Interactive multimedia learning object (IMLO) for dyslexic children

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Abstract

Dyslexia is a type of Specific Learning Disability (SLD). Dyslexia individuals usually have a poor-short-term memory, difficulties with directional orientation, reading, spelling, writing, and numeracy problem. With the use of instructional technology and Information Technology, intervention for dyslexia is possible. In this study, the researchers try to conduct a usability testing on using Interactive Multimedia Learning Object (IMLO) amongst dyslexic children. The objective of this paper is to develop an Interactive Multimedia Learning Object and test its usability amongst dyslexic children. In this study qualitative approaches were used. The subject is dyslexic children. Preliminary survey was set up amongst three dyslexic children performed tasks using the prototype being tested. Usability testing was used to evaluate IMLO and this study reveals how the learning object supports the learning process of dyslexic children. The research instruments used are the prototype of learning object, observation lists, interviews and video recording. Observations through playback have been done. To obtain more inputs, interview to the teachers were also done. The result of responds in using IMLO was found good. The study also revealed that there was evidence that the dyslexic children enjoyed learning using IMLO. The researchers believe that IMLO can be used as effective teaching materials for dyslexic children. Following this study, the researchers will look into more opportunities in improving the IMLO prototype.

1. Introduction

1.1 What is dyslexia?

Dyslexia is a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and socio-cultural opportunity. It is dependent upon fundamental cognitive disabilities which are frequently of constitutional origin (Alwell and Cobb, 2009). On the other hand, Carol & George (Blustein, 2006) defined dyslexia as a specific type of learning disability involving a severe impairment in reading ability which affects and disrupts a person’s language development and functioning. The individual with dyslexia can actually become confused when several instructions are given at the same time, and will usually have a poor-short-term memory, difficulty with directional orientation, such as telling right from left and map reading (Alwell and Cobb, 2009). Furthermore, dyslexia individuals may also have a word finding difficulty and in discussions and conversation may use inappropriate words that sound or look similar such as ‘they’ and ‘their’. In his research, Gavin also stated that dyslexia individuals may also confuse syllables in words, or put these in the wrong order when writing or talking such as “preliminary” or “elephant”. However, dyslexia individual characteristics can amount to a different way of processing information-they usually have visual, right brained global processing style.
and it is important to acknowledge the strengths in this style, as well as considering the difficulties. Despite the definition of dyslexia, it is also found that dyslexia has difficulties in some aspects of mathematics, most particularly in numeracy (Alwell and Cobb, 2009). From the medical point of view, Daniel Ansari, an assistant professor and Canada Research Chair in Developmental Cognitive Neuroscience in the Department of Psychology at Western, uses brain imaging to understand how children develop math skills, and what kind of brain development is associated with those skills. Using functional Magnetic Resonance Imaging (fMRI) to study the brains of children with math difficulties, Ansari says that it becomes clear that children with developmental dyscalculia (math disabled) show a typical activation patterns in a part of the brain called the parietal cortex. As stated by Blustein(2006)He also added that math skills are hugely important to life success and children who suffer math difficulties may avoid careers that, with help, might be a great fit for them. The problems with the language of mathematics and the concepts associated with it have been revealed. Blustein(2006) stated that the mathematic difficulties include spatial and quantitative references such as before, after, between, one more than, and one less than. Mathematical terms such as numerator and denominator, prime numbers and prime factors, and carrying and borrowing may also be problematic. In addition, these individuals may be confused by implicit, multiple meanings of words, e.g., two as the name of a unit in a series and also as the name of a set of two objects. Furthermore, difficulties may also occur around the concept of place value and the function of zero.

1.2 Dyslexia intervention

Alwel(2009) recommended some intervention approaches and techniques can be employed to help SLD students, including educational intervention (strategies, activities & environment) technical intervention (learning packages & voice printing programs) and medical intervention (Drug therapy and diets). According to Brown (2002) exploring the ways in which multimedia can be used to enhance the accessibility of the learning environment. Multimedia has the potential to reduce or even remove such problems. For example, learning materials, containing text, can be supplemented with and/or represented in graphical and auditory forms. He also added that dyslexic students are able to comprehend meaning from what is being spoken about a picture. Having learning materials delivered in this way can reduce the difficulties dyslexic students have recognizing or confusing between letters or familiar words. Furthermore, hearing new spoken words can help dyslexic students with mispronunciations. It can help them to form links between what a new word sounds like and what it looks like. Interactive Multimedia Learning Object (IMLO) is developed using instructional technology facilitated multi-sensory approach on interactive multimedia. It is hoped that IMLO will be a new successful way in assisting dyslexic children to learn mathematics. Nor Hasbiah [9] reported that multimedia courseware has the capability to motivate dyslexic children. She also added that multimedia technology possesses the ability to touch various sensory modalities of dyslexic children. It is also confirmed by Brown (2002) through his notes that multimedia negates the need for a dyslexic student to rely on the text alone and provides a multimodal means of relaying that information to the brain, placing control back in the hands of the student.

