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LEVERAGING ON ARTIFICIAL INTELLIGENCE IN SUPPORTING INCLUSION OF STUDENTS WITH DYSGRAPHIA IN KADUNA POLYTECHNIC

Emem Effiong Akpan*, Rasheedah Adebola Zibiri, Juliet Stephen Tauna
Department of Special Needs Education & Rehabilitation Sciences, Kaduna Polytechnic, Kaduna State, Nigeria.
Corresponding Author: Emem Effiong Akpan, Email: sophyajogi@gmail.com

Abstract: Dysgraphia is a type of learning disability that is characterized by the inability to express ones thought in written form. It is also manifest in illegible or poor handwriting which can be due to developmental delay or several other risk factors. The paper discussed two main kinds of Dysgraphia namely developmental dysgraphia, which implies that one was born with the condition and acquired dysgraphia, implies that one's ability of writing or fine motor skill was lost or impaired due to an injury or an accident. This condition impedes the progress of students in school thereby posing a threat to their academic success. One of the solutions in curbing this challenge is Artificial intelligence which with its tools is able to improve the academic performance of students with dysgraphia. The paper concludes that the diverse challenges these students face cannot be addressed by remedial approach alone, therefore technology (AI) should be considered as a tool for reducing the challenges faced by students with dysgraphia. Recommendations include, lecturers in the institution should make it a point of duty to identify students in their various classes who may be experiencing dysgraphia. The management should make available adequate writing tools that may be necessary for the students with dysgraphia.
Keywords: Dysgraphia; Artificial Intelligence (AI); Learning disabilities

1 INTRODUCTION

Dysgraphia, one of the learning disabilities is characterized by the inability to express ones thought in written form. It is also seen in illegible or poor handwriting which can be due to developmental delay or several other risk factors. Dysgraphia which is a categorized as severe writing disorder is however seen as an inability to communicate ones thought through written expression. According to Merriam Webster Dictionary, Dysgraphia can be described as an impairment of handwriting ability that is characterized chiefly by very poor or often illegible writing or writing that takes an unusually long time and great effort to complete. Dysgraphia is described as a severely impaired ability to write which is presumed to be due to Central Nervous System dysfunction. Students who suffer from this condition usually face difficulties expressing their thoughts and ideas in written form. This condition has been identified among students of Kaduna Polytechnic. Students with this condition often have difficulties attempting questions during examination either due to the challenges they face expressing their thoughts in written form, poor hand coordination or illegible handwriting.

Such students usually have difficulties translating their thoughts into written expression. This can be seen by the difficulty they experience thinking and writing at the same time, word finding to communicate their thoughts appropriately or difficulty with sentence completion as well as comprehension of concepts. This may result in lecturers grading them low because of incomplete or illegible work which in turn can drastically affect their overall academic performance. Performance is crucial for academic excellence and with the disadvantages persons with Dysgraphia are already faced with, excelling without any meaningful intervention will be challenging. The introduction of recent technological innovations is responsible for changes that enhance performance or productivity. One of such innovations is Artificial Intelligence (AI). AI is a rapidly evolving field where what is current today may quickly become outdated. However, it is crucial to be familiar with its tools which ultimately help one to become proficient. AI is used in different fields or professions; education is not left out as AI provides a significant support in the teaching and learning experience. It is used to create lesson plan and lecture notes within the shortest period, standard test and examination question can be written effortlessly. It provides ideas on how to make the learning experience interesting, lecturers and teachers can use AI to hold personalized instruction and equally analyze students' results and attendance. Generally, AI can be used to carry out educational or academic activities. It is most likely that when students with Dysgraphia are exposed to AI, it will not only ease their learning but also improve their performance. This paper therefore, will explore how Artificial Intelligence can assist students of the institution who are experiencing dysgraphia.

