

# A MTB-MLE User Experience Design for Dyslexic Children

Gene E. Gulanés Jr

College of Computer Studies  
University of the Immaculate  
Conception  
Davao City, Philippines  
ggulanés\_18000000405@uic.edu.ph

Jullylla Marie Lalis

College of Computer Studies  
University of the Immaculate  
Conception  
Davao City, Philippines  
jlalis\_18000000458@uic.edu.ph

John Christian Prieto

College of Computer Studies  
University of the Immaculate  
Conception  
Davao City, Philippines  
jprieto\_180000002409@uic.edu.ph



Figure 1. Ash Casper, How Artists See Dyslexia

## Abstract

Dyslexia is a specific learning disorder that involves literacy learning difficulties; large quantity research is being conducted in exploring the benefits of Information and Communication Technology as a learning platform for children with learning disabilities. This current paper focused on helping Dyslexic students in using technology with UI/UX designs that have a Dyslexia/Dyslexic design approach and also with Mother Tongue-Based Multilingual Education to achieve a high quality of education using their native language. We redesigned the portal called Learning Resources Management and Development System (LRMDS) to make the interface and experience of the website easily readable for the people who have dyslexia. Survey shows a promising outlook for the design, prototype's general objectives were attained that help dyslexic children to read easier while using the design.

**CCS Concepts:** • Human-centered computing → Interaction design theory, concepts and paradigms.

**Keywords:** dyslexia, user experience, learning, MTB-MLE

## 1 Introduction

Dyslexia is a specific learning disorder that involves literacy learning difficulties in learning to read, spell, write, and speak. It refers to a cluster of symptoms in which people with Dyslexia can experience difficulties in matching letters to sounds, having hard time in spelling a word, as well as mixing up letters in words. There are no clear statistics in the Philippines about people with dyslexia but according to the PSA government census, of the 92.1 million household population in the Philippines in 2010, 1.44 million persons or 1.57 percent had disabilities not including people who are not diagnosed. It is necessary that we assist people with learning disabilities, especially children, because of early learning fosters children's language skills. Young children's mental, social, and physical growth have a strong effect on their overall development as adults.

Mother Tongue-Based Multilingual Education or MTB-MLE is about "first-language-first" education that involves implementing local mother tongues to make lessons more interactive and more easier for the students.

There is a portal called Learning Resources Management and Development System (LRMDS) that is a quality assurance system to help access learning, teaching, and professional development resources providing support to DepED Regions, Divisions and Schools. Unfortunately, the portal itself has some features that are not suitable for dyslexic

students. LRMDS website has considerable length with their sentences, people who have dyslexia have trouble reading at a good pace and without mistakes and may also have a hard time with their reading comprehension.

This paper has been made in aims to help Dyslexic students use technology with modern UI/UX designs that have a Dyslexia/Dyslexic design approach. This approach is mainly based and designed to work with tablets/ipads since it has a larger screen and can easily accommodate the desired UI/UX designs.

## 2 Review of Related Literature

Azmi et al. [1] developed a mobile application called CInTA that allows dyslexic children to learn alphabets and write in which the app is in Bahasa Melayu, a Malay Language, due to apps in this language being very few. They tested CInTA with five students and found out that dyslexic children are interested with pages that are attractive, simple and easy to use.

The work of [12] have shown that one of the the effective ways to improve the learning of dyslexic children is using suitable multimedia elements and principles such as multimedia principle, coherence principle, and spatial contiguity principle. There are previous studies that show both the graphical and textual attributes of application helps dyslexic students in concentrating, avoid distractions and grab their attention on the application's screen, for example [8]. Rello and Baeza-Yates [7] have stated that specific text and background colors can benefit dyslexia people that makes text more readable for them.

Text presentation and Text content matters on reading. Dyslexic people are not that different from regular people when it comes to reading, but they are more sensible to textual conditions. Accessible textual conditions give benefit on their reading performance [6]. Several studies have recommended text presentation parameters that can help the reading performance of dyslexic children: using dyslexia friendly font [10, 11] which don't have thin strokes, it could be one of the sans-serif, roman, and monospaced font families [7] such as Arial, Helvetica, Tahoma [1, 3, 4, 7, 8, 12], and using font size ranging from 12 points [1, 3] to 26 points [4, 7]. Also, studies show that the amount of displayed text being controlled can give benefit for dyslexic readers [5].

