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INTERFACE DESIGN FOR DYSLEXIA: TEACHERS' PERCEPTION ON TEXT PRESENTATION

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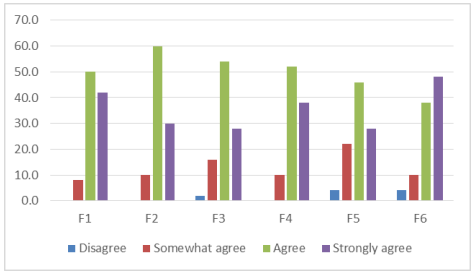
Graphical abstract



Abstract

The use of educational courseware and online materials for learning has the potential in helping dyslexic children in education and self-development. As reading is one of the dyslexic's main problems, a guideline for making text in digital presentation is essential. We conducted a research to explore teachers' perception on the criteria of text in designing online materials for dyslexic children. These features are based on user studies with a group of dyslexic students from four primary schools in Klang Valley. 50 teachers from four schools participated in this study. The data were analyzed using standard descriptive statistical methods. It is hoped that the result will give suggestion on the criteria of text in digital presentation for developing educational courseware or any online materials for dyslexic.

Keywords: Dyslexia, text, digital presentation, educational courseware

1.0 INTRODUCTION

Teaching students with learning difficulties needs high commitment and patients. Parents and teachers need to find ways in teaching these students so that they were not left behind from their peers in academic performance and social behaviour. Specialized techniques and strategies in teaching dyslexics are very important before the student begins to develop low self-esteem due to their low academic achievement [1], [2], [3]. Being a teacher to these special students means that we need to put ourselves in their shoes. As a teacher and parents to dyslexic students, we need to get ourselves updated with the latest information that can be used to design effective strategies in teaching and dealing with the child emotions in a most creative ways. This is due to the limitations and weaknesses that every dyslexic has that may impact their academic and self-development [4], [5].

Dealing with dyslexic students involve different ways of teaching and require new and innovative ways of managing their strengths and weaknesses [6]. As every dyslexic may exhibit one or several signs of dyslexia, continuous support from parents and teachers are very important in helping them to devise compensatory strategies to overcome their weaknesses [5]. Educational materials and computer applications such as game based learning are widely used in today's teaching and learning process [7]. Considering that ICT has potentially provided broad access to education for children with learning difficulties, such as dyslexia, designers need to design suitable interfaces to tailor with their requirements [8][9][10]. The interface should be made as usable as possible to help them engage with the learning activities. Suitable interface design is important, as children with dyslexia have their own preferences and behaviours when interacting with these ICT related application [11]. Their preferences and behaviours could influence the effectiveness of using ICT to support their learning activity [12].

Most of dyslexic students find reading to be a painful activity, as they need to focus on the text

presented on the paper or even on the computer screen [13]. For this reason, a guideline for designing texts is in fact very important to help ease the reading difficulties that occur [11]. In our previous study we have identified elements of interface design that need to be considered in designing educational courseware or online materials that requires the dyslexics to interact with the interface either by manipulating the functions available or by just reading the text information presented on the screen [14]. Text, icon, audio and animation are among the main elements that need to be considered in developing educational courseware and online materials for dyslexic. The British Dyslexia Association has come up with the Dyslexia Style Guide that contains guidelines for dyslexic readers [15]. Our research further investigates the criteria of text that reflect the preferences of dyslexic student in Malaysia.

The objective of this study is to investigate the perception of teachers whom directly teaching dyslexic student on the criteria of text in digital presentation. The finding from this study could be used as a guideline for designers or even teachers to design more effective interfaces for dyslexics. More educational resources are now on the web. The right criteria of text helps dyslexic student to read and understand the information better.

2.0 DYSLEXIA IN MALAYSIA

Approximately 5 to 10 per cent of school children are affected by dyslexia [16]. According to Puan Sariah Amirin, President Dyslexia Association Malaysia it is estimated around 314,000 school children are dyslexics. For that reason, the Ministry of Education Malaysia has developed Special Education Unit in selected schools throughout Malaysia to facilitate the needs of this population [17]. At present, a specialized module has been designed that comprises various techniques in teaching to ensure that dyslexics will have the same chances and opportunities in acquiring knowledge as mainstream students. Observations made in four government schools that has special Education Unit reveals that various approaches in teaching have been adopted to improve the educational experience and academic performance of dyslexic students. A small group of six to eight students will be placed in a classroom that has been designed to accommodate the needs of students with learning difficulties. However these dyslexics were placed together with other learning difficulty such as autism, slow learner and ADHD.

