

# Web text reading: what satisfy both dyslexic and normal learners?

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Received: 27 October 2014 / Revised: 11 September 2015 / Accepted: 30 September 2015 /  
Published online: 8 October 2015  
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**Abstract** The study employs an exploratory approach to examine the satisfaction of normal and dyslexic learners toward different web text modes. As an average of 10 % of the population shows some traits of dyslexia, presenting web text solely based on the guidelines for normal web users will put users with dyslexia at disadvantage. Due to the ubiquitous use of the web for online learning purposes and the availability of tremendous amount of text on the web, this investigation intends to derive appropriate guidelines for presenting web text that could accommodate both groups of learners. This qualitative study uses a multiple case study design and data are mainly collected via observations and guided interviews. The study reveals that existing dyslexia-friendly text guidelines are also appropriate for normal learners and the use of screen reader, an assistive technology that reads text aloud, does not fit every dyslexic and normal learner.

**Keywords** Web text reading · Inclusive guidelines · Screen reader · Dyslexia-friendly

## Introduction

Dyslexia is a specific learning difficulty that is neurological in origin (Lyon et al. 2003) and affects literacy development and language-related skills (British Dyslexia Association n.d.a). While dyslexia is mostly defined as a learning difficulty, Vellutino et al. (2004) use the terms ‘dyslexia’ or ‘specific reading disability’

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interchangeably. Tunmer and Greaney (2010) include four components into their definition of dyslexia. Dyslexia is referred to as “(a) persistent literacy learning difficulties, (b) in otherwise typically developing children (c) despite exposure to high quality, evidence-based literacy instruction and intervention, (d) due to an impairment in the phonological processing skills required to learn to read and write” (Tunmer and Greaney, p. 239). Although there is no single definition of dyslexia and several approaches are used to define it (Smythe 2011), deficiency in reading ability is a critical element highlighted in most definitions.

To date, a number of guidelines are recommended to facilitate reading among people with dyslexia. For example, considering the visual stress experienced by dyslexics, British Dyslexia Association (n.d.b) publishes a set of guidelines for creating dyslexia-friendly text and similar guidelines are also published by Dyslexia Association of Ireland (n.d.). Among the aspects emphasized by these guidelines include the media used, choice of font, presentation of headings, ways to make emphasis, writing styles, and the use of various visual techniques to increase accessibility. Zarach (2002) proposes ten guidelines to enhance readability and accessibility for dyslexics and Rello et al. (2012) suggest some layout guidelines for web text to assist this group of web users.

Numerous web text guidelines to cater the needs of normal users are also available, for example those by Nielsen (2003) and International Organization for Standardization (2008). There are also inclusive recommendations on web text formatting that move beyond typical users to include users of all ages, experience levels, and physical or sensory limitations such as those proposed by Lynch and Horton (2008) and Web Content Accessibility Guidelines (WCAG) that provide technical standards on how to make web content more accessible to people with disabilities (World Wide Web Consortium 2008). According to McCarthy and Swierenga (2010), most of such inclusive recommendations consider diverse group of physical and cognitive disabilities instead of focusing on the specific needs of people with dyslexia. Due to the consideration of various types of impairments, existing recommendations often suggest general practices instead of specific ones that meet the specific needs of a particular type of disability.

Existing guidelines for web text accessibility focus either solely for dyslexia, normal or diverse (normal and all other types of disabilities and differences) web users. Minimal effort is known on deriving inclusive web text accessibility guidelines that are appropriate for both normal people and people with dyslexia. Such guidelines are essential as it is estimated that 700 million people worldwide, around 10 % of the population, are having some symptoms of dyslexia (Dyslexia International, n.d.). The ubiquitous use of web, generally, and online learning, specifically, implies that a significant minority of online learners are from this group of population. Thus, guidelines that specifically inform the appropriate web text design for these two groups of online learners would be useful as they form the majority of the online learning community. The question raised in this study is “What satisfy both dyslexic and normal learners in web text reading?” This study aims to yield guidelines that afford web text reading for both dyslexic and normal learners by exploring their satisfaction toward different web text modes.