Color plays an important role to help dyslexic children learn actively [8]. In the results of studies, colors have an impact on the reading process may or may not be dyslexic people. For instance, using specific background colors such as cream and pastel colors [8], lighter shades of pink and green [8], or any color but simple [12], and using specific font colors such as dark colors [3, 4]. There are colors that should be avoided which are red and green [3, 11], pure white and black [1], and type of background which is background graphics [12].

Text input style allows people to input data, and according to [4] it is important for dyslexic people to have suitable and easy text entry methods due to them having difficulties in writing or inserting input. They asked six children with dyslexia to test their proposed prototype and one of their main focuses is the input types such as drop down list, button, keyboard and checkbox. They found out that button clicks are more suitable and preferred for getting input.

## 3 Methodology

### 3.1 Data Collection

This study had utilized the use of a qualitative approach in gathering data and relevant details to be included in the application. We reviewed related literature and based some features of the applications on what we have reviewed. We also conducted a focus group discussions with the dyslexic participants and recorded it using a video conferencing tool. We also collected data from recent interviews from Experts in UI/UX designs to experience of dyslexic users when using the internet. A working prototype was then designed based on the gathered information.

### 3.2 Materials and Methods

This study had utilise FGD, In Depth Interview and Derived Data to further understand the elements to be included in the application.

**3.2.1 FGD.** Then during the discussions, the selected participants were asked on how they are coping up with dyslexia during their online class sessions.

The rationale of why this question was asked is to ensure that we can get what would be needed to create a usable app for dyslexic students. Finally, information analysis was only delimited to qualitative type whereby only the linguistic experiences of the participants were described. One of the participants named Phil who has a mild dyslexic answered that she was having a hard time when reading walls of text and from time to time have a hard time when reading rhyming words. Also, she would also be reluctant to participate in a reading session.

**3.2.2 Derived/Compiled Data.** We also subsequently gathered data from an already available data and information from experts. Some were from institutions around the world and some were dyslexic sharing on how they navigate the web. First would be [9], he used a special eReader named "Kobo" so that he can read online contents easily. One of the things that he specifically used was an eReader that can take text from a website, change the fonts and sizes of texts, as well as it doesn't have distractions like ads or images which makes it easier for him to consume text contents. The other one was taken from [13] interview during the MobX Conference in Berlin. Mr.Andrew shared that the design should be flexible such that a system should have multiple access

pathways allowing the dyslexic to comfortably find information via multiple routes. We also gathered some information from the interview of [2], Founder and Director of the organization Sliding Doors STEM and Dyslexia Learning Center, in which we quoted her "Dyslexia need to be taught to read using this specialized method designed for them and that a lot of times the schools are unable to deliver this kind of curriculum and that to get it outside the school becomes very expensive". She also said that dyslexic student should be taught via Universal Design Learning and its an idea of designing a curriculum that meant to access people and meet them where they are. Dyslexic students should be taught with a specific way and they are more likely to excel in STEM, graphic design and visual thinkers, in which they are less of text, more in visuals and hands on work. These areas are where dyslexic students are more likely to learn more.

### 3.3 Data Analysis

The data that we have gathered resulted into us creating a design in which it incorporates multiple ways to retrieve/get an information. It also has the functionality to change fonts and size of the texts in the app. We also had it designed in a way that it is less obtrusive and allows the user to focus on specific task most of the time.

### 3.4 Development

We used Figma to design a Working Prototype. It is based on hybrid research and a Feature-driven prototype and we considered the designs based on the several RRLs that we have gathered using the suitable font sizes and font styles based on [4] which was to use Arial, Helvetica and Tahoma, as letters can appear less crowded with a font size of 12-14 and we also avoided using underlines on italic and bold text as it appears to make it harder for dyslexics to read it and sufficient spacing for texts. We also used creamed colors with sufficient contrast to ensure easy visibility of texts. We also incorporated elements of flexible designs wherein the user can find information with different routes which allows for an easier usage of the design as well as ensuring that there will be no obtrusive designs in which it can affect the usability and readability of the design. The prototype contains the following functions: First is the Register/Login which allows the teacher and students to login and register separately this would also determine the level of access that they can use within the system (Ex. Teachers can access teachers guide and students have access to student materials). Then, next would be the Home dashboard, the students and teachers would have the same dashboard but might contain different information depending on the student level and teachers access. Next, would be the Resources wherein available materials or information that student or teacher can be access may vary depending on the level of access allowed. The Resources contains the materials all the teachers and students will need. Next, would be Media Gallery

