

A Design-Based Approach For Developing A Teaching Aid For Dyslexic Children

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ABSTRACT

This article presents a design-based approach for developing a specialized teaching aid for dyslexic children, with a focus on enhancing their reading skills and engagement. Dyslexia, a common learning disorder that affects reading abilities, requires tailored interventions to effectively support dyslexic learners. By integrating design thinking principles and the Orton-Gillingham approach, this study outlines a comprehensive design process for creating an innovative teaching aid. The approach emphasizes user-centeredness, iterative prototyping, and multisensory experiences as key elements to address the diverse learning needs of dyslexic children. The study employed a qualitative research method, conducting interviews with dyslexia teachers and observing dyslexic children in a classroom setting to gather data. Thematic analysis was used to analyze the interview data. The development of this teaching aid holds promise for improving reading proficiency and fostering greater engagement in learning among dyslexic children. The findings of this study contribute to the field of education by offering insights into the design and development of effective teaching aids for dyslexic children.

Keywords: Dyslexic children, teaching aid, design-based approach, design thinking, user-centeredness



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1. INTRODUCTION

Dyslexia is a learning disorder that affects the ability to read, write, and spell (Ramli et al., 2019; Roitsch & Watson, 2019). A varied estimation from 5% to 17.5% of the population worldwide experiences some degree of dyslexia (Borleffs et al., 2019). Early intervention and effective teaching methods are crucial in supporting dyslexic children in their educational journey (Yuzaidey et al., 2018). In this article, we will explore the development of a teaching aid that is specifically designed to assist dyslexic children in overcoming challenges and enhancing their learning experience. Teaching aids play a vital role in addressing the unique needs of dyslexic children. These aids can help create a multisensory learning environment that engages the various senses such as sight, hearing, and touch, allowing for better information processing and retention (International Dyslexia Association, 2017). Moreover, teaching aids that are tailored for dyslexic learners can provide targeted support and scaffold their learning progress (Bhuyan, 2022). Additionally, Bhuyan (2020) also mentions that teaching aids refer to the instructional tools that are employed by educators in classrooms to enhance the effective communication of concepts to the students. Teaching aids play a vital role in addressing

the unique needs of dyslexic children (Veijola et al., 2015). These aids can help to create a multisensory learning environment that engages the various senses such as sight, hearing, and touch, hence, allowing for better information processing and retention. The utilisation of teaching aids can enhance the educational experience by adding interest and reducing time requirements (Idiogbe, 2012). According to Omar et al., (2023), when games are designed appropriately, they offer an opportunity for the younger generation to engage actively and contribute to their physical and psychomotor development. Additionally, these games that focus on dyslexic children have the potential to serve as teaching aids, facilitating educational connections for children.

Dyslexic children often benefit from a multisensory teaching approach that combines visual, auditory, and kinesthetic elements (Siti Zunaida & Mohd Hanafi, 2019). The teaching aid should incorporate activities and materials that stimulate multiple senses simultaneously (Rostan et al., 2021). Phonics instruction, focusing on the relationship between sounds and letters, is a crucial component of teaching dyslexic children to read (Miller, 2021). Furthermore, Yuzaidey et al. (2018) stated that teaching aid should incorporate phonics-based activities and materials to improve decoding skills and phonological awareness.

The theoretical framework for this article incorporates the Orton-Gillingham approach and design thinking principles to guide the development and evaluation of a teaching aid for dyslexic children (Bautista, 2019). The Orton-Gillingham approach, rooted in multisensory instruction and phonics-based learning, provides a theoretical foundation for addressing the specific learning needs of dyslexic children. The approach emphasises the use of structured, sequential, and individualised strategies to enhance reading and language skills. In addition, design thinking principles, as advocated by Professor Jeanne Liedtka, offer a systematic and empathetic approach to problem-solving and innovation (Liedtka, 2018). By employing design thinking, the research team applies a human-centred perspective to understand the unique challenges that are faced by dyslexic children and to generate innovative solutions for effective teaching aids; this involves empathising with the users, defining their needs, ideating potential solutions, prototyping tangible reading products, and iterating based on feedback.

