentations, (3) Organizing information and revision, (4) Planning and writing letters, emails, essays and reports, (5) Maintaining a consistent quality of work, (6) Meeting deadlines filling in forms and personal organization.

The following definition was adopted by the International Dyslexia Association in (2018) and is used by the National Institute of Child Health and Human Development: Dyslexia is a specific learning disability that is neurobiological in origin. In other words, students are born with dyslexia, often with a genetic base. Dyslexia is caused by differences in brain structure or brain functioning that are present at birth but become evident only as students are learning to read. These differences lead to problems in processing, storing, or producing information and should not be confused with mental retardation, autism, deafness, blindness, or behavioral disorders.

How Dyslexia Impact the Reading Process

According to the Simple View of Reading (Gough & Tunmer, 2016), reading comprehension is the product of decoding and language comprehension. Decoding is the ability to recognize the words on a printed page. Language comprehension involves the skills and processes needed to understand language, such as vocabulary, background knowledge, attention, and memory. The two components of reading comprehension work together in an interdependent balance; both are necessary, and inefficiency in one of the components can lead to overall reading failure. The reader who has difficulty decoding will not be able to derive meaning from a text, while the reader who has difficulty comprehending spoken language will receive little reward for their effortless decoding.

A student with adequate language comprehension but inadequate decoding may be diagnosed with dyslexia. This student's inadequate reading comprehension is unexpected in relation to their adequate oral language comprehension, which may be at or even well above grade level. The cause of poor reading comprehension is most likely the student's slow and often inaccurate recognition of words, which makes it difficult to pay attention to meaning. Explicit and systematic instruction in the reliable reading and spelling patterns of written language should improve reading comprehension to at least the level of listening comprehension.

According to the view of Torgesen (2022), stressed another important issue in reading instruction for students with dyslexia which involves the intensity of intervention. Because of the need for more explicit and direct guidance, students with dyslexia often need more intensive instruction. The intensity of instruction should differ depending on the dyslexic student's skill level and rate of progress; teaching for the student with dyslexia needs to be strategic with systematic progress monitoring to determine whether dyslexics should remain at their current intensity level or move to a more or less intensive level.

Concept of Assistive Technology

There are lots definitions of assistive technology given in the literature. Assistive technology is any device, software, or equipment that helps people with disabilities learn, communicate, or function better. Assistive technology can be as high-tech as a computer. Or as low-tech as a walking stick like a wheelchair, an app that reads text aloud and a keyboard for typing. Students who struggle with learning can use assistive technology to help with subjects like reading, writing, and math. Many workers use these tools on the job. Using assistive technology can help people become more confident and independent. That is because assistive technology empowers people to do things for themselves. Assistive technology provides dyslexic students opportunities to excel in academic environments. Dyslexic students perhaps struggle with reading, writing, and organizational skills and competencies needed to perform at a high level in school. Assistive technology may improve the performance of dyslexic students with disabilities in those areas. Technology can often provide assistance for these students in unique ways that may help them overcome their learning difficulties. As technology becomes ubiquitous in the classroom, it is consistently transforming the educational opportunities for students with learning disabilities. Assistive Technology can be used to compensate a disability, such as when nonverbal students use communication devices, or to mediate a disability, such as when students with print disabilities use text-to-speech programs (Kennedy & Boyle, 2017). Assistive technology is accessible to aid individuals with many