which contains artworks/illustrations that are available for students and teachers to use. This part is mostly for teachers to use as they use this to create learning materials and can also be used by students if needed. Then, we also have the FAQ/Help section which contains basic QA regarding the system and contact information. We designed the prototype of our app based on the information we have gathered. We used buttons mostly as opposed to checklist, keyboard input and drop down list since dyslexics have it easier when buttons are used [4]. We based the design of the prototype from DepED’s LDRMS and we manage to create an UI which is accessible to dyslexic users.

## 4 Results and Discussion

Results showed that the student’s User Experience in exploring the prototype was highly positive with majority agreeing that the designs **Readability, Structure, Color and Layout Designs** are acceptable and easy to read. Meanwhile, a few have expressed discontentment which could be attributed to different factors such as design and color preferences of the student.

### Readability

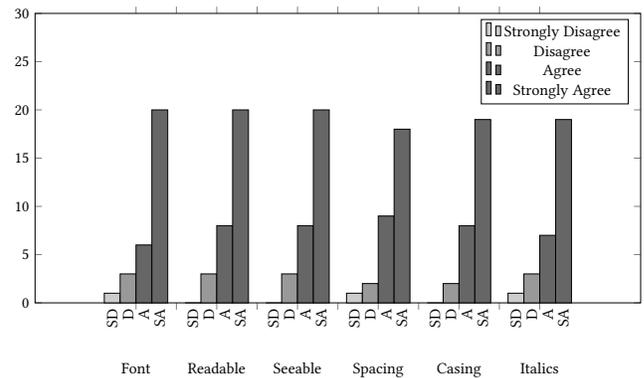


Figure 2. Readability Results

As shown in 2, the overall Readability of the prototype was quite high where out of the 30, 26 (87%) , 27 (90%) , 26 (87%) , 29 (90%) , 27 (90%) , 26 (87%) participants have strongly agreed/agree that the *Fonts* used are readable, the text sizes can be read and seeable, the text spacing is adequate, the casings are appropriate and there is no issue with underlines and italics. Meanwhile, the 4(14%) , 3(10%) , 4(13%) , 3(10%) , 3(10%) , 4(13%) remaining participants strongly disagrees or disagree. One of the respondents had expressed discontentment on the readability of the prototype because of its inability to change the spacing of the text, and another one expressed that he had trouble reading the text due to the fonts since some words would appear flipped to him.

### Heading Structures

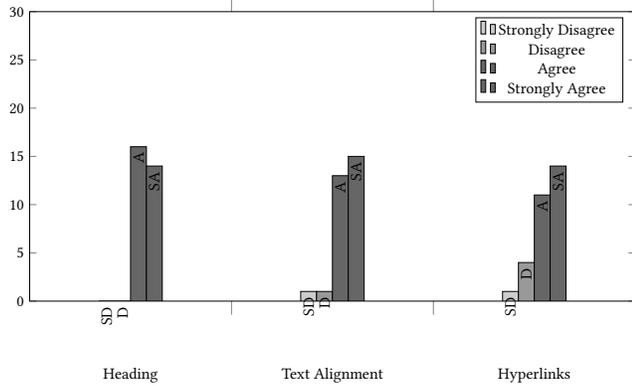


Figure 3. Heading Structure Results

As shown in 3, the overall *Heading Structures* of the prototype was received highly positive, where with the 30 respondents, 30 (100%) , 28 (93%) , 25 (83%) strongly agrees/agree that the overall text structure of the prototype is highly readable for dyslexics, while 0 (0%) ,2 (7%) , 5 (17%) strongly disagree/disagrees.

