Toward Linking Dyslexia Types and Symptoms to The Available Assistive Technologies

Aisha Yaquob Alsobhi
School of Sciences and Technologies
Middlesex University
London, United Kingdom
a.alsobhi@mdx.ac.uk

Nawaz Khan
School of Sciences and Technologies
Middlesex University
London, United Kingdom
n.x.khan@mdx.ac.uk

Harjinder Rahanu
School of Sciences and Technologies
Middlesex University
London, United Kingdom
h.rahanu@mdx.ac.uk

Abstract—**As a result of the widespread, and accelerating, dissemination of digital technologies, there has been a profound effect on how people learn. These effects have been greatly debated over the years. While many educational developers have agree on the effects technologies have brought on educational performance, little attention has been made to the relationship between such technologies effects and individual differences such as individuals who suffer dyslexia. There are readily available Assistive Technologies[1] that offer potential to help students with learning difficulties such as dyslexia. This paper will attempt to tease out these technologies and dyslexia types, hence attempt at providing a solution. The focus should not be on correlating one technology to one disability. Instead of identifying different pedagogical needs such as help with reading and writing. Then, trying to meet those needs by looking at the whole range of ways that available.**

Keywords—**Dyslexia; E-learning; Assistive Technologies.**

I. INTRODUCTION

Albert Einstein, Walt Disney, Thomas Edison, Isaac Newton, and Pablo Picasso, all of these well-known people who have an immeasurable contribution to mankind have suffered from dyslexia [1]. They were recognised as lazy and incompetent in their school days, without any support from their teachers or the educational system. Today, the situation is to some extent better than the past, but students with diagnosed dyslexia still have to face many difficulties in their education. This is because that the educational system is not always prepared to cater to their specific needs. The persons that diagnose with dyslexia may demonstrate exceptional intuition, perceptual capacity, visualization potential, originality and creativity, as well as strong global comprehension ability and initiative [1]. However, if there is guidelines that emphasise the strong points of dyslexia, persons suffering from this condition can [2] achieve better academic success and make an impact on the overall human knowledge by their inherent abilities.

II. BACKGROUND

A. What is Dyslexia?

Many authors over the years have made attempts at defining dyslexia. Up till now, researchers have still not agreed on a definition for dyslexia, probably the variation of the definition due to the variation of the scientific backgrounds of the individual researchers and what they conceptualise as the fundamental cause of dyslexia [3]. Many definitions and perspectives have been expressed in turn to describe dyslexia, from the time when the concept of dyslexia was first introduced in the academic and medical world. Various perspectives in which dyslexia is defined are acknowledged. However, for the purpose of this research, dyslexia will be defined mainly from educational point of view. Therefore, the main definition of dyslexia that will be considered in this paper is the definition by the British Dyslexia Association (BDA): "The word 'dyslexia' comes from the Greek. The prefix "dys" means difficulty, and the root-word "lexia" means language. The literal translation is 'difficulty with words. It is a difference in the brain area that deals with language. It affects the underlying skills that are needed for learning to read, write and spell. Brain imaging techniques show that dyslexic people process information differently. Dyslexic people, of all ages, can learn effectively but often need a different approach" [4]. This definition is practically fitted our research because it concerns with all age not only children but on adults as well who have dyslexia. In addition, it is derived from an educational perspective and covers many types of dyslexia.

B. Dyslexia Classification

There are various types of dyslexia. It is hard to categorise specific dyslexia as a single condition. There have been various attempts in the literature at classifying dyslexia. Classifying dyslexia helps to provide more insight into what dyslexia difficulties are. Therefore, provide a proper solution for them. Many authors classify dyslexia according to the symptoms it addresses. Some of these classification overlap, while others simply represent distinct viewpoints of the authors. Since all dyslexics do not share the same symptoms, Ingram classifies dyslexia according to their symptoms [5]. In order to identify different subtypes of dyslexia Johnson and Myklebust standardised reading tests in addition to tests for reading diagnosis [6]. Boder takes a similar position to Ingram and categorised dyslexia upon its symptoms as well. Based on the qualitative results of her tool and pattern she divided dyslexia into three subtypes [7].

As mentioned above, there are many different types of dyslexia, and many ways of dividing it into categories. However there is still a lot of confusion surrounding the condition. This makes categorising it into different types challenging. We consider Ingram [5] classification as we highly acknowledging other classification and arguments. Dyslexia can be divided into three categories [5]:

(1) Visuo-spatial difficulties: persons who suffer this type of dyslexia have problem in distinguishing between letters, syllabus and phrase orders and have problem in reproducing them. They usually try to guess the letter by its shape not by its context so they have a difficulty in identifying the letters. They may also read words backwards and confuse reversible letters.

(2) Speech sound difficulties: people who diagnosed with this type of dyslexia have difficulties in forming sentences and breaking words into syllables due to problems in understanding spoken language.