2 CONCEPT OF LEARNING DISABILITY

Learning disabilities as special needs conditions is as old as mankind because in African traditional society teaching and learning took place with emphasis on cultural heritage and gender-based role socialization. It was however not identified

and known as a disability yet, there were persons who had difficulties learning, following directions, knowing names of things, counting, differentiating objects, sounds, making meaning from culture-based signs, interpreting and following sounds or rhythm of traditional drums used for different occasions. Disability has gone through many phases of development without a universally accepted nomenclature until 1963 [1]. Before the role of Samuel Alexander Kirk in shaping disability, it was known by different names such as minimal brain damaged, brain dysfunction, perceptual disorder among others Within 60 years of existence, the disability had experienced many controversial issues inclusive of lack globally accepted conceptual definition. However, Learning disability is conceptually seen as: "Learning disabilities is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical skills. These disorders are intrinsic to the individual, presumed to be due to dysfunction of central nervous systems, and may occur across the life span. Problems in self-regulatory behaviors, social perception, and social interaction may exist with learning disabilities but do not, by themselves, constitute a learning disability. Although learning disabilities may occur concomitantly with other disabilities (e.g., sensory impairment, mental retardation, serious emotional disturbance), or with extrinsic influences (such as cultural differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences" [2].

Learning Disabilities is a group of disorders that affects people's ability to either interpret what they see and hear or to link information from different parts of the brain. These limitations can show up in many ways: as specific difficulties with spoken and written language, coordination, self-control, or attention. Such difficulties extend to schoolwork and can impede learning to read, write, or do math. Learning disability is a neurological disorder that affects the brain's ability to receive, process, store, and respond to information [3]. The term learning disability is used to describe the seemingly unexplained difficulty a person of at least average intelligence has in acquiring basic academic skills. These skills are essential for success at school and work, and for coping with life in general [4].

Learning disabilities vary from individual to individual and may present in a variety of ways. Learning disabilities may manifest as difficulty: Processing information by visual and auditory means, which may impact upon reading, spelling, writing, and understanding or using language, Prioritizing, organizing, doing mathematics, and following instructions, Storing or retrieving information from short or long term memory, Using spoken language and Clumsiness or difficulty with handwriting [4].

3 CONCEPT OF DYSGRAPHIA

Dysgraphia is a neurological condition in which someone has difficulty turning their thoughts into written language for their age and ability to think, despite exposure to adequate instruction and education. Dysgraphia can present with many different symptoms at different ages. Dysgraphia, from the Greek "dys" meaning "impaired" and "graphia" meaning "making letter forms by hand," is a disorder of writing ability. At its broadest definition, dysgraphia can manifest as difficulty writing at any level, including letter illegibility, slow rate of writing, difficulty spelling, and problems of syntax and composition. According to Peter Chung and Dilip R Patel Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5), dysgraphia no longer exists as a separate category but falls under the category of "specific learning disorder" [5].

According to DSM-5 specific learning disorder refers to difficulties in learning and using academic skills, as indicated by the presence of at least one of the following symptoms that have persisted for at least 6 months, despite the provision of interventions that target those difficulties: inaccurate or slow and effortful word reading; or difficulty understanding the meaning of what is read, or with spelling, or with written expression, or mastering number sense, number facts, or calculation; or difficulties with mathematical reasoning. The DSM-5 further specified that, "the affected academic skills are substantially and quantifiably below those expected for the individual's chronological age, and cause significant interference with academic or occupational performance, or with activities of daily living, as confirmed by individually administered standardized achievement measures and comprehensive clinical assessment [5].

4 TYPES OF DYSGRAPHIA

Dysgraphia can be divided into two main kinds;

- Developmental dysgraphia
- Acquired dysgraphia

Developmental dysgraphia implies that one was born with it whereas acquired dysgraphia implies that one's ability of writing or fine motor skill was lost or impaired due to an injury or an accident.

However, there are several categories of dysgraphia which includes

- Motor dysgraphia: This type of dysgraphia affects fine motor coordination as well as visual perception.
- Spatial dysgraphia: This affects one's ability to understand where things are in relation to each other. It typically affects writing between lines or paper or filling out a form where information must fit in a specific space.
- Linguistic dysgraphia: this type impacts language processing skills required in writing. This type of dysgraphia mostly affects spontaneous writing like responding to questions in written forms, creative writings, or responding to an essay question [6].

5 CHARACTERISTICS OF DYSGRAPHIA

Dysgraphia may manifest in a variety of ways depending on the age at presentation, as neurodevelopment progresses and academic expectations increase. As a disorder of written expression, dysgraphia may affect one or more levels of writing, including handwriting, spelling, and higher-order organizational skills. Given the normal development of handwriting, dysgraphia is seldom recognized before the first grade, although it may also be missed even in the school age child or young adult [7]. The National Center for Learning Disabilities provides an excellent discussion for dysgraphia warning signs across ages. Manifestations of dysgraphia parallel stages of child development, with more concrete "lower order" difficulties giving way to abstract "higher order" difficulties as the child ages.