kinds of disabilities which also cover cognitive issues to physical impairment. Huang, Cheing, Rumrill, Bengtson, Chan, Telzlaff and Snitker (2016) examined the use of assistive technology that enhances learning in children where they often experience greater success and use their abilities in a good manner. On the other hand, this provides children knowledge to work around on their disability's challenges. Tshiswaka, Clay, Chiu, Alston and Lewis (2016) stated that assistive technology is explained as any piece of equipment or a device that helps bypass, compensate individual's specific learning deficits with learning disabilities. On the other hand, Hook, Verbaan, Durrant, Olivier and Wright (2014) demonstrated that assistive technology does not remove learning difficulties but can help dyslexic students reach their potential. This allows dyslexic students to capitalize on their strengths and avoid their difficult areas. Generally, assistive technology compensates in dyslexic students' skills and also allows dyslexic students to receive remedial instruction at alleviating deficits such as the software intended to enhance poor phonic skills. Assistive Technology can mediate challenges with reading, writing, and spelling. Readily available Assistive Technologies can make a notable difference for students with dyslexia, but they often go unused due to lack of awareness among teachers and students. The strength of assistive technology approach is in its ability to improve the students' learning experiences. Previous research works like Chukwuemeka and Anekwe (2023) have shown that assistive technology minimizes failure rate, improves access to online materials, facilitates learning, helps engagement, encourages collaboration and prepares dyslexic students to become lifelong learners. It integrates the best part of face-to-face teaching and online learning in ways that enable learners to learn at their own pace. For example, a dyslexic utilizing assistive technology in class who grasps a concept earlier than his peers can go on without delay, and conversely, a dyslexic who needs more time is not compelled to go on before they fully understand the content. As viewed by (Owston, York & Murtha 2020). Based on the view of Cuesta (2019), suggested that an adequate analysis and implementation of these assistive technologies should aim at providing dyslexic students with the opportunity to customize their learning experiences according to their needs, styles, skills, demographics, previous learning history with technology, and beliefs. Consequently, interaction outcomes should favour satisfaction, participation, communication, exploration, and self-regulation processes while the learning is a replica of how UNESCO (2014) defines learning as a social, natural and active process which is based on a strength model of student abilities, interest and culture. Bhuasiri (2020), assistive technology is an innovative approach to education delivery via electronic forms of information that enhance the learner's knowledge, skills or other performance such as text to speech, speech to text, smart pen, audio book, virtual classroom and digital collaboration. It includes the delivery of content via internet, intranet/extranet (LAN/WAN), audio and video tape, satellite broadcast, interactive TV, CD, ROM and more. (Oliveira, Aparico, & Bacao 2018).

Apps and Tools for Dyslexic Students

Mathew (2017) stipulated some Apps dyslexic students can benefit greatly from using technology. There are apps and tools available that can help dyslexic students read, write, and more. Using these apps and tools with dyslexic students perhaps will ensure they can keep up in the 21st century classroom.

Text to Speech: With Text-to-Speech technology, dyslexic students can listen to words while scanning text or visualizing the narrative. This can be used to improve reading speed, develop visualization skills, and many students report that it can helps them see whole words instead of strings of letters.

Speech to Text: Speech to text software takes the spoken word and translates it into text. Individuals with dyslexia can speak into a built-in or external microphone and their words appear on the screen. Spelling is no longer a barrier to writing; however, users have to learn to speak their punctuation, by saying "comma" or "new paragraph" as needed.

Reading Guides and Colour Overlays: If students with dyslexia are experiencing visual stress - they are overwhelmed by a page of text, struggle with visual tracking, battle with maintaining attention while reading, or they dislike the contrast of black letters on a white background, reading guides and colour overlays can assist.

Learning Ally: Learning Ally is a great resource for audiobooks. This app has hundreds of books for kids and teens available with a monthly subscription. Users can follow along and adjust the size or type of text to make it easier for dyslexic students.

Natural Reader: Reading webpages, emails, and texts can be hard for dyslexic students. However, many text-to-speech apps sound mechanical and feel clunky. Natural Reader has a nice, natural-sounding voice that can read a variety of documents.

Dyslexia Quest: Dyslexia Quest is an app that looks and feels like a game, but is designed to help dyslexic kids and teens work on memory skills, phonics, and sequencing all skills that dyslexic students typically struggle with.

Sound Literacy: For younger students with dyslexia, working with phonics is especially important. Sound Literacy is a fun app with game-like activities designed to help students learn to recognize letter sounds.

Ginger Page: Dyslexic students often have trouble with spelling. Software with autocorrect or spellcheck sometimes can't figure out what a dyslexic student is trying to spell. Ginger Page is a more sophisticated word processor that can help dyslexic students write flawlessly.

vBooks PDF Voice Reader: Many text-to-speech apps are unable to convert PDF documents into speech. vBooks PDF Voice Reader can, and it can also change the font to one designed for dyslexic readers.

OpenWeb: OpenWeb is a web browser that converts text into a dyslexic-friendly font, allowing dyslexic students to read with less difficulty. It is useful for times when text-to-speech is unnecessary or disruptive.

Reading Intro by Oz Phonics: Another great app for young students with dyslexia, Reading Intro by Oz Phonics helps kids learn to recognize letter sounds. The tasks are fun and simple enough for kids to play on their own.

What is Dyslexia? This app is not necessarily just for students with dyslexia, but it is a great tool. It has a quiz that may help determine if a child is dyslexic or needs further screening. It also has information for teachers, parents, and other students to help them understand dyslexia.

