
User Experience Design and Prototypes of Mobile-Based Learning Media for Children with Special Needs in the Dyslexia Category

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ABSTRACT

Education is the right of all living things regardless of social status, gender, or physical condition. Persons with disabilities have the same rights and obligations as citizens. Based on the 1945 Constitution Article 31 Paragraph 1 and Law Number 20 of 2003 concerning the National Education System, it can be concluded that the state provides full guarantees for children with special needs to obtain quality education services. Children with special needs are divided into several categories, in this study the research team will focus on solving learning problems for children with disabilities in the dyslexia category. Dyslexia also known as reading disorder, is a disorder characterized by reading below the expected level for one's age. This study aims to find learning solutions by developing user experience designs and prototypes of mobile-based learning media for children with special needs in the dyslexia category. This research applies design thinking methodology to understand users, challenge assumptions, redefine problems, and create innovative solutions to prototype and test.

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1. INTRODUCTION

The Indonesian government guarantees that persons with disabilities have the same rights and obligations as citizens. Based on the 1945 Constitution article 31 paragraph 1 and Law Number 20 of 2003 concerning the National Education System, it can be concluded that the state provides full guarantees for children with special needs to obtain quality education services [1]. Children with special needs are divided into several categories, in this study the research team will focus on solving learning problems for children with special needs in the dyslexia category. Dyslexia is a form of difficulty in learning to read [2]. Dyslexia also has difficulties in solving symbols or codes, including phonological processes or pronunciation [3]–[5]. The learning difficulties he faced did not occur in all areas but only occurred in one or a few specific areas, including reading, writing and arithmetic. In addition, there are several factors that can cause children to have difficulty reading such as internal and external factors.

Reading difficulties make it difficult for them to develop both academically and socially, even though reading and language skills are basic skills that every human being must possess. Dyslexic children generally have five problems in learning as follows [6]–[8]:

- a. Unable to recognize the visual form of words and difficulty pronouncing them correctly. This problem is known as surface dyslexia
- b. Unable to manipulate basic sounds in language and difficult to identify new words but able to read familiar words, is known as Phonological Dyslexia

- c. A person is not capable of achieving surface dyslexia and phonological dyslexia. However, with the right learning method, they can recognize one letter at a time and read it correctly called Spelling Dyslexia.
- d. Able to read correctly but not understand spoken words or letters, known as Direct Dyslexia;
- e. Able to understand the meaning of the words shown, but they have difficulty recognizing letters or the phonology of letters in these words, known as Comprehension Without Reading.

So based on the background above, the researcher intends to create user experience designs and prototypes of mobile-based learning media for children with special needs in the dyslexia category using the Design Thinking method. This research is limited by several things, namely:

- a. This platform is specifically intended for children with surface type dyslexia and phonological dyslexia
- b. Explore recommendations for solutions to help dyslexic children learn
- c. Learning media is built for children with dyslexia at the Elementary School (SD) level

2. METHOD

In this study, we use the design thinking method to explore user needs and validate proposed prototypes. Design thinking is a design methodology that provides a solution-based approach to solving problems. Design Thinking is carried out to explore the problems/needs faced by the target user so that they can determine the best solution to solve them. Design thinking is very useful in overcoming complex problems with a structured way of thinking [9]:

- a. Understanding the needs of the people involved
- b. Reframe the problem,
- c. Human-centered,
- d. Generating lots of ideas in a brainstorming session, and
- e. Adopt a hands-on approach in prototyping and testing ideas.

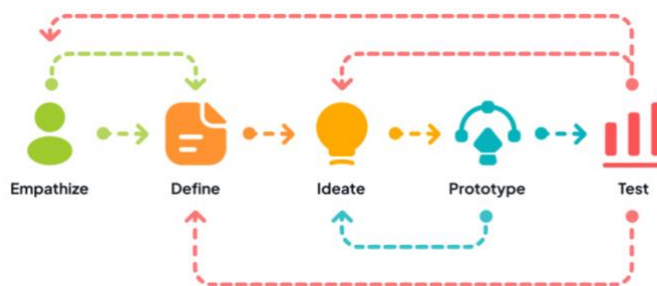


Figure 1. Design Thinking Roadmap

Design thinking has 5 stages, that is [9]–[12]:

1. Empathize

At this stage, an approach to the target user is carried out. This stage is also the stage to understand user needs, business objectives, and technological capacity/capabilities. What users say is not necessarily what they do, so in this process, we have to find out:

- a. What do users think and feel?
- b. What do users usually do?
- c. What kind of anxiety do they feel?
- d. Anything that can make them happy.