## Method

This qualitative study employed a multiple case study design. In this study, the sample was narrowed down to involve secondary school students only. It involved 12 dyslexic secondary school students (7 female, 5 male) as well as 12 normal secondary school students (8 female, 4 male), with their ages ranging from 14 to 18 years old. All these students learned English in schools as their second language. Data were collected by observing participants' behavior and their facial expression when using each of the web text modes as well as via guided interview sessions.

### Web text modes

This study involved the use of three web text modes, named as Control, Standard, and Enhanced. Each mode consisted of a reading passage which was written in English. Table 1 shows the differences and similarities between these modes. In the Control mode, the passage was presented using the layout and typefaces that are similar to those commonly found in a conventional printed book. This mode served to evaluate participants' satisfaction toward the use of printed format on the computer screen. As for the Standard mode, the passage was presented based on some dyslexia-friendly text guidelines as suggested by The British Dyslexia Association (n.d.b) for the background color, font type, font size, layout, and writing style. This mode served to evaluate participants' satisfaction toward the web text that was presented in accordance with the recommendations of these guidelines. It would be insightful to know whether guidelines that are originally derived for dyslexics are also appropriate for normal participants. The Enhanced mode was similar to the Standard mode except with the addition of a screen reader to read the web text aloud. The screen reader used was known as Natural Reader, a text-to-speech software that allows the user to control the speed of reading as well as to choose his or her preferred reading voice. This mode served to evaluate participants' satisfaction toward the use of audio in aiding their reading.

### Instruments

Satisfaction is one of the major aspects used to evaluate learning effect. To ensure the validity of this construct, various literatures were reviewed to derive relevant

**Table 1** Characteristics of the web text modes

	Media	Font	Layout	Writing style
Control	White background	Serif, 12–14 point, black	Single spaced, justified	Paragraph from
Standard	Beige background	Sans serif, 16–18 point, black	1.5 spaced, left justified	Bulleted points
Enhanced	Beige background, screen reader	Sans serif, 16–18 point, black	1.5 spaced, left justified	Bulleted points

questions for the interview guide which was used in the study. Satisfaction is found to be positively affecting students' behavioral intention to participate in online learning and such behavioral intention is highly correlated with learning effectiveness (Liaw 2008). Questions to examine participants' satisfaction check whether the web text reading experience produces positive feelings and attitudes (Lee 2008; Tough 1982), willingness to focus when learning (Lee 2008), management of emotions (Lee 2008; Sun et al. 2008), management of behavior (Lee 2008), perceived usefulness and ease of use (Arbaugh and Duray 2002; Gardner and Amoroso 2004; Isik 2008; Sun et al. 2008; Wu et al. 2006), learning motivation (Lee 2008), and learning interest (Lee 2008). Table 2 shows the list of interview questions that guide the collection of data on participants' satisfaction toward the different web text modes.

## Procedures

Each participant was requested to read the passage of each mode. The session involved two researchers, one acted as an interactant while the other one helped in recording the sessions. Each participant started with the Control mode, followed by the Standard mode, and finally, the Enhanced mode. After reading passages of all three modes, an interview guided by questions which were derived earlier on (see Table 2) was conducted. Screenshots of each mode were shown during this interview session to assist participants in recalling the different modes that they had experienced earlier on. The whole session was video-recorded and the researchers also jotted down all pertinent observations.

**Table 2** Satisfaction questions in the interview guide

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Willingness to focus when learning (Lee 2008)
Does the way the passage is presented attract you to focus on it?
Management of emotions (Lee 2008; Sun et al. 2008)
Do you think reading the passage makes you nervous?
Do you think the passage make you feel uncomfortable/uneasy?
Do you think reading the passage let you feel psychological stress?
Management of behavior (Lee 2008; Tough 1982)
Do you think reading the passage makes you confused?
Do you think reading the passage needs a lot of patience?
Perceived usefulness and ease of use (Arbaugh and Duray 2002; Gardner and Amoroso 2004; Isik 2008; Sun et al. 2008; Wu et al. 2006)
Do you find it easy to read the passage?
Do you think reading the passage is difficult/complicated?
Learning motivation (Lee 2008)
Are you eager to understand about the content of the passage?
Do you think [specific features of each mode] are useful in helping you to read?
Learning interest (Lee 2008)
If you have another opportunity to read the passage using [each mode], would you gladly do so?

