User Modeling Approach for Dyslexic Students in Virtual Learning Environments

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ABSTRACT

Dyslexia or reading disability is one of the most common learning disabilities. It is defined as a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and sociocultural opportunity. In this paper the authors focus on the potential benefits of the use of Information and Communication Technology (ICT) for students with dyslexia to promote the learning process, by considering the relationship between their learning style preferences and their cognitive traits in virtual learning environments. At this propose the authors investigated the relationship between dyslexic’s learning style and cognitive trait within the hypothesis that dyslexic learners may have possible preferences in virtual learning environment, which may be used to improve the dyslexic user modelling. The aim of this paper is to provide an adaptive learning environment for users with dyslexia based on their learning styles preferences and their cognitive traits.

KEYWORDS

Dyslexia, Information and Communication Technology (ICT), Learning Disabilities, Learning Style, Personalized Learning, User Modeling, Virtual Learning Environments

INTRODUCTION

Learning disabilities is a general term used in special education that describes specific types of learning difficulties, is characterized by a disorder in one or more of the basic psychological processes involved attention difficulties, an inability to perform well at spelling, writing, readings, and mathematical skills. Dyslexia or reading disability is one of the most common learning disability that mainly affects the development of literacy and language related skills. Confirming to (Association, 2013) dyslexia is described as a neurological learning disability manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and sociocultural opportunity. It is characterized by difficulties with phonological processing, working memory, rapid naming, processing speed, and the automatic development of skills that may not match up to an individual’s other cognitive abilities.

However, in recent years, there has been an increase in the use of Information and Communication Technology (ICT) in the field of education (Ismaili & Ibrahimi, 2016) (Zikl et al., 2015) (Drigas, Kokkalia, & Lytras, 2015). Many of these electronic learning resources represent a major force towards empowering students with learning disabilities (LD) by providing assessment and training for these target users. Consequently, digital resources designed especially for users with LD should be based on appropriate guidelines to overcome barriers to their learning. One such target should be dyslexic user modeling which is a cognitive profile model for users with dyslexia who have specific learning difficulties. However, there are only a few practical studies that have investigated the effect

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of ICT use on users with LD when considering learner’s learning preferences and cognitive capacity. This research work investigated the impact of ICT on dyslexic users’ cognitive development based on learning styles and cognitive traits. Besides, this study attempted to provide evidence that ICT can be used in personalized learning to enhance learning activities and promote innovation in education especially for students with specific LD (Aljawarneh, 2011, Aljawarneh, et al., 2015, Aljawarneh, et al., 2016).

The remainder of this paper is organized as follows: Section 2 presents the background of ICT use and how digital technologies enhance the learning process. Section 3, describes the problem and proposes a user modeling approach for personalized learning system towards dyslexic users. Section 3 discusses conclusions and future works.

RELATED WORK

This section presents an introduction to ICT use towards users with learning disabilities, learning style models, cognitive trait model and user modeling in order to provide background information for the current investigation.

Information and Communication Technology (ICT) and Learning Disabilities (LD)

Recently, there has been increased interest and empirical research concerning the use of ICT in education, their influence has changed the daily life of many users. Digital technologies are used in the educational process to reinforce learning and it seems to have strong positives effects. Thereby, they tend to be a support tool to train, help and even enable the learning process. Recent research (Ismaili & Ibrahimi, 2016) (Drigas et al., 2015) (Skiada, Soroniati, Gardeli, & Zissis, 2014) agree that ICT likely to be a useful tool towards users with learning disabilities. It can support and reinforce the learning process, as well as it can create a developmental appropriate learning environment depending on the needs of learners. Some studies have been conducted to improve the benefits of the use of ICT especially for students with LD, including the use of websites as an educational motivators for adults with LD (Johnson & Hegarty, 2003). Text editing and adjustment of the visual aspects of the text using specific fonts to the needs of students with dyslexia permitting to them to try different fonts and graphic arrangements and chose the most efficient option so as to improve their reading performance (Zikl et al., 2015). Text-based adjustments in synchronous learning activities and browser extension to help users with dyslexia adapt Web content to make it easier to read and more accessible (Woodfine, Nunes, & Wright, 2008) (Velasco et al., 2015). Also, eBooks reader for Android designed in an accessible way according to dyslexic user needs (Rello, Kanvinde, & Baeza-Yates, 2012). Virtual environments and virtual reality applications as powerful and sensitive clinical tools for adult and children with neurocognitive and neuropsychological impairments (Rose, Brooks, & Attree, 2002) (Kalyvioti & Mikropoulos, 2014). As well mobile learning or mobile applications as an alternative learning tool to assist students with special needs which provide an educational experience which is altering the nature of knowledge (Skiada et al., 2014) (Ismaili & Ibrahimi, 2016), and computer game-based (Shaw, Grayson, & Lewis, 2005).

Besides, the term assistive technology (AT) is used largely in education. It refers to devices equipment and systems that enhance learning process of users with disabilities and improve their functional capabilities. AT represents an innovative concept that integrates technology in daily life to improve functional health, safety, security and quality of life, AT covers devices such as scanners, adapted keyboards, hearing aids, print screens, and software such as speech recognition, software reading, spelling programs and visual alerting systems (Cook & Polgar, 2014) (Marcia Scherer & Gerald Craddock, 2001).

Learning Styles and Cognitive Trait Model (CTM)

Research on learning styles as an individual trait has been of interest to psychologists for many years. Numerous learning style models and theories have been proposed to identify students’ learning
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