Pre-school children with dysgraphia may present with the following characteristics: An awkward grip or body position when writing ,gets tired easily with writing ,avoidance of writing and drawing tasks , written letters are poorly formed, inversed, reversed, or inconsistently spaced and difficulty staying within margins

In addition to the above characteristics, the school-aged child with dysgraphia may demonstrate the following: Illegible handwriting, switching between cursive and print, difficulty with word-finding, sentence completion, and written comprehension.

Finally, the teenager and young adult with dysgraphia may also present with the following: Difficulty with written organization of thought, difficulty with written syntax and written grammar that is not duplicated with oral tasks.

At all ages, individuals with isolated dysgraphia may not be as readily noted as children with more obvious learning impairments such as dyslexia

Students who may experience several difficulties with writing may speak more easily and fluently than they write. Such students may have issues with Students who may experience several difficulties with writing may speak more easily and fluently that they write. Such students may have issues with; letter formation and/or legibility, letter size and spacing, spelling, fine motor coordination, rate or Speed of writing, grammar and composition. They may also exhibit specific characteristics such as difficulties writing on a straight line; Writing letters in reverse; Struggling to form written sentences with correct grammar; Omitting words from sentences; Incorrect ordering of words in sentences; Wrong usage of verbs and pronouns in sentences.

6 CAUSES & RISK FACTORS OF DYSGRAPHIA

Dysgraphia is a term used to describe those individuals who despite exposure to adequate instruction demonstrate writing abilities discordant with their cognitive level and age. The exact cause of dysgraphia is unknown but myriads of factors have been attributed to it, some of which are:

6.1 Brain Differences

There are variations in the structure and functions of the brain that can affect language and motor control. This can go a long way to impact the way written text is formed.

6.2 Brain Injuries

Damage to that part of the brain (parietal lobe) that is concerned with writing can cause dysgraphia.

6.3. Developmental Disorder

Dysgraphia can co-exist with other developmental disorder and conditions like dyslexia, autism, attention deficit hyperactivity disorder, ADHD.

6.4 Neurological Disorder

Affectations of the neurons or any neurological deficit can make it more difficult to process information and put such information into writing.

6.5 Psychomotor Problems

Alterations in fine motor movements in hands and arm coordination can make it difficult to write.

6.6 Orthographic Coding

Problems or inability of the brain to create visual memories of written words based on their meaning or pronunciations [8].

7 PROBLEMS FACED BY STUDENTS WITH DYSGRAPHIA

Students who have been identified to experience dysgraphia in higher institutions are faced with various challenges within the school environment and the society at large. These challenges range from academic struggles, to emotional problems as well as stigmatization.

- Academic challenges: Dysgraphia can make it challenging to keep up with academic demands, including reading, writing, and math. This can impact overall academic achievement which could eventually result to frustration and anxiety.
- Social-emotional challenges: Individuals diagnosed with dysgraphia may struggle with problems of self-esteem, anxiety, and depression. Particularly this disorder tend to cause students withdraw from their counterparts thereby resulting in poor social interaction with peers and subsequently social isolation.
- Access to appropriate support: Dysgraphia in students is usually not easily identified as such lack of diagnosis of such conditions would result in late intervention. Such students do not receive appropriate support and accommodation, which can impact academic and social-emotional outcomes.
- Stigma and misconceptions: There are still a great deal of stigma and misconceptions surrounding dysgraphia, which can make it challenging for individuals with these conditions to access appropriate support and accommodation.

Students with dysgraphia face a range of challenges in language learning. These challenges include difficulties in reading, writing, and spelling, lack of access to alternative learning materials, inadequate support from educators and language learning institutions, and social and emotional challenges. These challenges highlight the need for language learning models to be inclusive and supportive of individuals with special needs [9].