OCR Instantly Pro: Text-to-speech apps are great for online content, but what about books or worksheets? OCR Instantly Pro allows users to snap a photo of any page and convert it to text, which can then be read aloud by a number of apps.

MindMeister: For dyslexic students, traditional note-taking is difficult. This app allows users to create graphic organizers or mind maps to jot down their thoughts quickly and easily.

Kinesthetic Desks, Chairs, and Tools: For dyslexic students with attention issues or who may fidget and fiddle in the classroom, there are "kinesthetic" desks and other furniture that allow movement or feature movable parts like swiveling platforms, elliptical, and bike pedals. These tools increase heart rate, improve circulation and, in turn, stamina and mental function.

Assistive Technology and Reading

Informatics changes and the large diffusion of technologies impact on the educational environments by increasing the need to promote not only literacy acquisition but also the acquisition of the so-called informatics literacy (Cummins, 2018). Clinical interventions start once the reading disabilities is identified or diagnosed and, usually, they provide ad hoc educational strategies for the specific difficulties encountered by the child. If and while these difficulties are not overcome, the child needs to develop or adopt procedures that are different and alternative to those classically used for reading and writing. Assistive technologies are powerful from a rehabilitative point of view, by supporting the child in reading and writing acquisition, but also from a compensative point of view, by offering alternative methods to traditional reading and writing. Therefore, technologies for dyslexia can be classified into two main categories that are not mutually exclusive but present some degree of overlap: rehabilitative technologies, devised to help dyslexic children to strengthen and improve their linguistic abilities by providing specific rehabilitative trainings, and compensative technologies that comprise those devices developed to help the child to overcome the deficit and to have access to grade-level texts (Hasselbring & Bausch, 2016). Rehabilitation and compensation are two key factors in the relationship between dyslexic students and technology and have to be considered in parallel.

Specifically, the designed educative program should include one or more of the standard procedures but also the use of technological devices that can be helpful in rendering effective the rehabilitative programs. But compensative technologies should also be employed in order to provide alternative paths to acquire the content and knowledge need for school success and social well-being. Thus, compensation is an auxiliary, and not a substitutive, tool for education (Hasselbring & Bausch, 2016).

A method that has shown interesting results in enhancing reading fluency is the Rapid Serial Visual Presentation (RSVP) procedure. RSVP allows to dynamically present a text on the screen (Mills & Weldon, 2019) simultaneously controlling for speed, location, and size of linguistic units. More so, text to single words or short sentences is presented in rapid succession in a fixed location of the screen with the purpose of avoiding saccadic eye movements during reading.

A software suited for helping dyslexic children that combines RSVP and a personalized control of text presentation, is AirBook. This device is especially designed for dyslexics and, in general, for students with visual and upper-body disabilities. It consists of a computer, a monitor and a tabletop interface as mobile pads. AirBook is devised to adapt to the reader emphasizing personal control of reading speed and of text presentation thanks to two force-free sensors, able to read proximity of hands or fingers that slide along or above the tablet. One of the sensors allows controlling the speed of text presentation.

Fluency is crucial in text Comprehension and this latter is indispensable to be a good reader. Text comprehension relies on a number of abilities and mechanisms, including a vocabulary of adequate size and the building-up of the orthographic lexicon. The former allows for a fine and specific appreciation of subtle differences in meaning, and for a richer lexical network that support comprehension. The latter allows for fast and easy decoding of the text.

An interesting and promising program dedicated to improve fluency, vocabulary, and text comprehension of less able readers is READ 180, a technology-based reading intervention program designed for older students, specifically those in grades 4–12 in USA. READ 180 provides helpful tools to help students in reading and texts comprehension integrating different sensory modalities and strategies and providing individualized instruction targeted on the reading level and reading deficiencies (Hasselbring & Bausch, 2016). For instance, before reading a test, the dyslexic students can view a video that provide a background to understand the text. When the text is presented, the dyslexic students can receive help in decoding words and sentences thanks to an automatic text reader. Furthermore, problematic words are trained providing decoding, pronunciation, spelling and segmentation of that words and, if necessary, a translation in another language. At the end of text processing, both comprehension questions and a summary of well-read words are provided. READ 180 shows promising results in improving reading proficiency of poor readers (for a detailed overview see, e.g., WWC Intervention Report, 2009; 2010).