2 RELATED WORKS

In 1977, Thomas advocates a multi-sensory approach with children using remedial problems: the use of audio-visual and mechanical aids-overhead projectors, typewriters, and epidiascope-spelling aloud, sounding out, look-and-say. In 1976, Hooton adopts a multi-sensory approach. She said that there were few children who cannot be helped by looking at the symbol, saying the sound and feeling the shape simultaneously. She sees the multi-sensory way as succeeding with any child no matter what is dominant channel for learning. In 1970 (As stated in Paula Alwell and Cobb(2009)) Cotterell states: ‘When writing a word I encourage vocalization, with clear articulation, so that kinaesthetic, visual and auditory pathway to brain are all engaged to strengthen the memory pattern to recall’. In 1969 (As stated in Paula Tandley & John Panckhurst, 1981, p. 236-238), Shedd affirms oneto- one instruction, a multi-sensory approach and highly structured material as the critical ingredients of success. The alphabetic-Phonetic-Structural-Linguistic (APSL) program was employing methods similar to those of the UK dyslexia centres. The use of multi-sensory learning was also confirmed by Spafford and Grosser(Brown,2002), They stated that for the student with dyslexia, repeated readings, retellings and so on would be needed to reinforce presented materials. They recommended that structured lesson activities be used that incorporate a multi sensory interactive approach for the full benefit of enrichment for the student of dyslexia. John Bradford(Brown,2002) outlined some usable principles
in designing screen-based content. Many dyslexic readers are particularly sensitive to the brightness of text on a pure white background. This can cause the words to appear to move around and to blur together. Therefore, darker/colored background (not patterns) with bright colour text is recommended. Type face of sans serif such as 'Arial' is clearer and is preferable. It would be better if the text is provided with visual support to stimulate memory. Text with long sentences needs to break up into shorter ones. Therefore, the best way is to plan and put strategy before providing the learning material.

2.1 MyLexics
A courseware that integrates all multimedia elements that supports interactive and self-learning environment both for dyslexic children has been made, namely MyLexics. It comprises of modules to learn basic reading in Malay such as alphabet, syllables, and words. According to Brown(2002), MyLexics content has been structured as building-up process, where the children initially learn the individual ‘alphabets’ and then combine the alphabets to make ‘syllables’, before finally they add the combined syllables to other syllables and form ‘words’. Abdullah believed that the implementation of stated principles via multimedia elements allows independent and interactive learning, and yet engages the learners in interesting tasks. To learn alphabet, MyLexic provides sample of letter writing in two-dimensional (2D) animation. The dyslexic children can click on the letters to view the animation. Afterwards, voice over will pronounce the letter and dashes lines of the letter will be provided on screen as guidance. To learn syllables, MyLexics employs Simultaneous Oral Spelling (SOS) technique by hearing, saying, seeing and writing. Again, animation is used to sustain interest. To learn words, MyLexics utilizes the consistency of colours used on the previous sub-module (syllables), and uses animation as well as voice over to explain the letter transition.

2.2 Interactive Story Software
Anita Keates [15] believes that ICT (Information Communication Technology) is an area where what is possible to support and facilitate dyslexic students. She reported that dyslexic students use ICT because it is an area where they generally have not previously failed. It is helpful, supportive, facilitating and motivating. In her research, Anita has proven that dyslexic children have skills in keyboarding, handling mouse, and interact with the screen. It was also proven that an interactive story software like one of the Living Book series: Broderbund (TAG) has presented a multi-sensory environment, listening to the words, watching them and then being able to interact with the page on the screen. Anita also claimed that dyslexic pupils can create moving adverts, cartoon stories, talking stories and other multimedia presentation. She confirmed that by understanding the dyslexic students and their particular strengths and difficulties, one can select software that helps and facilitates them. Brown (2002) asserts that students are able to retain 20% of what they see, 30% of what they hear, 50% of what they see and hear and 80% of what they see, hear and interact. This statement was also confirmed by Flether (Brown, 202) saying that computer based instruction is more cost-effective as it allows for a 10% to 20% improvement in performance than traditional training methods, allowing for one-third less time usage. With the capabilities of dyslexia children in interacting with multimedia tools such as cartoon stories, talking stories and other multimedia presentation, the researchers are confident to implement an interactive learning object application.