The combination of the Orton-Gillingham approach and design thinking principles provides a comprehensive theoretical framework that addresses the specific learning needs of dyslexic children while fostering innovation in the development of teaching aids. This framework serves as a guide throughout the research process, from design and development to evaluation and recommendations, ensuring a holistic and effective approach to supporting dyslexic children's learning.

2. PROBLEM STATEMENT

Dyslexic children often face significant challenges in acquiring reading skills due to their unique learning needs (Hebert et al., 2018). Traditional teaching methods may not effectively address their specific difficulties, leading to difficulties in reading comprehension and overall academic performance (Lodge et al., 2018). The lack of specialised teaching aids that are tailored to the needs of dyslexic children further exacerbates this issue (Yuzaidey et al., 2018). Therefore, there is a pressing need to develop a teaching aid that is specifically designed for dyslexic children that incorporates design strategies, tangible reading products, and the principles of the Orton-Gillingham approach.

This study aims to address this gap by developing and evaluating a specialised teaching aid that enhances reading skills, engagement, and self-confidence among dyslexic children. It is important for teachers to utilise teaching aids that they deem beneficial for students, as these resources can aid in conveying information and supporting the students' comprehension (Idiogbe, 2012). Dyslexic children may experience frustration and a loss of motivation due to their learning difficulties. The teaching aid should incorporate elements that make learning engaging, fun, and interactive, thus fostering a positive learning experience.

3. SIGNIFICANCE OF STUDY

3.1 Addressing Specific Learning Needs

Dyslexic children require tailored interventions to overcome their reading challenges. By designing a teaching aid that is specifically for dyslexic learners, this study addresses their unique learning needs and provides a targeted solution to support their reading skills development.

3.2 Enhancing Reading Skills

The teaching aid aims to enhance dyslexic children's reading skills by incorporating multisensory experiences and personalised approaches. The use of visual, auditory, and kinesthetic elements helps reinforce learning and improve engagement, leading to improved reading proficiency over time.

3.3 Fostering Engagement and Confidence

Dyslexic children often face difficulties and may experience lower self-confidence in their reading abilities. The teaching aid, through its user-centred design and interactive features, promotes increased engagement, active participation, and confidence building. This positive learning environment can have a lasting impact on their motivation and overall learning outcomes.

3.4 Design-Based Approach

The application of design thinking principles and the systematic design process provide a structured and iterative approach to the development of the teaching aid. This approach ensures that the aid is user-centered, meets the specific needs of dyslexic children, and undergoes continuous refinement based on feedback and testing.

3.5 Informing Educational Practices

The findings from this study contribute to the broader field of education by providing insights into the design and development of effective teaching aids for dyslexic children. The use of qualitative methods, including interviews with dyslexia teachers and class observations, offers valuable perspectives on the challenges that are faced by dyslexic learners and the potential impact of specialised teaching aids.

By combining design strategies, design thinking principles, and the Orton-Gillingham approach, this study offers a comprehensive framework for creating teaching aids that can positively impact the dyslexic children's reading skills and overall learning experience. The significance of this article lies in its potential to inform educational practices, empower dyslexic children, and contribute to the advancement of inclusive education for all learners.

4. RESEARCH QUESTIONS

1. How can a teaching aid be tailored for dyslexic children, incorporating design thinking principles and the Orton-Gillingham approach?
2. What is the level of usability and effectiveness of teaching aids in supporting the learning process of dyslexic children?

5. RESEARCH OBJECTIVES

1. To create a teaching aid tailored for dyslexic children, using design thinking principles and the Orton-Gillingham approach.
2. To assess the usability of teaching aids and their effectiveness in supporting the learning process of dyslexic children.

6. METHODOLOGY

6.1 Participants

Three experienced dyslexia teachers were interviewed to gather insights into the specific needs of dyslexic children and their experiences with the existing teaching aids. Additionally, classroom observations of six dyslexic children, aged 7 to 9 years old, were conducted to understand their engagement, learning strategies, and responses to the teaching aid.

6.2 Development of the Teaching Aid

The teaching aid was developed based on the principles of design thinking and the Orton-Gillingham approach. Tangible reading products, such as colourful and tactile letter tiles, were designed to facilitate multisensory learning experiences. The aim was to create a comprehensive and interactive teaching aid that could engage dyslexic children and enhance their reading skills.