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This study employed the iterative qualitative data analysis model as proposed by Gay and Airasian (2003). This iterative process involves the following steps: (i) familiarize with data and identify potential themes, (ii) provide detailed descriptions, (iii) code and categorize data into themes, and (iv) interpret and synthesize data into written conclusions.

The researchers transcribed the recorded interviews and cross-checked the transcript with video recordings in order to add pertinent non-verbal information. Three researchers independently analyzed data for each mode. For each online reading mode, significant statements on each learning experience aspect were coded with a label and corresponding statements were coded with the same label. Then, the researchers chose an appropriate theme to summarize statements within a mode. The researchers discussed among themselves to reach consensus on any inconsistent interpretations. This organization of data into different modes has allowed a more effective comparison of the three online reading affordances.

### Findings and discussion

Table 3 shows the satisfaction themes that emerged from the data analysis.

#### Control mode: moderate satisfaction (dyslexic, normal)

Referring to Table 3, based on the questions that focus on participants’ willingness to focus when learning, it was found that most participants regarded this Control mode as unattractive. Half of the normal participants reported minor dissatisfaction as small font size caused some reading discomfort and lengthy sentences caused some confusion. These affect their satisfaction in terms of their emotion, behavior, as well as perceived ease of use. Table 4 states the comments from these participants.

On the other hand, the remaining normal participants and about half of the dyslexic participants reported this reading mode as not causing any discomfort, confusion, and anxiety to them. Familiarity to such information presentation, which is often found on typical printed books, may explain their positive emotion and behavior toward this mode. Although some favorable comments were collected on this aspect, these participants are classified as having moderate satisfaction because they have the least satisfaction toward this mode when compared to the other two modes.

**Table 3** Satisfaction Themes for Control, Standard, and Enhanced Modes

	Control		Standard		Enhanced	
	Dyslexic	Normal	Dyslexic	Normal	Dyslexic	Normal
Satisfaction themes	Moderate and low	Moderate	High	High	Excellent, moderate, and low	Excellent and moderate

**Table 4** Comments (labeled as ‘minor reading discomfort and confusion’)

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Font is small...a bit tiring
Uncomfortable and a bit confused due to lengthy sentences
Nervous as I scared I could not understand
A bit uncomfortable
Reading passage is sometimes difficult
Confused due to long sentences
Confused...points should be highlighted
Uncertain as font is small

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**Control mode: low satisfaction (dyslexic)**

Most dyslexic participants also thought the Control mode as unattractive. Six of the dyslexic participants also expressed low satisfaction toward the easiness to read the passage. Table 5 states the comments from these participants.

Some dyslexic participants also reported negative emotion as they thought the passage made them nervous, confused, uncomfortable, and the passage was perceived as difficult to read. Among the reasons given include “Words move around makes me feel nervous” and “Difficult to read because black on white” which are related to the use of black font on white background as well as “Very lengthy... need to read and stop frequently,” “I feel lost because of long sentences,” “I am scared of reading wrongly” and “Confused and stressed in identifying main points,” which are related to the use of paragraph form. Hence, these participants are classified as having low satisfaction.

Kolers et al. (1981) and Grabinger and Amedeo (1988) are among others who raised concerns over the direct application of standards used in printed sources for screen text, which is similar to the passage used in the Control mode. This finding provides evidence on the undesirable effect resulted by such application. An examination into the brain activities using EEG by Geske and Bellur (2008) reveals that their subjects’ parietal lobes show tighter beta activity which indicates greater cognitive load when reading text on screen as compared to the similar printed text. According to them, the light from the screen that shines into the eye possibly causes this problem as parietal lobes are responsible for processing luminance.