2. Define

The information that has been collected during the Empathize stage is analyzed and synthesized to determine the core problems to be identified. This stage is the stage in defining what problems are experienced by users when interacting with a product or process. The final result at this stage is:

- a. What problems will be solved?
- b. Who are we solving this problem for?
- c. What is another way to solve this problem?

3. Ideation

This stage is the stage for generating ideas. All ideas will be accommodated for solving the problems that have been defined at the defined stage. It is important to get as many ideas or problem solutions

as possible at the beginning of the idea phase and then choose the best way to solve the problem or provide the elements needed to avoid problems that later occur.

4. Prototyping
At this stage, several low-cost and scaled-down versions of the product are produced, or special features are found in the product. This prototype can be tested on multiple target users in the next phase.
5. Testing
Testing and evaluation of the product to users and the results will be made changes and improvements to eliminate problem solutions and gain a deep understanding of the product and its users.

3. RESULTS AND DISCUSSION

Here are the results of user research using the design thinking method that has been carried out by the research team:

3.1. Empathize

At this stage, the potential persona which is a fictional profile based on our initial hypothesis is made. The persona are represents a group of users and has certain goals, criteria, and anatomy. The results of the potential persona are as follows:



Figure 2. Parent Potential Persona

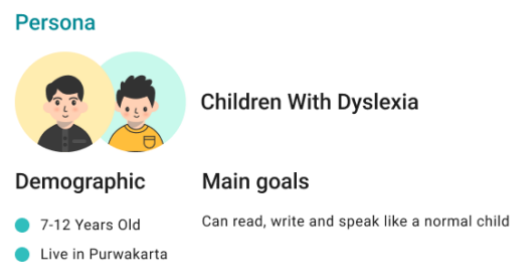


Figure 3. Kids Potential Persona

After determining the potential user persona, then an analysis of the problems faced by the potential user is carried out by observing the dyslexia forum and conducting interviews with 2 parents. In this study there were challenges and also learning problems by dyslexic children and parents in guiding children. Some of the problems found were then mapped into the empathy map and user journey map as follows:



Figure 4. Empathy Map

User Journey Map



Figure 5. Parent User Journey Map

User Journey Map



Figure 6. Kids User Journey Map

3.2. Define Problem (analysis based on observation of the problem, problem statement)

The information that has been collected during the Empathize stage is analyzed and synthesized to determine the core problems to be identified. The following problems have been defined for each research object:

Table 1. Defining Problem

User	Problem
rent	The limitation of teaching materials for dyslexic children to study at home
Parent	Parents do not have the basic knowledge for teaching dyslexic children.
Children	Unstable children mood and feeling bored when studying
Parent	During the pandemic, parents must look for special tricks in educating. Parents are also looking for webinar info to find out how to educate dyslexic children.
Children	When reading There are some letters that are lost or exchanged
Children	Does not understand the concept of literacy, confused understanding symbols

3.3. Ideate (the proposed solution, describe the run and its features)

Here are the solution ideas that the research team succeeded in defining to answer the problems above:

Table 2. Ideation Solution

User	Problem	Solution
Parent	The limitation of teaching materials for dyslexic children to study at home	The platform provides learning modules that can be downloaded and used by parents
	Parents do not have the basic knowledge for teaching dyslexic children.	The platform provides information for live sessions or webinars
	Unstable children mood and feeling bored when studying	The platform provides tips in guiding children for parents
Children	During the pandemic, parents must look for special tricks in educating. Parents are also looking for webinar info to find out how to educate dyslexic children.	The platform provides reading and writing motor skills training for users
	When reading There are some letters that are lost or exchanged	Platform provides learning videos
	Does not understand the concept of literacy, confused understanding symbols	Learning videos are made interactively and not boring

3.4. Prototype

The solution is designed in the form of prototype design ranging from low fidelity to high fidelity prototype using Figma. Figma is a vector graphics editor and prototyping tool which is primarily web-based, with additional offline features enabled by desktop applications for macOS and Windows. The following is a high fidelity prototype that has been developed to facilitate inclusive learning for children with special needs in the dyslexia category.