Based on the interviews with the teachers from the schools that involve in this study, parents need to get letter from doctors to certify that their child have been identified having dyslexia upon admission. There is also some cases where a child is identified having dyslexia based on teacher's observation and obtained low marks in LINUS assessment conducted while they were in Year One. Dyslexics were generally slower than non-dyslexics in learning due to difficulty in reading acquisition. Continuous support and high commitment from the teachers and parents are essential. According to teachers, dyslexics are indeed creative student, but it requires more time and effort to help them succeed in their academic environment. In fact Corlu and his colleagues have indicated that dyslexic individuals generally have the ability to express ideas and perceive concepts differently and able to explore the remarkable interpretations than non-dyslexic [18].

3.0 DYSLEXIA AND INTERFACE DESIGN

One of the main difficulties of dyslexic is regarding visual deficit [19], [20], [21]. Although the cause of dyslexia is multifactorial e.g. auditory deficit, processing speed, short-term memory, organization, sequencing, motor skills and the list continues but undoubtedly visual perception can contribute to a dyslexic's reading abilities [22], [23]. It was reported that nearly 50% of dyslexic children complaints about how they see letters moving around, blurring and shimmering [24], [25]. Sometimes they may also complain about not comfortable seeing and reading text with white as background color [26]. The situation can worsen when the texts were written using small size [27]. These certainly can interfere with the reading and learning process. Not surprisingly, dyslexics do not like reading unless they have to and often they become disengage from education due to literacy difficulties.

As mentioned earlier, student with dyslexia need different approach and using various techniques to help them engage with the learning activities. Most dyslexic students nowadays are exposed to the Internet and educational courseware to enhance their learning experience. This indicates that the interface design of ICT-based materials should consider the strengths and limitations of dyslexics in order to design a usable interface that promotes ease of use. The interface design should reflect on the dyslexic's abilities, interests and developmental needs to support effective learning experience. Indeed, it is important for designers of ICT-based materials such as educational courseware and online materials to follow a specific interface design guidelines to help minimize dyslexics' difficulties when interacting with the online materials.

In this study we emphasis on the text features. Past research stated that the text presented on the computer screen need to be eligible to make it readable for dyslexic users [28]. The presentation of texts should be visually clear and simple to enable dyslexic to recognize its symbol and relate it with the sound. [29], [30]. Text that can be recognized easily and readable help to reduce cognitive load and at the same time reduce visual stress, tired eyes and acute headaches [31], [32], [33], [34], [35].

The selection of right criteria for text in designing interface for digital presentation such as for online materials could help dyslexic to minimize the impact of their visual limitation when it comes to reading and manipulating the online materials.

4.0 METHOD

This was an exploratory study conducted to examine the importance of interface design particularly on text features for Dyslexia. The text features were identified during preliminary study that was previously conducted with a group of dyslexic children from four primary school in Klang Valley [14], [36]. The questionnaire used in this study was constructed by the researchers and had undergone the procedure of content validity. A pilot study had also been conducted to test the reliability of the questionnaire in terms of language and content item. The questionnaire was distributed to teachers from the Special Education Unit and have experience teaching dyslexic students.

4.1 Participants

The sample consisted of fifty teachers from four primary schools in Klang Valley. All of the participants have received training on teaching students with learning difficulties specifically dyslexia.

4.2 Instruments

The questionnaire was designed based on the observation and result from our previous study that investigated the experience of dyslexic users interacting with educational courseware and educational website. The self-administered questionnaire has been validated by four experts from three different organizations. The panel of experts consisted of two senior lecturers with expertise in Human computer interaction, one expert from the Dyslexia Association of Malaysia and another expert from Ministry of Education that actively involved in research related to designing teaching and learning strategies for dyslexic students.

4.3 Data Analysis

The data were analyzed using SPSS 19. We executed Cronbach's alpha on all constructs for reliability analysis. For research purposes, a useful rule of thumb is that reliabilities should be at least 0.70 and preferably higher. Results show Cronbach's alpha value of Font type (F) – 6 items (.896), Font size (S) – 4 items (.919), Highlighting (H) – 3 items (.822), Color (C) – 6 items (.882) and Spacing (SP) – 3 items(.914) All criteria had a good value level of 0.80 and above. Table 1 shows the full list of items.