The within-subjects experimental study investigated the relative effects of word reading and word meaning instruction (WR+WM) compared to word-reading instruction alone (WR) on the accuracy, fluency, and word meaning knowledge of 4th-5th graders with dyslexia. We matched word lists on syllables, phonemes, frequency, number of definitions, and concreteness. We assigned half the words to WR and half to WR+WM. Word reading accuracy, word reading fluency, and word meaning knowledge were measured at pretest, immediately following each intervention session, and at posttest,

administered immediately following the 12, 45-minute, daily instructional sessions. Compared to WR instruction alone, WR+WM significantly improved accuracy (d = 0.65), fluency (d = 0.43), and word meaning knowledge (d = 1.92) immediately following intervention, and significantly improved accuracy (d = 0.74), fluency (d = 0.84), and word meaning knowledge (d = 1.03) at posttest. The use of assistive technology seems to have transfer effects on reading ability and to be supportive, especially for students with the most severe difficulties. Findings support the premise that word meaning knowledge facilitates accurate and fluent word reading, and that instruction explicitly integrating word reading and word meaning may be an effective support for secondary school students with dyslexia.

CONCLUSION

Dyslexic students have their own talent, if they are treated with care then they can learn as normal students. Even though assistive technologies are not affordable by many students. But using these technologies in a right way can help them overcome their disability. The learning future is bright for students with a learning disability who have access to technology to allow them learn in the best possible way.

SUGGESTIONS

Based on the literature reviewed and conclusion of this paper, the following were suggested:

1. Government should provide assistive technology free-of-charge to dyslexic students to help them participate fully in the teaching and learning process, as well as influence their performance in Reading Comprehension.
2. Parents of dyslexic students should know that early intervention with explicit and intense instruction in the sound structure of language (phonemic awareness) and how sounds relate to letters (phonics) is the key. They should provide Text-to-Speech assistive technology for their wards to enable them gain the ability to retain what is learnt extensively.
3. Community members should be aware of the importance of treating each member of within and outside the community with much love, care and support regardless of condition one has. As such, members of the communities should understand that people with disabilities are part and parcel of the community and should be accorded all necessary support to thrive academically.

REFERENCES

Alexander-Passe, N. (2016). Dyslexia, success and post-traumatic growth. *Asia Pacific Journal of Developmental Differences*, *3*, 87–130. Dyslexia Association of Singapore. www.das.org.sg

Balcı, E., & Çayır, A. (2017). The impact of multiple sensory learning in increasing the phonological awareness of the 4th grade student with dyslexia. *Journal of Mother Tongue Education*, 5(2), 201-216.

Bell, S. (2013). Professional development for specialist teachers and assessors of students with literacy difficulties/dyslexia: To learn how to assess and support children with.

Bhuasiri, W., (2020). Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty. *Computers and Education, 58*,843-855.

Chukwuemeka, C. J., & Anekwe, J. U. (2023). Effect of assistive technology for dyslexia on students' performance and retention in reading in Port Harcourt Metropolis, Rivers State. *EPRA International Journal of Research and Development (IJRD)*, *8*(3), 59-69.

Collins, A. & Halverson, R. (2019). *Rethinking education in the age of technology: The digital revolution and the schools*. New York, NY: Teachers College Press. http://ocw.mit.edu/courses/media-arts-and-sciences/mas-714j-technologies-for-creative-learning-fall-2019/readings/MITMAS714JF09_read03_coll.pdf.

Cuesta, H. A. (2019). El diálogo social y la negociación colectiva como herramientas para lograr una transición digital justa. *Lan Harremanak-Revista de Relaciones Laborales*, (42).

Cummins, J. (2018). The potential of ICT to promote academic language learning. In *Proceedings of the 3rd International Conference Information and Communication Technology in Education*. Rhodes: University of the Aegean, 55-64.

Dyslexia International. (2018). *Prevalence of 'dyslexia' worldwide, and implications for teaching and educational policies*. https://www.dyslexiainternational.org/wp-co

Dyslexia Research Institute. (2017). the dyslexia research institute mission. http://www.dyslexia-add.org.

Eide, B., & Eide F. (2019). *The dyslexic advantage*. Penguin.

Gough, P. B. & Tunmer, W. E. (2016). Decoding, reading and reading disability. RASE: Remedial and special Education,7, 6-10.