The first is a high fidelity prototype of the learning video feature on the learning platform for children with dyslexia which displays a flow from the home page that displays information in the form of greetings to users, a learning video button icon that can be used to go to the learning video list page. Is the List of Learning Videos page on the learning platform for children with dyslexia which displays a search bar to search for learning videos and displays information in the form of a list of learning videos that can be selected to watch as a learning tool on the detail page of the learning videos. The Learning Video Details page on the learning platform for children with dyslexia displays information in the form of Video Titles, video descriptions, downloadable learning modules, and buttons to add videos to bookmarks.

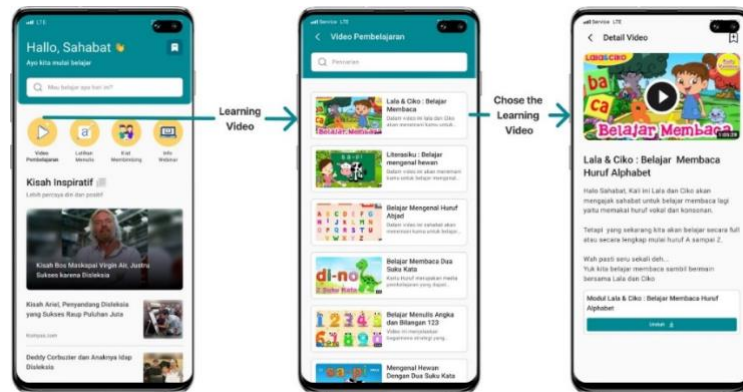


Figure 7. High fidelity prototype for the Learning Video feature

The following is a high fidelity prototype of the Writing practice feature on a learning platform for children with dyslexia. On the main page, the user can access the Writing Practice Menu, then the user will be presented with a choice of writing exercise materials that they want to be trained. There are options to practice writing numbers, practice writing letters and are equipped with instructions for using this practice feature. On the Writing Practice page, users can see examples of the material they want to practice and a section is provided that can be used for writing exercises. This feature is equipped with options to change the writing color, undo, adjust the writing size and clean the writing area.

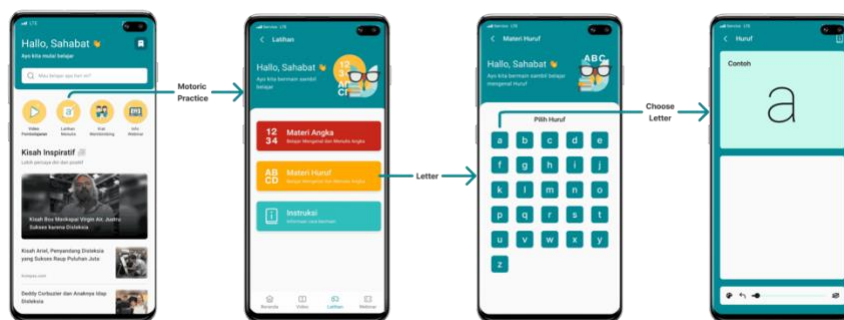


Figure 8. High fidelity prototype for writing practice features

The following is a high fidelity prototype of the parenting tips feature on a learning platform for children with special needs in the dyslexia category that displays flow from the home page. Users can access the parenting tips menu which can be used to enter the parenting tips page. This feature displays information on tips and tricks in educating children with dyslexia.

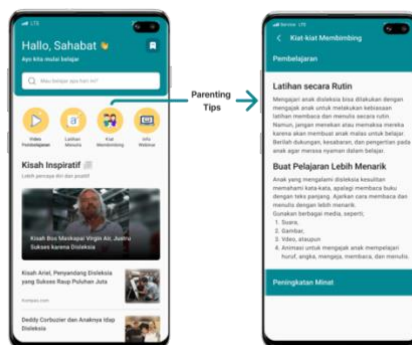


Figure 9. High fidelity prototype for the parenting tips feature

The following is a high fidelity prototype of the webinar information feature on a learning platform for children with dyslexia. Users can access the feature by selecting the webinar information

menu which can be used to enter the webinar list page. On the webinar list page, users can select the webinar activity they want to participate in, or search for webinar information using the search feature. On the webinar details page, users will get information in the form of webinar title, webinar description, register button and a button to add the webinar to bookmarks.