**Table 5** Comments (labeled as ‘uneasy to read the passage’)

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The passage is lengthy...small font, unattractive color and boring
Design looks boring and words are too small
It is long and boring
Hard to read
No motivation to read
Need more effort and patience reading compared to the other two modes

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### **Standard mode: *High satisfaction (dyslexic, normal)***

All participants reported satisfaction toward this reading mode. The reading passage was able to attract them to focus on it. They also did not experience nervousness and discomfort during the reading experience. Table 6 states some related comments that are labeled as ‘calmness and comfortable.’

In terms of perceived ease of use, participants also reported their reading as not difficult due to bigger font size and highlighted keywords. Dyslexic participants also highlighted the absence of ‘dancing words’ eased their reading. The passage for this Standard mode was presented using black text on beige background, which produces lower contrast comparing to the black on white setting used in the Control mode. This finding further supports earlier work such as Gregor et al. (2003) who reported higher reading comfort for dyslexics when reading using settings that have lower contrast both in luminance and color.

### **Enhanced mode: *Excellent satisfaction (normal, dyslexic)***

Four dyslexic participants and eight normal participants reported excellent satisfaction toward the Enhanced mode. As compared to the Control and Standard modes, these participants made a firm preference toward the Enhanced mode. They perceived the screen reader as useful and would gladly use it for future web reading. The screen reader was regarded as successfully attracted them to focus on the passage. The screen reader did not cause them to feel nervous, discomfort or confused but rather eased their reading and understanding. Tables 7 and 8 list some of the related comments that are labeled as ‘most satisfied.’

Screen reader is an assistive technology tool recommended to help individuals who struggle with reading as it facilitates decoding, reading fluency, and comprehension (GreatSchools 2008; Shaywitz and Shaywitz 2012). This tool accesses a dyslexic’s listening capability and enables him/her to gain knowledge from an auxiliary source (Shaywitz and Shaywitz 2012). Elkind et al. (1993) who studied on computer-based readers found that 70 % of 28 middle school dyslexic students read with greater comprehension when using such readers and concluded

**Table 6** Comments (labeled as ‘calmness and comfortable’)

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I am comfortable because can read myself
Easy to follow
I am comfortable with the font and layout
Can focus...main points are highlighted
Reading is not difficult
Easy to read because of bigger font
Comfortable and not confusing
I feel calm and comfortable
Reading a passage is not difficult
Not difficult to read

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**Table 7** Comments from dyslexics (labeled as ‘most satisfied’)

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Most attractive
Most comfortable
The sound helps me in remembering the passage...it is the easiest to read with screen reader...easy to follow through the passage without the need to stop
Computer reading helps a lot
Helps in pronunciation

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**Table 8** Comments from normal participants (labeled as ‘most satisfied’)

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It attracts my attention the most
I would definitely choose this mode for my future use
It is very useful in helping me to read
This mode attracts me the most
I am comfortable with the audio
It sounds like my teacher teaching

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that computer readers are important compensatory aids that enable dyslexics to perform more effectively in reading-related tasks. Many existing literature such as Buzzi et al. (2009); Chandrashekar (2010); Evett and Brown (2005); Hersh (2014); Kiraly and Ridge (2001); Lazar et al. (Lazar et al. 2007); Leporini and Paternò (2004); Raskind and Higgins (1998) as well as Wies et al. (2001) highlight the use of screen reader among people with disabilities which include learning disabilities, blind, and visually impaired. As majority of the normal participants in this study also indicated their strong preference toward this mode, the screen reader is also deemed appropriate for this group of learners.

### **Enhanced mode: *moderate satisfaction (normal, dyslexic)***

Analysis of data also revealed another subgroup of dyslexic participants who are classified as having moderate satisfaction. Two participants, who generally preferred the Standard mode commented that they opted for the Enhanced mode only if the reading passage was presented in English, a language in which they were not proficient in. These two participants highlighted the benefit of the screen reader in aiding their understanding of the English passage compared with self-reading. According to Freire et al. (2011), unable to make sense of language is one of the problems reported by dyslexic web users. Thus, the findings from this study point to the potential of the screen reader in alleviating this problem.