**Color**

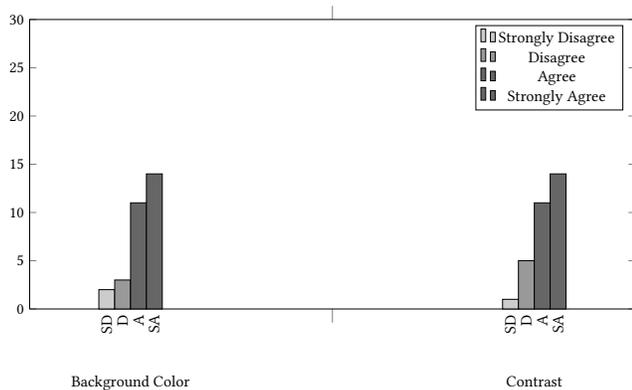


Figure 4. Color Results

As shown in 4, the overall color scheme and contrast was received highly positively where out of the 30, 25 (83%) , 24 (80%) participants have strongly agreed/agree that the color scheme and contrast are pleasing and the respondents were able to read text with the available background color and contrast. With one of the respondents commenting that the color palette is very pleasing which collaborates the findings of [7] that is to use a cream and dark color for contrast. Meanwhile, 5 (17%), 6 (20%) of the respondents strongly disagree/disagrees with the available color scheme.

**Layout**

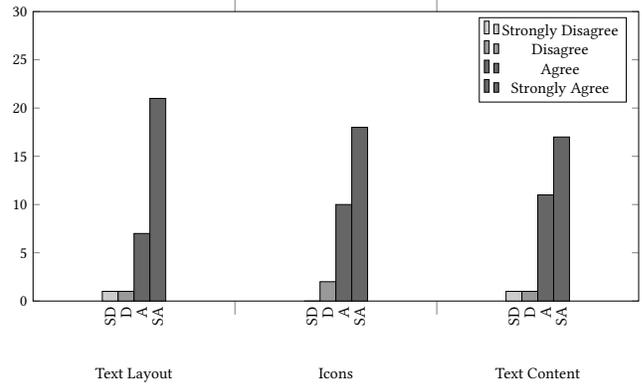


Figure 5. Layout Results

As shown in 5, *The Text Layout, Icons and Text Content* was received highly positively where out of the 30, 28 (93%) , 28 (93%) , 28 (93%) participants have strongly agreed/agree, while 2 (7%) , 2 (7%) , 2 (7%) strongly disagreed/disagree.

The results show that the layout of the Prototype is deemed good enough. With majority of the participants agreeing that the layout is readable, while others had an issue with how long the text contents are. This can be attributed that several dyslexics have different tolerance on the amount of words that they can process.

**Concerns**

During the survey, the participants were left unguided and was asked to fully explore the prototype design on their own. All of the participants were able to explore the prototype and those who answered back are in high school and college level. The participants from Elementary and Grade School did not reply back nor answer the survey which limits our testing to only High School and College students. Also, due to the limited time we were only able to translate the part of the design’s language into mainly English and sparsely Tagalog Bisaya dialects.

**5 Conclusions**

Based on the survey results, the researchers concluded that the general objectives of the prototype has been accomplished. The researchers were able to design a comfortable User Experience for dyslexic users in which it would help them read easier and comfortably. Also, the survey participants were highly satisfied with the User Experience and User Interface that we have designed.

**6 Recommendations**

We believe that the overall design of the User Interface and User Experience are highly compatible with dyslexics users, but it is lacking in the language translation to other local dialects. Turning this into a fully functional web design is high

feasible but would require support and time as translating it to local dialect would not be an easy task.

## Acknowledgments

We would like to acknowledge our teacher, Miss Kristine Adlaon, who greatly helped and guided us in making this paper. To our parents who wholeheartedly supported us. To God who protected and guided us from above.