Table 1 List of items

	Item	Mean	SD
F1	Font1-Selection of right font improve readability	4.34	.626
F2	Font2-Monospaced font is easier to read and improve readability	4.20	.606
F3	Font3-Font without serif is easier to read and improve readability	4.08	.724
F4	Font4- Font that can be changed to suits the dyslexic needs improve readability	4.28	.640
F5	Font5- Capital letters to all text is harder to read	3.98	.820
F6	Font6- Moving and blinking text complicates reading and can lessen the readability	4.30	.814
S1	Size1-Selection of right size for text can improve readability	4.36	.663
S2	Size2-Bigger font sizes can improve readability	4.30	.735
S3	Size3-Readability improves better for text that uses size of 18points and above	4.04	.669
S4	Size4-Font size that can be customized to make it readable can improve readability	4.28	.607
H1	Highlight1-Bold to highlight important keywords can improve readability	4.24	.625
H2	Highlight2-Italics distract and worsen reading ability	3.92	.778
H3	Highlight3-Underline distract and worsen reading ability	3.92	.778
C1	Color1-Selection of right colour for text and background can improve readability	4.30	.580
C2	Color2-White for background colour can obfuscate reading ability	3.76	.771
C3	Color3-Selection of pastel colour for background can improve readability	3.92	.634
C4	Color4-Dark colour for texts improve readability	4.02	.654
C5	Color5-Background colour can be altered to suits dyslexic needs can improve readability	4.08	.634
C6	Color6-Using different colour between syllables facilitate reading and can improve readability	4.28	.640
SP1	Spacing1-Extra-large letter spacing helps reading and improve readability	4.28	.573
SP2	Spacing2-Screen with crowded texts complicate reading and can lessen the readability	4.34	.658
SP3	Spacing3-Screen with less texts helps reading and improve readability	4.34	.658

5.0 RESULTS

This was a small scale study and the results should be interpreted with this in mind. The results of the descriptive analysis for each item were based on a Likert Scale.

Figure 1 shows the results of Font Type (F) criteria. On the scale, the answers of the teachers were more towards agreeing and strongly agree. The results indicate that the choice of font used for teaching materials such as using MS power point or in any digital presentation is one of the important criteria to improve readability for dyslexic student. The selection of right font type can improve readability for dyslexic student (n=46, 92%), a monospaced font is easier to read (n=45, 90%), a font without serif is easier to read (n=41, 82%), font type that can be changed by users can improve readability (n=45, 90%). the use of Capital letters to all text makes it harder to read (n=37, 74%) and moving text and blinking text complicates reading (n=43, 86%). For item F3, F5 and F6 less than 5% disagreed with the criteria.

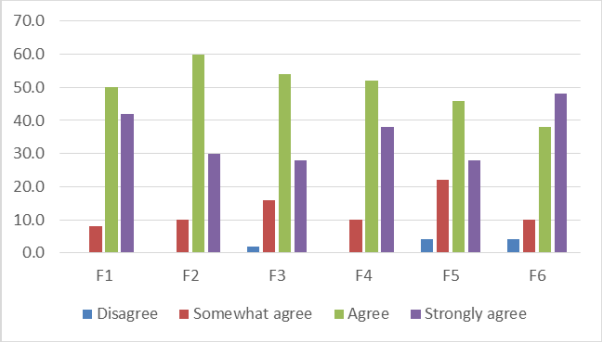


Figure 1 Result for Font type criteria

Figure 2 shows the result of Font size criteria. It shows that most teachers strongly agreed that the selection of the right font size for text can improve readability (n=23, 46%), bigger font sizes can improve readability (n=23, 46%), most of them agreed that readability improve when using font size of 18 points (n=28, 56%) and font size that can be customized by users to suit their needs (n=28, 56%). The results show that none of the teachers disagreed with any of the items.

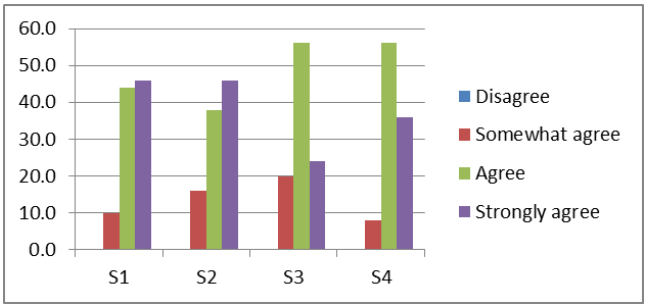


Figure 2 Result for Font size construct

Figure 3 shows the result of using Highlighting to emphasize on important words or keywords. In general, teachers agreed and strongly agreed that the use of Bold to highlight important keywords in the presented text is better compared to Italics or using Underline (n=45, 90%) and most of them agreed that the use of Italics and Underline can distract the reading activity (n=37, 74%). The results shows that none of the teachers strongly disagreed with any of the items with less than 10% disagreeing.