Another dyslexic participant chose this Enhanced mode over the Standard mode only when she was given the option to control the reading speed and play/pause function of the screen reader. As shown in the experiment done by Stenneken et al. (2011), the reduced attention span of the dyslexic group is due to the slowing of the visual perceptual processing speed. The speed of reading the passage, which



involves visual perceptual processing, needs to be coherent with the audio processing. Giving screen reader control option enables the speed for both processing to be adjusted accordingly. On the other hand, none of the normal participants commented on the needs for such control. A normal participant preferred female voice while another one preferred her teacher's voice. Another three normal participants also commented on the audio distraction caused by the screen reader but still thought this affordance is better than the Control mode. Thus, they are classified as having moderate satisfaction.

### **Enhanced mode – low satisfaction (dyslexic)**

Generally, those who were satisfied with the Enhanced mode thought the audio attracted their attention and helped much in their reading. The use of audio allows these participants to access knowledge using an auxiliary source via listening (Schoeberlein and Wang 2009). However, four dyslexic participants found the audio to be distracting. They are categorized as having low satisfaction as they reported their incapability to cope with both reading and listening at the same time and would not opt for such reading affordance. Comments from these dyslexic participants include *'audio is distracting,' 'I prefer self-reading,' 'I dislike computer reads for me,'* and *'This is distracting...I like to read quietly.'*

## **Implications**

The low satisfaction toward the Control mode among the dyslexic participants implies the unsuitability of using text layout used in the conventional printed book for web text reading. Receiving the least satisfaction toward this mode, comparing to the other two modes, by normal learners leads to similar implication. This finding provides evidence on the risk of direct application of standards used in printed text for web text.

The Standard mode was designed based on dyslexia-friendly text guidelines. High satisfaction toward this mode by both groups of learners points to two important implications. Firstly, this finding provides empirical evidence on the appropriateness of using these guidelines among dyslexics as according to McCarthy and Swierenga (2010), many existing web accessibility guidelines for dyslexic users are not empirically derived. Secondly, high satisfaction among normal learners also indicates their acceptance toward web text that was designed using dyslexia-friendly guidelines. Hence, these guidelines are inclusive for these two major groups of online learners.

The distinct differences on the level of satisfaction for the Enhanced mode, ranging from excellent to low satisfaction, implies that the use of a screen reader does not fit all normal and dyslexic learners. Findings from this study show that about one third of the normal and dyslexic participants found the audio to be distracting although the effects of such distraction is more severe among the dyslexics. These findings imply that while a screen reader may serve as an excellent reading aid for some learners, others found it distracting. Many existing guidelines,

such as those suggested by British Dyslexia Association (n.d.b) and World Wide Web Consortium (2008) recommends the use of screen readers to assist reading among the disabled. This finding suggests the use of screen readers may not necessarily aid reading among dyslexics. In addition, excellent satisfaction among some normal learners also indicates the potential to harness the benefits of screen readers among normal learners even though screen readers are often only recommended for dyslexics.

## Conclusion

This study concludes that dyslexia-friendly text guidelines, limited to those used in the Standard mode which include beige background, sans serif font type, font size of 16–18 points, black font, 1.5 line spacing, left justified, and the use of bulleted points, are appropriate to be incorporated into the inclusive guidelines for presenting web text to both dyslexic and normal learners. Making screen readers as an optional instead of compulsory aid for reading web text is another inclusive guideline as this assistive technology greatly benefits some dyslexic and normal learners but not others.

As this study only involved secondary school students, these recommended inclusive guidelines are deemed appropriate to only this group of population. Future studies may take into account other groups of population. This study could be further extended to derive more comprehensive inclusive guidelines by examining dyslexic and normal learner's satisfaction toward other aspects that are very much involved in online learning such as affordances to add and edit text, to present various types of multimedia learning resources as well as to use online collaborative learning tools.

**Acknowledgments** The authors acknowledge the financial support rendered by Universiti Malaysia Sarawak through Fundamental Research Grant Scheme, Ministry of Education, Malaysia, grant no. FRGS/06(20)/847/2012(87).

**Funding** We, the authors whose names are listed above certify that we have NO affiliation with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter discussed in this manuscript.

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