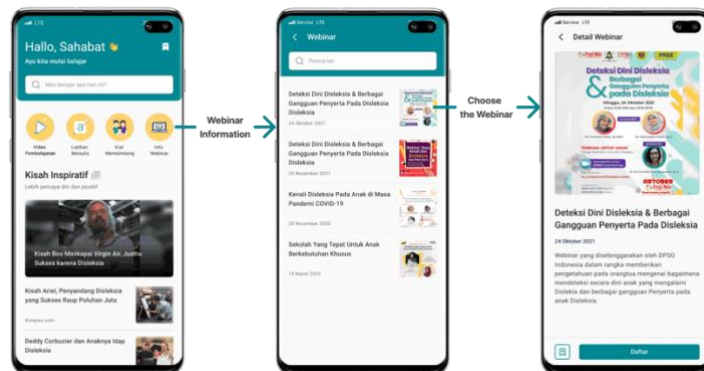


Figure 10. High fidelity prototype for webinars/training information features

Good fonts for people with dyslexia are sans serif font types because increased significantly the reading performance [13]. The prototype developed uses the font "Roboto" which is included in the sans serif font type. With the sans serif font type in the user interface design, it can facilitate and improve the reading performance of users who suffer from dyslexia to read the text presented. In addition to using the right font, the use of colors and the right level of contrast also greatly affects the quality of an interface design. The use of colors and contrast levels that are not appropriate can give a bad impression on users which ultimately makes users feel uncomfortable when using the application. In this study the colors used are colors with a high contrast level and adjust to the target users, namely parents and children.

3.5. Test

This stage aims to measure the level of usability of the design platform. The metrics used in this study refer to ISO/IEC 9241-11:2018 Ergonomics of human-system interaction. ISO/IEC 9241-11:2018 Ergonomics of human-system interaction has three attributes that are used to perform usability testing, namely effectiveness, efficiency, and satisfaction [14]. The number of respondents required to conduct usability testing is sufficient with 5 (five) respondents [15], [16]. This amount was also used in research [17] which in this study involved 5 (five) respondents in testing the system usability scale (SUS) instrument. Based on previous research and theory, in this study the researcher used 5 (five) respondents, so that the researchers got the following results:

Table 3. Result

Respondent	Question										Results	
	1	2	3	4	5	6	7	8	9	10	Total	Average
Respondent 1	4	2	4	4	3	2	4	4	4	3	85	
Respondent 2	4	3	3	3	3	3	3	3	3	3	77.5	
Respondent 3	4	3	4	3	4	3	3	4	4	3	87.5	82.5
Respondent 4	4	3	3	0	3	4	3	2	4	3	72.5	
Respondent 5	4	4	4	4	4	4	4	0	4	4	90	

In the testing phase, the usability testing method uses a satisfaction metric. Based on the results of product testing on the sample, the prototype made shows the results of the SUS score with a value of 82.5, which with the SUS score is already in category A and can be accepted by the user.

4. CONCLUSION

User experience design and prototypes of mobile-based learning media for children with special needs in the dyslexia category were developed with a focus on several main features that are refers to the user needs and problems. The features contained in the user experience design and prototypes are learning video features, webinar information, writing exercises, guiding tips and inspirational stories. In usability testing phase, it was concluded that the tests carried out have been successful and obtained very good qualifications, based on the SUS score obtained a value of 82.5 indicating very good results and acceptable to the respondents. It can be concluded that the development of user experience designs and prototypes of mobile-based learning media for children with special needs in the dyslexia category using the Design Thinking method can be used easily by target users and is feasible to be developed as a learning platform that helps optimize the learning experience for children with dyslexia. Here are some suggestions that can be followed up in further research by adding some features that can increase usability values and more optimal problem solving for dyslexic children such as online dyslexia assessment, phoneme, and gamification.

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