8 MANAGEMENT OF DYSGRAPHIA

In general, when addressing developmental and learning disorders, interventions can be organized by intensity in the following fashion: 1) accommodation, in which the individual is provided with assistive or augmentative strategies to access the general curriculum; 2) modification, in which the individual's tasks and expectations are changed to minimize the impact of their disability; and 3) remediation, in which the individual is provided instruction specific to his or her disability. Management of dysgraphia is a life-long process that must address the underlying symptoms experienced by the individual at that time; as the manifestations of dysgraphia change with cognitive development and academic expectations, the management must be equally fluid in its approach. The educational system should assess and provide the appropriate support structure in the school setting for the individual's level of disability [5].

Other strategies may involve trying several classroom adjustments to help the students such as trying different types of pens, pencils, and pencil grips, using paper with raised lines to help stay within the lines and using printed lesson outlines in class to ease note taking. Teachers can also allow plenty of time to complete assignment, prefilling in the name, date, and title of assignments, thoroughly explaining how each element is graded, sharing previous assignments and grades as well as offering alternatives to written assignments.

Students can also use technology and support systems to help them complete assignments to the best of their ability, including: using dictation software when writing, asking for a proofreader to check work, using a computer to type up an assignment and asking for extended time on tests [10].

9 AI AS AN INTERVENTION TOOL FOR STUDENTS WITH DYSGRAPHIA

Dysgraphia is a learning disorder that affects an individual’s ability to write or express themselves in written language. Students with dysgraphia may struggle with a variety of writing-related tasks, such as spelling, handwriting, organizing their thoughts on paper, and producing written work at an appropriate speed or level of detail. There is no cure for dysgraphia, but there are several strategies and accommodations that can help students with dysgraphia improve their writing skills. Two major approaches that can be beneficial to alleviate dysgraphia are remedial treatment and bypass strategies. The remedial treatment includes traditional methods of accommodation and adjustments either by direct handwriting instructions or fine motor coordination skills. The bypass strategies include use of technology as a compensatory technique [11]. These may include the use of assistive technology, such as speech-to-text software or word processing programs with spell-checking and grammar-checking features, as well as specialized writing programs that help individuals with dysgraphia learn to write more efficiently and effectively. There is a wide range of Artificial Intelligence applications that can help improve students’ writing skills. They help with grammar checks, organizing contents, assisting in generating and structuring essays and so on. Such applications include Chat GPT, MyEssayWriter Ai, Grammarly, Quillbot, Copy Ai. Perplexity Ai and so on. AI writing assistants can detect and correct grammatical errors, spelling mistakes, and punctuation issues, helping students produce polished and error-free written work. This real-time feedback allows students to learn from their mistakes and improve their writing skills over time.

AI writing tools are revolutionizing the educational landscape by enhancing accessibility for students with learning disabilities such as dysgraphia. These AI tools address a range of challenges students may face with expressing their thoughts in written form thereby empowering students to overcome barriers and achieve their academic goals. However, as

these technologies become more prevalent, we must also consider the ethical dilemmas of AI-generated content. Issues such as plagiarism, authorship, and the potential for misuse require careful examination to ensure that AI enhances learning without compromising academic integrity. As AI technology continues to advance, its potential to improve accessibility and inclusivity in education will only grow, ensuring that all students have the opportunity to succeed while maintaining ethical standards [12].

10 CONCLUSION

Remedial approach alone cannot effectively resolve the challenges faced by students with dysgraphia in higher institutions. Therefore, Technology based approach which includes artificial intelligence and virtual reality cannot be over emphasized. Early identification of students with dysgraphia is pertinent to adopt an intervention plan which will help meet the specific learning needs of students in the institution thereby improving their overall academic achievements.

11 RECOMMENDATIONS

- Lecturers in the institution should make it a point of duty to identify students in their various classes who may be experiencing dysgraphia
- The management should make available adequate writing tools that may be necessary for the students with dysgraphia
- Lecturers who teach students faced with dysgraphia should be give considerations for assignments and examinations.
- The School Management should make provision for semester examination to be computer based as it eliminates the problem of writing especially for students experiencing dysgraphia.
- Admission regulatory bodies such as Joint Admission & Matriculation Board (JAMB) should make admission process into the polytechnic more thorough and efforts should be geared towards identification of students with specific learning disorder such as dysgraphia. Where such is found, efforts should gear towards remediation so as not to alienate the students.
- Awareness should be created by specialists in the Department of Special Needs & Rehabilitation Sciences to sensitize the academic community on the prevalence of dysgraphia among learners and importance of early detection and purposeful remediation.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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