

User Friendly Interface for Young Dyslexic

[Rozita Ismail, Maznan Deraman, Azizah Jaafar]

Abstract - The first journey to knowledge is reading, a must-have capability or skill to discover life's full potential. Dyslexia is a problem related to reading difficulties and inability to comprehend textual or phonological materials that is easy for non-dyslexic person. The situation will lead to anxiety and frustration when a person with dyslexia finds reading as one of the most hated activities especially for children. This paper presented few findings from a study involving twelve (12) dyslexic children in a primary school in Malaysia. An educational multimedia courseware is used in the experiment to test set of research questions related to reaction towards text instruction, icons, colors and other elements of interface. Findings from the experiment were discussed to understand reasons behind learning difficulties by dyslexic children. We also put emphasize on the engagement activities with the courseware to understand any design issues which may cause the low success rate of normal multimedia courseware. One notable finding in the experiment is that, some students possessed good listening skill to compensate the reading difficulties when trying to read the text-based instruction of the courseware. The results and findings will help multimedia courseware designer to focus on developing a more engaging courseware or online materials that will increase level of comprehension and ability of dyslexic children to apply the knowledge they have learned.

Keywords- Dyslexia, educational multimedia courseware, interface design

I. Introduction

Reading skill is a basic requirement in children early education, as there are many inputs to a new knowledge that require them to digest it from books and academic literature. Government of Malaysia as in many other countries, has been emphasizing on the importance of reading to develop a strong nation whom are highly knowledgeable that could contributes their expertise towards the development of the country. By reading, we get to know something new that never been taught before.

In Malaysia, most of the children are exposed to reading exercise as early as three or four years old during their days in kindergartens. Reading teaches the children a new knowledge about the world around them and at the same time it can improves their level of concentration in the learning process. The more they read the more the brain gets a new input and this input will be stored and definitely will be used later. The more they read, the more new connections will be built in their brain and even strengthen the existing connections. Children who read often have shown great improvement in their vocabulary. As a result they are able to write well as compared to those who seldom read. Not only that, most of the time they perform better in school as they have been exposed to many new things around them and develop their own imagination and experience.

In most cases, the problem with reading difficulties commonly associated with a symptom of dyslexia or children with reading disabilities [1]. Even though this is not a serious health problem as the children are actually behaving normal in every aspect of their life. Dyslexic children need appropriate teaching method to help them to read and recognize their strength and areas of competence [2, 3]. Unable to read can lead to low self-esteem and low-confidence and will cause failure in the children's education life [4].

The objective of this study is to investigate extensive information on the difficulties experienced by children with dyslexia when interacting with computers particularly using educational multimedia courseware. Getting a better understanding of what children with dyslexia know about interacting with courseware and how they use the computers can help researchers and designers to design more effective interfaces specifically for them [5]. In addition, it can also provide insights to increased opportunities for dyslexic to seek knowledge by themselves thru the use of ICT as all information can be retrieved by just clicking using their finger.

II. Understanding Dyslexia

Dyslexia is the most common learning difficulties in children and estimated around 10 percent to 17.5 percent across countries [3]. According to Ministry of Education Malaysia (2005), there are still children aged between 7-12 years old having problems in reading and forming basic sentences. Dr. Aziz Abu Hassan, Vice President Dyslexia Malaysia stated that there are about 314,000 school children in Malaysia having dyslexia. Previous studies stressed that dyslexia is one of several distinct learning difficulties in reading, writing, mathematics orientation and coordination [6, 7]. Dyslexia also has problem related to inability to use the short-term memory, which sometimes referred to neurological

Rozita Ismail
Universiti Tenaga Nasional
Malaysia

Maznan Deraman
TM Research & Development
Malaysia

Azizah Jaafar
Universiti Kebangsaan Malaysia
Malaysia

deficit [6, 8, 9]. As a result, the usual method in teaching normal children is not suitable for those with dyslexia. They will feel dejected and lost interest when the normal method used does not give positive results.

It is important for teachers and educators to observe dyslexic child in the early stage to ensure they are not abundance or left out in mainstream education. The majority of the new research focuses on the use of phonological techniques in helping the child to learn how to read [3, 10, 11]. According to past research, children were put through a series of exercises over the 12 weeks course that were designed to facilitate the gradual expanding use of letter-phoneme relationships in early reading and spelling [12]. These studies are designed for early intervention so that necessary steps can be taken to help dyslexic in their academic environment.