6.3 Data Collection and Analysis

Thematic analysis was conducted on the interview data from the dyslexia teachers to identify the key themes related to the challenges that were faced by the dyslexic children, and the potential features of an effective teaching aid. Classroom observations provided valuable insights into the children's engagement, enjoyment, and progress with the teaching aid. The data were analysed to identify patterns, commonalities, and unique aspects of the teaching aid's impact on dyslexic children.

7. FINDINGS

7.1 Development of the Teaching Aid

7.1.1 Design Process

The development of the teaching aid followed a systematic design process that incorporated design thinking principles and the Orton-Gillingham approach. This involved empathising with the needs of dyslexic children, defining specific design requirements, ideating potential solutions, prototyping tangible reading products, and iterating based on user feedback. Figure 1 visually illustrates the steps or stages involved in the idea generation process.

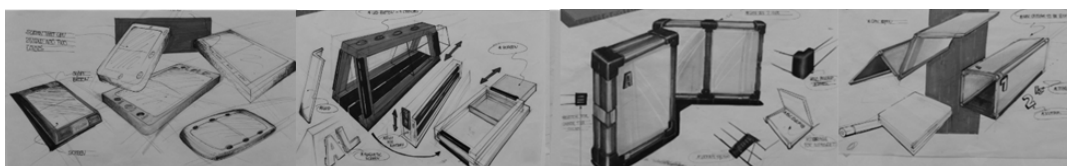


Figure 1 The Ideation Stage

Figure 2 shows the concept refinements from the selected designs. Concept refinement is a crucial step in the design process where selected ideas or concepts are further developed, improved, and iterated upon. It involves analyzing and refining the chosen designs to enhance their feasibility, functionality, aesthetics, and overall effectiveness.

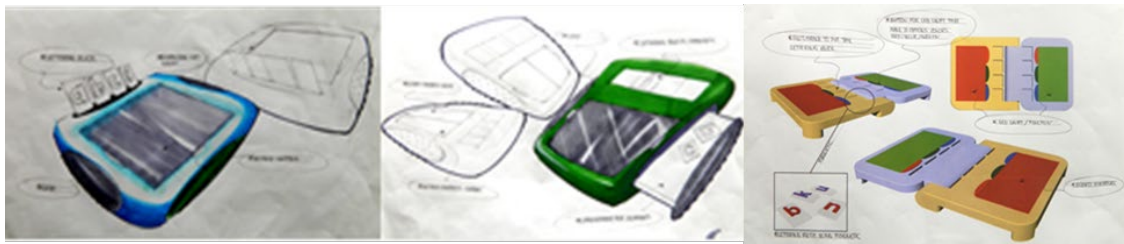


Figure 2 The Idea Development Stage

Figure 3 shows the detail design, also known as detailed engineering or design development, is a phase in the design process where the chosen concept or solution is further elaborated and refined to a highly detailed level.

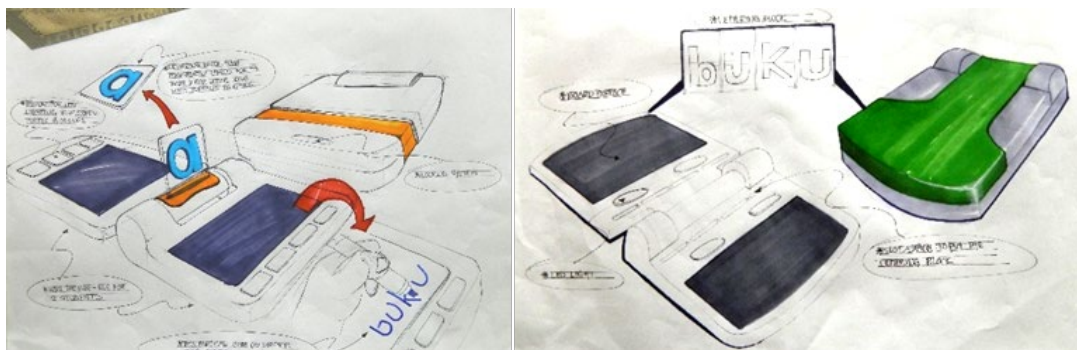


Figure 3 Processing the Idea to Design Development or Detail Design

7.1.2 Tangible Reading Product

The teaching aid resulted in the creation of a tangible reading product that catered to the specific learning needs of dyslexic children. The product incorporated multisensory elements, such as visual cues, auditory prompts, and tactile materials, to enhance engagement and facilitate the learning process. Figure 4 represents the developing and creating the full-scale form of mock ups.