3 METHODOLOGY
The researchers have adapted think aloud protocol usability testing. Think aloud protocol Daniels(2007) involved the users thinking aloud as they were performing a set of specified tasks. The users were asked after completing at least one task, to say whatever they were looking at, thinking, doing, and feeling, as they went about their task. In specific, they were asked direct questions on the interface design including the navigation button design, layout design, as well as the use of images and animation. This enabled the researchers to see first-hand the process of task completion and experience. Test sessions were videotaped so that the researchers can go back and refer to what participants did, and how they reacted. Set of questions on usability issues were asked. Answers are retrieved from three resources:
1. Asking and observing the dyslexic children directly when they use the prototype.
2. Observation through playback video
3. Interview the teacher.
The researchers found that such field testing was useful and successfully implemented since 2005. Daniels (2007) have done a survey on usability testing on multimedia application (comparison between laboratory and field testing). The usability of a consumer application was tested in two environments: in a laboratory and in a field with a total of 40 test users. Her study results indicate that it is possible that field testing is worthwhile when combining usability tests with a field pilot or contextual study where user behavior is investigated in a natural context. Since many dyslexic readers are believed sensitive to the brightness of text on a pure white background, bright text over dark background is used. The recommended sans serif font (Font type that has no tail on the letter) is also used. As soon as the lesson finish, next button is highlighted (glowing effect) to indicate the next step.

4. RESULTS AND DISCUSSION

IMLO has been tested and evaluated. All three dyslexic children have completed the test. When they use IMLO, issues such as acceptance, usability, and preferences were asked. IMLO has provided dyslexia students with a new look on learning style where they can enjoy the learning process along with their preferences. When they were whether they can use computer, all of them confessed that they use computer at their homes. Their first impression when introduced to IMLO was good. All of them were excited to know and use the application. The introduction page was found attractive, simple and easy to use. One of them can read all the text, while the other two were found difficult to read the word “multiplication”. Maybe the font size was not big enough, may be the word itself was a bit too long, or maybe the background color was not dark enough as compared to the word “MATHEMATICS”. They didn’t show obvious responds on the “passing by cats” animation concept, but it really attracted them to focus. As they went inside the page 1, they paid attention on the image and listened the voice over carefully. It was also found that all of them showed good understanding on the multiplication concept. All of them have spoken out the answer of the calculation (while) while the animation was still playing. They also admitted that the design of the page was user friendly and the navigation buttons were complete. The interface design was also found good. Had too much of numbers viewed at one time? However, the other two managed to continue to page 4 with good understanding. In terms of text, there were some issues. Two of the dyslexic children read some text slowly, especially on the area where the background colour was not-too-dark background colour. They can read each letter, but not reading the words fluently. Perhaps the background colour should be very dark (such as black), while the text should be very bright and clear (such as white). For easy reading, perhaps the text size can also be made bigger. All three dyslexia children agreed that the use of graphic and images are suitable. In terms of graphic and images, all of the dyslexic children agreed that images are suitable. It is also confirmed by the teacher that such graphic and images are important to attract the attention. She also added that putting more animated character, animated buttons, and animated cursor will create more interest amongst the dyslexic children to be more active in the program. In terms of sound and voice, all three dyslexic children agreed that they are clear. The voice over synchronized well with the animation. However, mathematics and science subjects are thought in Iranian. Two of the three dyslexia children found the use navigation was confusing. In terms of navigation, two dyslexic children were found confused. At certain time, they asked the researchers for choosing right button. They understand the next step to click the next button, but seemed to be not sure in interpreting the icon button. Maybe, putting animated button (when it is rollover) and voice over will help them.

5. CONCLUSION

Overall perception of IMLO prototype was good. All three dyslexic children and teacher liked IMLO. They wanted to have more prototypes like IMLO to be done. They found that learning with IMLO was motivating, fun, easy, and help them to understand the topic better. Dyslexia students need to be encouraged to learn with something they like. By breaking down content into small steps such as IMLO, dyslexic children can perform the task in a short time, and lead to better learning process. The teacher is helped through prepared teaching materials, the dyslexic children is motivated to learn, and the learning object itself is reusable.
References