(3) Correlating difficulties: this type of dyslexia concerns more with difficulties in writing. They are unable to link the individual letter to its appropriate speech sounds especially the words that only have one syllable "monosyllabic".

---

[1] "Assistive Technology" refers only to hardware and software designed to facilitate the use of computers by people with impairments.

C. Dyslexia Signs and Symptoms

Dyslexia affects individuals in very different ways. Rarely, two people have the same symptoms. Most dyslexia students have different experiences of learning and they have different needs. This study recognises that. Since types of difficulties and needs of student with dyslexia may vary from one student to another and it is nearly impossible to make generalisations when designing the module material prior to the start of the learning period, teachers and module developers must deal with each dyslexic student as an individual case. Therefore, there is a plenty of possible problems that characterise dyslexic people in the literature such as [8; 16; 17]. This can be divided into six areas of difficulties, which are Reading, Writing, Speaking, Memory, Organisational, and Mathematics.

The symptoms of dyslexia are based on modern scientific studies. Though it is not easy to divide in it into groups. Each theory divides up dyslexia symptoms differently, and offers different methods of interference. After studying the above type and symptoms we draw the our conclusion see Figure 1. *Visuo-spatial* difficulties symptoms are reading, writing, organisation and mathematics. While, *Speech sound* difficulties symptoms are reading, writing, organisation and speaking. Writing is *Correlating* difficulties symptoms.
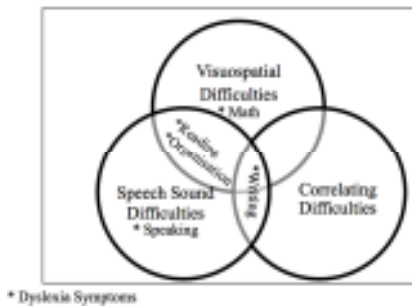

Figure 1. Dyslexia Types and Symptoms

III. FINDINGS

After conducting an extensive study concerning the available assistive technologies in the respective domain, Table 1. Shows 17 technologies, which have been developed for helping dyslexic students in their educational process. Each dyslexia symptoms has been match to group of technologies.

Table 1 The avaialbe Assitive Technologies

In order to link dyslexia types and symptoms to the readily assistive technology in more precise yet compact way, a decision table has been developed. One of the decision table advantages is that it delivers a more compact visual presentation. Therefore, it leads to a better knowledge of the choice problem. It is easy to check the completeness, correctness and consistency of the information input; this is probably the most important advantage of the decision tables. According to Reference [5] dyslexia has three different categories, which are here the conditions for the decision table. The alternatives for these conditions are simple Boolean values (Y/N). We have 3 conditions so $2^3=8$ different alternatives. TABLE. 1. Shows 17 different assistive technologies considered as the actions for the decision table. Whereas, the action entries are check marks, representing which of the actions in a given column are to be performed. This decision table will help e-learning developers before making any plan or design. This table established the functional or technical requirements the design must meet, considering the needs and constraints imposed by students with dyslexia, policies and the environment. TABLE 2. below illustrates the decision table:

TABLE. 2. Decision Table

IV. CONCLUSION

E-learning applications are ineffective and/or failing dyslexic learners may be because developers have not put in their minds the different types of dyslexia. They simply developed generic applications, whereas what may be required are specific e-learning applications that are tailored for specific categories. Since all dyslexics do not share the same symptoms. Teachers now have to consider the students learning capabilities and provide options that satisfy as many students' needs as possible. They have to deal with each student as a special case when adopting e-learning tools. This will result in more powerful learning environment. User and expert evaluations are being conducted to validate the framework. Such evaluation activities will be discussed in detail in future papers.

REFERENCES

[1] V. Sekovanić, DP. Vukovac, and Z. Podbojec, "Usability Case Study of Adapted E-Learning Course for Dyslexic Students". Madrid, Spain, *the 5th International Conference of Education, Research and Innovation*. 2012.

[2] T. Tinklin, S. Riddell and A. Wilson, *Disabled Students in Higher Education, 2004.* http://www.ces.ed.ac.uk/PDF%20Files/Brief032.pdf (Accessed date: 22 April, 2013).

[3] P. Ott, How to Detect and Manage Dyslexia: A Reference and Resource Manual , 1st edn, Heinemann: Oxford, 1997.

[4] BDA, 2013. *An Overview of Dyslexia,* 2013. http://www.bdadyslexia.org.uk/about-dyslexia/adults-and-business/an-overview-of-dyslexia.html (Accessed date: 22 April, 2013).

[5] T. Ingram, "The dyslexic child", *The Practitioner*, Vol 192, pp. 503–516, 1964.

[6] D. Johnson and H. Myklebust, Learning Disabilities: Educational Principles and Remedial Approaches, Grune & Stratton:New York, 1967.

[7] E. Boder, "Developmental dyslexia: a diagnostic approach based on three atypical reading-spelling patterns", *Devl. Med. Child Neurol*, Vol 15, pp. 663–687, 1973.