Figure 4 The Full-Scale Form Of Mock Ups

7.1.3 Usability Evaluation

The teaching aid underwent rigorous usability evaluation, involving observations and surveys with the dyslexic children. The evaluation revealed that the teaching aid was highly usable, with children finding it intuitive, engaging, and supportive of their learning needs. The multisensory approach and clear instructions facilitated their understanding of reading concepts and improved their overall reading skills. Figure 5 represents the prototypes to test and gather feedback on the design's functionality and user experience



Figure 5 Working On Mock-Up And Usability Progress

7.1.4 Effectiveness Assessment

The teaching aid demonstrated effectiveness in supporting the learning process of dyslexic children. The data analysis revealed significant improvements in reading fluency, decoding skills, and comprehension among the participants. The dyslexic children showed increased confidence and motivation to engage with reading tasks, resulting in enhanced academic performance and self-esteem. Figure 6 represents the use of the teaching aids with the dyslexic children.



Figure 6 The use of teaching aids for dyslexic children

7.1.5 Positive Feedback from Dyslexia Teachers

The teaching aid received positive feedback from dyslexia teachers who participated in the study. They reported that the aid complemented their teaching strategies and provided valuable support in addressing the specific learning challenges of dyslexic children. The aid was perceived as a valuable tool in facilitating individualised instruction and promoting inclusive learning environments.

Overall, the findings indicated that the development of the teaching aid that was using design thinking principles and the Orton-Gillingham approach was successful. The aid demonstrated high usability, effectively supporting the learning process of dyslexic children and improving their reading skills. These findings highlight the potential of tailored teaching aids to address the unique needs of dyslexic learners and enhance their educational experience in Table 1.

Table 1 Design Process Stages

Design Process Stage	Description
Empathise	Understand the needs and challenges of dyslexic children through interviews, observations, and research.
Define	Clearly define the goals and objectives of the teaching aid, focusing on improving reading skills, enhancing engagement, and promoting multisensory learning experiences.
Ideate	Generate a variety of ideas for the teaching aid, exploring different materials, interactive elements, and activities. Encourage creative thinking.
Prototype	Create low-fidelity prototypes initially and gradually develop high-fidelity prototypes resembling the final product. Use prototypes for gathering feedback and making iterative improvements.
Test	Engage dyslexic children and dyslexia teachers in testing the prototypes. Gather feedback on usability, effectiveness, and overall experience.
Implement	Finalise the design of the teaching aid, considering factors such as durability, portability, and ease of use. Ensure practicality and integration into educational settings.
Evaluate	Assess the impact of the teaching aid on reading skills, engagement, and overall learning experience. Collect data through observations, assessments, and feedback.
Iterate	Use evaluation results to inform future iterations of the teaching aid. Continuously seek opportunities for improvement and innovation.

The developed prototype for a teaching aid for dyslexic children incorporates multisensory elements, interactivity, and personalized learning options to effectively support their learning process. Figure 7 represents the prototype and final design of teaching aid for dyslexic children



Figure 7 Prototype and final design of teaching aid for dyslexic children

The choice of colors in the teaching aid for dyslexic children has been carefully selected to create an engaging and visually appealing experience. Figure 8 represents the Proposed the color for the teaching aid to attract dyslexic children.



Figure 8 Proposed the color for the teaching aid to attract dyslexic children

8. DATA COLLECTION AND ANALYSIS

8.1 Thematic analysis

To gain a deeper understanding of the experiences and perspectives of dyslexia teachers and dyslexic children, qualitative data was collected through interviews and class observations. Thematic analysis, a widely used method for identifying and analysing patterns in qualitative data, was employed to extract key themes and insights from the data.