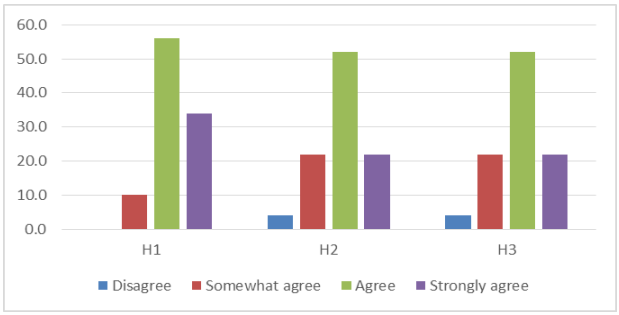


Figure 3 Result for Highlighting text criteria

Figure 4 presents the results for text and background colour criteria. The result shows that most teachers had positive feedback on all the items. On the scale, teachers answered more towards agreed and strongly agreed. None of them answered strongly disagree with any of the items with less than 10% disagreeing. Thus, considering the features for text and background colours would help improve the dyslexic readability.

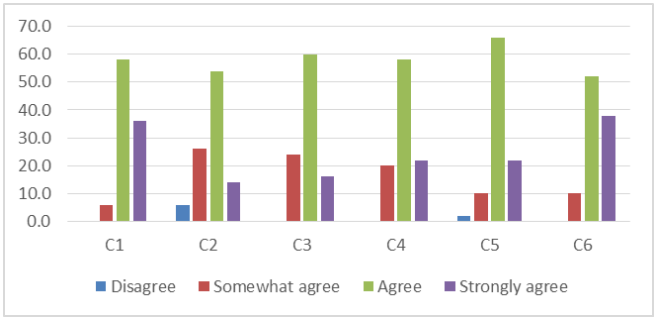


Figure 4 Result for Text and background colour

Figure 5 shows the results of spacing between texts criteria. It shows that most teachers agreed and strongly agreed that extra-large letter spacing really helps dyslexics in reading (n=47, 94%), screen with crowded texts can complicate reading and lessen the readability for dyslexics (n=47, 94%) and screen with less text helps reading and improve readability. Based on the results, the highest score on the scale is agreed, followed by strongly agree and somewhat agree. None of the teachers chose strongly disagree for any of the items, with less than 5% disagreeing.

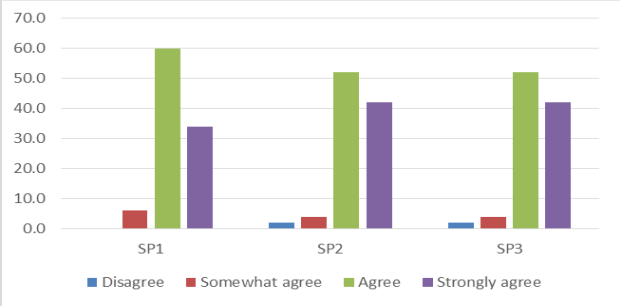


Figure 5 Result for Text spacing criteria

In light of the results obtained when analyzing our data, we also received comments and suggestion from our participants.

Most teachers (n=48, 96%) agreed that ICT should be integrated in the school curriculum as it will benefit the dyslexic students in a long run. ICT-based materials such as educational courseware, educational website and online materials have been proven offers a motivating, safe and engaging experience for not only dyslexics but also for all students [37]. They also mentioned that these materials help dyslexic to become engaged with the lessons and improve their attention during the learning session. Teachers also added that, as most dyslexics are visual thinkers, the use of multimedia courseware that offers attractive multimedia elements such as animation is appreciated. As a result, dyslexic students are more inclined to find creative ways to learn appropriate information to increase their understanding of particular subject.

Teachers also point out some limitations of school computer lab facilities. Poor internet connection and old version of desktop computers are inevitable. Hence, schools need to be equipped with sufficient resources necessary to deal with large classes of diverse ability students with different needs. It is worth mentioning that ICT is not just another way of delivering knowledge, it encourage dyslexic students to be more effective otherwise they will be left behind. This is why it is important of having more research on diverse preferences and responses of the dyslexic users towards interface design.

6.0 CONCLUSIONS

This study investigates the teachers' perception on having specific guidelines for designing user interface for dyslexic student. Our study concentrates on the features and criteria of text to improve readability. From the analysis, it illustrates the positive feedback from teachers of having specific guidelines for text in designing educational courseware and online materials for dyslexic students. The right choice of font type, appropriate size for text, proper spacing between line of text, highlighting text and suitable colours for the text and the background improve the readability. The findings are in line with previous study that to promote the success use of ICT-based materials, designers need to follow specific interface guidelines that consider the limitations and preferences of dyslexic users [38], [26], [39]. It is undeniable that educational courseware and online materials support self-learning for dyslexic students. It would be good to facilitate them with interfaces that suit their needs so that they can easily explore and discover the knowledge without any problems. This finding can have impact on the digital text book that the Ministry of Education Malaysia would like to implement in Pelan Pembangunan Pendidikan Malaysia that the main content rely on text and visual images.

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