III. Computer Usage

Educational materials and computer applications are widely used in today's teaching and learning process. Children are exposed to the computer, Internet and multimedia courseware to enhance their learning experience and to increase their understanding of particular subject or syllabus. Although computers will never replace important features of play and learning material such as paint, blocks, sand, flash cards and books, it is proved that by using computer in classroom could increase their interest and help in engaging their attention towards acquiring knowledge. The current traditional teaching practice using book series and teacher using white board while children listening to them and try to grasp what the teacher is trying to tell them somehow is not suitable for children with special needs like dyslexia. Children with dyslexia need to be taught using alternative teaching techniques to attract their attention. Furthermore, using computer and educational materials provide opportunity to learn at their own pace benefits short-term memory suffers like dyslexic [13]. Educational multimedia courseware presents lessons that permit the children to re-play the lessons that support drill and practice which they can learn by themselves at home. The features of the multimedia and design create a sense of engagement [14]. If they are engaged with the learning session, it is easier for them to understand every lesson taught by their teachers.

Several studies have looked at the experiences of children with dyslexia using computer software and tools in supporting acquisition of reading competence. E-learning, word processor, multimedia courseware are among the tools that have been used quite some time. British Dyslexia Association has come up with Dyslexia Style Guide (DSG) that contains guidelines for dyslexic readers [15]. Most of the guidelines listed can be used for improving usability for people with other disabilities as well. In fact, non-disabled users benefited greatly from adherence to usability guidelines aimed at dyslexic users. Dyslexic has different style preferences and each dyslexic is treated individually. They should be given a freedom to create their visual environment that suits their

preferences [9]. Courseware designers need to adhere to certain design guidelines if the system is intended for dyslexic. Design considerations include aesthetics, accessibility, simplicity, usability aimed at enhancing readability for people with dyslexia.

IV. Method

A small-scale preliminary study was conducted to explore how a group of dyslexic's children feel and react towards the use of educational multimedia courseware in learning Bahasa Melayu (Malay Language). This was done using semi-structured interviews and observation with twelve school children whom identified by their teachers having dyslexia symptom. They were identified as having dyslexia after taking several series of tests under LINUS (Literacy Numeracy Screening) provided by The Ministry of Education Malaysia for all Year One students. Dyslexic children commonly exhibit any or several of the signs of dyslexia. This study aims at providing information on difficulties experienced by children with dyslexia when interacting with computers particularly issues related to the elements of interface and interaction design.

A. Participants

Twelve dyslexic children aged between eight to twelve years old participated in the study. They were selected by teacher in charge of Special Education Class (Kelas Pendidikan Khas) from Sekolah Kebangsaan Jalan 6 Bandar Baru Bangi. All the participating children had normal vision and ten out of twelve are all boys. School and parental consents were obtained for all the children that took part in the study.

B. Materials

The educational multimedia courseware that was chosen in the study was developed for Year One student of primary school in Malaysia. The courseware was used as a supplementary tool aiming to teach student to familiarize with alphabets A- Z. The courseware consists of several activities namely letter recognition, words recognition, letter pronunciation using video and exercises that uses a clear layout with simple text-based instructions together with audio-based instructions. The courseware uses multisensory techniques that allow the student uses his/her senses in the learning process. In this study, we focused on five elements of interface that make up the educational multimedia courseware (refer Table 1).

TABLE I. DESIGN ELEMENTS OF INTERFACE

No	Design Elements	Example
1	Text presentation	1. Typeface/ font 2. Font Size
2	Audio	
3	Icons	
4	Colours	1. Background 2. Text 3. Icons
5	Mouse	

Further we discuss the findings under the five design elements of interface stated in Table 1.

A. Text presentation

Young children normally have reading and writing problems if they were not introduced with these activities by their parents earlier. However, dyslexic experience more substantial problems in reading due to their inability to properly decode words into their component speech sound. Difficulty in reading can affect the way they interact with the educational courseware. We found that the dyslexic find it hard to read and took longer time to follow written texts especially if the texts were written using small font sizes and typefaces that were difficult for them to interpret to meaningful letter. In order to know exactly their problem and how they view text on the screen, we asked them to read aloud the text that were written in the courseware. There are several sets of written text that uses different types of font, sizes and colours. We asked them to compare between those sets to see which written text that they feel comfortable for their eyes to read.