## References

- [1] Anis Azmi, Nur Nasrudin, Rosida Junid, and A.W.N Wan. [n.d.]. *Mobile application to enhance writing skills ability among dyslexic children: CinTA*. [https://www.researchgate.net/publication/322817112\\_Mobile\\_application\\_to\\_enhance\\_writing\\_skills\\_ability\\_among\\_dyslexic\\_children\\_CinTA](https://www.researchgate.net/publication/322817112_Mobile_application_to_enhance_writing_skills_ability_among_dyslexic_children_CinTA) CinTA.
- [2] Krista Guthler. [n.d.]. *How Graphic Design Helps Children with Dyslexia Learn [Interview]*. <https://www.youtube.com/watch?v=cvqkLKG9Ejg>
- [3] Luis Marcelino Paula Ferreira 2015 Jorge Madeira, Catarina Silva. [n.d.]. *Assistive Mobile Application for Dyslexia*. <http://www-cs-faculty.stanford.edu/~uno/abcde.html>
- [4] Rehman Ullah Khan, Yin Bee Oon, Muhammad Inam Ul Haq, and Siti Hajarah. [n.d.]. *Proposed user interface design criteria for children with dyslexia*. [https://www.researchgate.net/publication/333044728\\_Proposed\\_user\\_interface\\_design\\_criteria\\_for\\_children\\_with\\_dyslexia](https://www.researchgate.net/publication/333044728_Proposed_user_interface_design_criteria_for_children_with_dyslexia) interface design.
- [5] Donald Knuth. [n.d.]. *Dyslexia Friendly Reader: Prototype, Designs, and Exploratory Study*. [https://www.researchgate.net/publication/280147479\\_Dyslexia\\_Friendly\\_Reader\\_Prototype\\_Designs\\_and\\_Exploratory\\_Study](https://www.researchgate.net/publication/280147479_Dyslexia_Friendly_Reader_Prototype_Designs_and_Exploratory_Study)
- [6] 2015 Luz Rello. [n.d.]. *Dyslexia and Web Accessibility: Synergies and Challenges*. <https://www.semanticscholar.org/paper/Dyslexia-and-web-accessibility%3A-synergies-and-Rello/eab3d90fba2acb873eb843cf4e7c83f8fcea0b7>
- [7] 2014 Luz Rello, Ricardo Baeza-Yates. [n.d.]. *Evaluation of DysWebxia: A Reading App Designed for People with Dyslexia*. <https://www.superarladislexia.org/pdf/2014-Luz%20Rello-w4a.pdf>
- [8] 2016 Rabbia Tariq, Seemab Latif. [n.d.]. *A Mobile Application to Improve Learning Performance of Dyslexic Children with Writing Difficulties*. <https://www.jstor.org/stable/pdf/jeductechsoci.19.4.151.pdf>
- [9] Morten Rand. [n.d.]. *I have dyslexia. Here's how I read the web*. <https://www.youtube.com/watch?v=Qyny9Ae7gbQ>
- [10] Anna Gardeli Dimitrios Zisis 2014 Roxani Skiada, Eva Soroniati. [n.d.]. *EasyLexia: A Mobile Application for Children with Learning Difficulties*. <https://www.sciencedirect.com/science/article/pii/S1877050914000271>
- [11] 2013 Salwani Mohd Daud, Hafiza Abas. [n.d.]. *'Dyslexia Baca' Mobile App - the learning ecosystem for Dyslexic Children*. [https://www.researchgate.net/publication/269032733\\_%27Dyslexia\\_Baca%27\\_Mobile\\_App\\_-\\_The\\_Learning\\_Ecosystem\\_for\\_Dyslexic\\_Children](https://www.researchgate.net/publication/269032733_%27Dyslexia_Baca%27_Mobile_App_-_The_Learning_Ecosystem_for_Dyslexic_Children)
- [12] Arifah Fasha Rosmani 2013 Siti Zulaiha Ahmad, Noor Izzati Jinon. [n.d.]. *MathLexic: An assistive multimedia mathematical learning aid for dyslexia children*. [https://www.researchgate.net/publication/261480919\\_MathLexic\\_An\\_assistive\\_multimedia\\_mathematical\\_learning\\_aid\\_for\\_dyslexia\\_children](https://www.researchgate.net/publication/261480919_MathLexic_An_assistive_multimedia_mathematical_learning_aid_for_dyslexia_children)
- [13] Andrew Zusman. [n.d.]. *Digital Dyslexia. Universal Design and the Dyslexic Experience*. <https://www.youtube.com/watch?v=H-SAgWUtnV4>