Hasselbring, T. S., & Bausch, M. E. (2016). Assistive technologies for reading. *Educational Leadership, 63*, 72-75.

Hook, J., Verbaan, S., Durrant, A., Olivier, P., & Wright, P. (2014, June). A study of the challenges related to DIY assistive technology in the context of children with disabilities. In *Proceedings of the 2014 conference on Designing interactive systems* (pp. 597-606).

Huang, I., Cheing, G., Rumrill, P., Bengtson, K., Chan, F., Telzlaff, J., & Snitker, M. (2016). Characteristics of people with disabilities receiving assistive technology services in vocational rehabilitation: A logistic regression analysis. *Journal of Vocational Rehabilitation*, *45*(1), 63-72.

Ilunga Tshiswaka, D., Loggins Clay, S., Chiu, C. Y., Alston, R., & Lewis, A. (2016). Assistive technology use by disability type and race: Exploration of a population-based health survey. *Disability and Rehabilitation: Assistive Technology*, *11*(2), 124-132.

International Dyslexia Association. (2018). Perspectives on language and literacy. MD.

IvyPanda. (2019). People with disabilities. https://ivypanda.com/essays/people-with-disabilities-dissertation**.**

Kenney, G. & Boyle. D. (2017). International language learning approach: Challenges, encountered and lessons learned in an action research study. *Journal of Asynchronous Learning Networks, 15*(1), 45–57.

Mathew, L. (2017). *Must-Have Apps and Tools for Dyslexics students*. https://www.thetechedvocate.org/11-must-apps-tools-dyslexic-students/

Mills, C. B. & Weldon, L. J. (2019). Reading text from computer screens. *ACM Computing Surveys (CSUR), 19*, 329-357.

Oliveira, T., Aparico, M. & Bacao, F. (2018). An e-learning theoretical framework. *Educational Technology and Society*, *19*(1), 292-307. www.ifets.info/journals/19_1/12.pdf.

Owston, R., York, D., & Murtha, S. (2013). Student perceptions and achievement in a university blended learning strategic initiative. *The internet and higher education*, *18*, 38-46.

Parr, M. (2018). Text-to-speech technology as inclusive reading practice: Changing perspectives, overcoming barriers. *Learning Landscapes*, *6*, 303–322.

Patton, C. M. & Roschelle, J. (2018). Why the best math curriculum won't be a textbook. *Education Week*, pp. 24-32.

Pino, M. & Mortari, L. (2014). The inclusion of students with dyslexia in higher education: A systematic review using narrative synthesis. *Dyslexia*, *20*,346–369. doi:10.1002/dys.1484.

Schneps, M. H., Chen, C., Pomplun, M., Wang, J., Crosby, A., & Kent, K. (2016). Re-inventing reading: Rapid multi-channel processing of language accelerates reading. *Journal of Vision*, *16*, 462. doi:10.1167/16.12.462.

Trogesen, J. K. (2022). Dyslexia and the brain: What does current research tell us? https://www.researchgate.net/publication/250055945_Dyslexia_and_the_brain_what_does_research_tell_us?

Understood.org. (2017). https://www.understood.org/en/learning-attentionissues/child-learning-disabilities/dyslexia/dyslexia-by-the-numbers and https://www.understood.org/en/learning-attention-issues/personal-stories/famouspeople/celebrity-spotlight-anderson-cooper-no-longer-hides-his-dyslexia**.**

UNESCO. (2014), Information and communication technologies in teacher education. http://www.unesco.org.university students' academic performance. *Ife Journal of Educational Studies,* 7(1).

United Nations (2021-2030). *Convention on the Rights of Persons with Disabilities*. http://www.un.org/disabilities/convention/conventionfull.shtml.

Wehmeyer, M. L., Palmer, S. B., Smith, S. J., Davies, D. K., & Stock, S. (2018). The efficacy of technology use by people with intellectual disability: A single-subject design meta-analysis. *Journal of Special Education Technology, 23*, 21-30.

Wood, S. G., Moxley, J. H., Tighe, E. L. & Wagner, R. K. (2017). Does use of text-to-speech and related read-aloud tools improve reading comprehension for students with reading disabilities? A meta-analysis. *Journal of Learning Disabilities, 51*, 73–84. doi:10.1177/0022219416688170

World Health Organisation (2021). *International Classification of Functioning Disability and Health*. WHO. Yale Center of Dyslexia and Creativity. (2018). http://dyslexia.yale.edu**.**