We found that eight out of twelve dyslexics stated that they can read the text written in the courseware provided it was written using simple sentences. While the rest mentioned that there are certain parts of the instruction that looks confusing as one of them reported that there are certain words that they were not able to interpret it into meaningful words due to unable to recognize certain letter. One of them stated (“... is this “c” or “a”...I don’t feel like reading it ..”). We discovered that they have problem with letter “a”, “g”, “c”, “b” and “d”. Another dyslexic informed us (“.. I think I prefer reading this one... the one written in the previous screen were too small and difficult for me to see ..”) He was referring to a text written in the courseware that uses larger font size.

Another two dyslexics did not give any answers pertaining to the question asked. From our observation we found that instead of reading, both of them were seen using alternative way that is using audio icon that was available on certain part of the activities. When it comes to activity that offers no audio instruction, what they did is either taking hard time to finish reading the text instruction or they will just click on at any icon that appear on the screen. That shows that, limited reading skills can affect the way dyslexics interact with the educational courseware. One of the dyslexic informed (“...if I feel tired to read..I will just click on the button that I think will bring me to the next activity”) another dyslexic mentioned (“..sometimes I understand the instruction..but sometimes I will click this button because I don’t like reading long sentences..”).

These findings reveal the importance of how text is presented to enable usability for user with dyslexia. Although there are many ways in presenting text and words using different combinations of font types, sizes and colours,

C. Procedure

The study was carried out in a computer labs with 2 children were being tested and observed concurrently. The children need to use and play around with the educational multimedia courseware by themselves with minimal assistance from researcher. The researcher sat behind them to observe the activity and at the same time record all the conversation with each child. All distractions were monitored and controlled by the researcher to ensure the children pay attention and execute their activities without interruption. They were being asked a few questions throughout the process. Basically, questions asked were to find out how they feel when interacting with the courseware. A part from that, we would like to identify what kind of problems that the dyslexics experienced while using the courseware. Prior to that, a brief instruction was given so that they understand and know the steps that they should take. Time given was approximately 30-35 minutes for each child. All activities were recorded using webcam and all comments and feedback by every child were taken by the researcher (e.g. things they liked and their behaviours and actions).

v. Findings

Based on the testing and observation, we identified few notable findings. Most of the participating children in our study have been using computer as early as five years old. In responding to our question “*Have you used computer and do you like to use it?*” Most of them stated that they use computer for playing games and also to do homework that requires them to search for certain information on the Internet. Two dyslexics also mentioned that they have their own computer at home and they use it to finish up their homework. One of them also mentioned that sometimes she uses her father’s Ipad to play games and facebook. This situation clearly shows that children nowadays are increasingly using computer for playing games, searching information and also social communication. This also indicates that more ICT-based materials should be designed to support effective learning experience for these children with dyslexia. The design should consider the children’s abilities, interests and developmental needs. Using computer and educational multimedia courseware has been proven offers a motivating, safe and engaging experience for not only dyslexics but also for all children.

designers need to know which one that can lead to motivation and satisfaction for these group of users.

B. Audio

Further we would like to know their preference on listening to audio instruction. Eight out of twelve told that they prefer to have both text and audio instruction. According to them, they will read the instruction first and after that if they were unsure, they will listen to the audio instruction. One of them said that (*" ... I think I prefer to read on my own...I cannot follow what the voice tells me to do"*). Whilst another dyslexic claimed that (*" I enjoyed listening..it helps me so that I don't have to trouble myself to read"*)

Another two dyslexics informed us that they have no problem in reading whatever text that appears in the courseware. They added that by reading a lot they will learn more new words and gains more confident in reading. However, another two dyslexics have different opinions. One of them stated that his weakness is that he got tired sooner when it comes to reading activity. He told us (*" I love books but I need to take breaks whenever my eyes hurts..when that happens I can see the texts were all closed to each other"*). He then added that by using a multimedia courseware, he can just click on the audio and just enjoy listening to it.

We then would like to know how they perceived verbal instruction. In order to do that, before they start using the courseware, verbal instruction was given to them on how to use the courseware. We showed them all steps that they need to follow so that they understand and all of them are aware of what they should do. We then observed and later ask them question whether they understand the instruction given earlier. Nine answered they understood with the instruction that was given by the teacher. While the remaining stated that it is not they do not understand but they claimed that they forgot what the teacher has mentioned earlier. One of them mentioned that (*"... I understand the instruction but when I started using this I can only recall a few and I just do it....."*). While another dyslexic whom was observed to be quiet just mentioned (*"Teacher speak too fast and I don't remember."*) But from our observation, surprisingly he managed to explore and use the courseware and try all activities. The only thing is that he was not following the steps explained in the briefing session given verbally by the researcher. Another dyslexic will just wait for the researcher to instruct and assist her. If she was not entertained she rather just sits and starred at the computer screen. We observed she was too shy to speak and communicate with the researcher.

C. Icons

Further we examine on the use of icons in educational multimedia courseware. We were interested to know how they perform an activity when it has icons that need to be clicked

on it. We observed that, most of them are understand the usage of the icon and its function. But there are also icons that their functions are not obvious to some of the children. Children with dyslexia may find these icons are hard to guess due to limited understanding of concepts and how they relate to each other.

We observed that when they were not sure about the function of the icon, they will just click the icon to see the result. Only a few of them have courage to ask the researcher on the function of the icon that seems was not familiar to them. We also discovered that most of them react positively to animated icons and images. One of them stated that (*" I like doing this task and I really enjoy myself"*). He was referring to an activity where it uses images and animation to describe and explain the situation.

D. Colours

It is important to know which colours the children enjoy the most. Colours play an important role in attracting children attention and at the same time can stimulate their mind to identify things better. In this study, we can see that every dyslexics enjoyed screens that uses pale or light blue as it can enhance concentration. We have made a few screens using red, green, blue, yellow and white for background colours and white, dark blue, black and pink as the colour for text. We found that there are certain colours that they tried to avoid such as text that uses red with light blue or white as the background colour. Although it is quite difficult for us to determine which colours suit their need but we agreed that colours do affect children's educational experience. [15] recommended on using certain colours for example to use dark blue or black for text and pale blue or yellow for background. One of the dyslexic stated that he would be happy if the courseware allows him to choose his preferred colours. According to him (*" sometimes I like green and sometimes I like blue..I hope I can easily change it whenever I like "*)

E. Mouse

For some children, they have difficulties in using mouse as interaction tool to access and manipulate the screen. This is due to reason such as their hand is quite small and unable to grab the mouse. Not only that, past studies of dyslexia have correlated the condition with difficulty of motor control [9]. Several questions pertaining to the usage of mouse were asked to get feedback from the respondent. Most of them answered that they know how to use the mouse. Ten out of twelve dyslexics mentioned that they can easily handle the mouse to accomplish the task. Based on observation, they are familiar and they know how to handle the mouse just like non-dyslexic children. However there are a few of them were seen slightly taking more time when it comes to activity of drag and drop using the mouse. Drag and drop requires the user to click and

hold the mouse button before it can be released to the desired place.

Five dyslexics mentioned that there are times they need to take a short break when it comes to activity that requires them to drag and drop object to different places. They commented that there are times where they need to carefully right-click the mouse and hold the button slowly to make sure the process of moving the object as required from the activity success. One of them commented (“*sometimes I get frustrated when I fail to drag the object to the correct place...I cannot hold the button too long..my finger hurts and my eyes feel tired...*”). Another dyslexic mentioned (“*..can I just use my finger..it is much more easier for me to move the object*”). She was referring to an activity where she needs to mix and match the letters to the correct pictures.

VI. Conclusion

This study provides valuable insights regarding the impact of using computers and educational multimedia courseware on children with dyslexia. We also learned that each dyslexic child were very unique and creative in many ways. Despite having problems with reading and in understanding simple instruction, they devise extraordinary compensatory strategies to overcome their weakness. The use of ICT particularly educational multimedia courseware can help dyslexics increase confidence and motivation through self-paced learning and independence learning. However, it depends on the quality of the courseware in terms of contents suitability and the interface design of the courseware itself. In terms of the contents, designers need to ensure the contents of the courseware should meet the learning objectives and the way they were presented accommodates the dyslexic’s different learning and emotional styles. The interface design of the courseware should consider the condition of dyslexic children and support to minimize their weaknesses and capitalize their strengths to a positive learning experience.

From the study, it is also acknowledge that each dyslexic is individualistic. They have different strengths, needs and approaches to learning. They are capable of using computers and interact with variety of activities provided. Early identification of dyslexia symptom is important to ensure that these children are given special support that comprises of proper teaching techniques and other learning opportunities across all areas of the curriculum. By adding a computer curriculum in a classroom, it encourage the children to think by themselves and engage them with the learning activities that promote acquisition of skills and knowledge in a pleasant interactive way.

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