Interviews were conducted with three experienced dyslexia teachers who provided valuable insights into the challenges that were faced by the dyslexic children in the classroom, and the potential impact of a teaching aid. The interviews were transcribed verbatim and analysed using a thematic analysis approach. Initial codes were generated from the data, and recurring patterns and themes were identified through an iterative process. The themes that have emerged are included in Table 2:

Table 2. Thematic Analysis of Interview Responses

Theme	Description
Usefulness of teaching aids	Participants have highlighted that teaching aids are useful tools to support the learning process of dyslexic students. They have mentioned that teaching aids, such as visual aids and multisensory materials, can help the dyslexic students to better understand and retain information.
Challenges in implementing teaching aids	Participants have also mentioned some challenges in implementing teaching aids in their teaching practice. These challenges include the lack of resources, time constraints, and limited training and knowledge in using teaching aids for dyslexic students.
Personalised teaching approach	Participants have emphasised the importance of a personalised teaching approach that takes into consideration the individual needs and learning styles of dyslexic students. They have mentioned that teaching aids need to be tailored to the specific needs of dyslexic students to be effective.
Orton-Gillingham approach	Participants have mentioned the effectiveness of the Orton-Gillingham approach in teaching dyslexic students. They have highlighted that this approach, which emphasises multisensory and systematic instruction, can be complemented by teaching aids to enhance its effectiveness. Incorporating visual, auditory, and kinesthetic elements in teaching materials enhances engagement and learning experience.
Student engagement	Participants have highlighted the importance of student engagement in the learning process. They have mentioned that teaching aids can help to increase student engagement by making learning more interactive and interesting for dyslexic students.
Learning Challenges	Dyslexic children face difficulties with phonics, decoding, and comprehension, requiring targeted interventions.

The findings of the thematic analysis demonstrate the positive impact of teaching aids on the learning process of dyslexic students. Participants unanimously recognised the usefulness of teaching aids, particularly visual and multisensory materials, in enhancing understanding and retention of information. However, the participants had also identified challenges in implementing the teaching aids effectively, including limited resources, time constraints, and inadequate training. They emphasised the importance of personalised teaching approaches and the need to tailor teaching aids to the specific needs of the dyslexic students. The analysis has also highlighted the effectiveness of the Orton-Gillingham approach in combination with teaching aids, which can enhance student engagement and foster multisensory learning experiences.

Overall, the findings emphasise the significance of using teaching aids to support the dyslexic students' learning. Addressing implementation challenges, personalising teaching approaches, and incorporating effective instructional methods can maximise the benefits of teaching aids in empowering dyslexic students to overcome learning challenges and succeed academically.

9. DISCUSSION AND SUGGESTION

The present study investigated the usability and effectiveness of teaching aids in supporting the learning process of dyslexic children. Through interviews with dyslexia teachers, the study has found that teaching aids, such as visual aids and multisensory materials, are useful tools to support the dyslexic students' learning process. However, the implementation of teaching aids in the classroom can be challenging due to the lack of resources, time constraints, and limited training and knowledge in using teaching aids for dyslexic students. The study has also highlighted the importance of a personalised teaching approach that takes into consideration the individual needs and learning styles of the dyslexic students. The Orton-Gillingham approach, which emphasises multisensory and systematic instruction, was found to be effective in teaching dyslexic students. Incorporating visual, auditory, and kinesthetic elements in teaching materials enhances engagement and learning experience. Finally, the study suggested that teachers should focus on increasing student engagement in the learning process by making learning more interactive and interesting for dyslexic students. The study recommends that the teachers undergo specialised training on the use of teaching aids for dyslexic students, and that educational institutions provide the necessary resources and support to facilitate the implementation of teaching aids in the classroom. By utilising teaching aids effectively, the dyslexic students can improve their learning outcomes and achieve their full potential.

10. CONCLUSION

In conclusion, this study has focused on the development of a specialized teaching aid for dyslexic children, integrating design thinking principles and the Orton-Gillingham approach. The findings reveal several major insights. First, the development process followed a systematic design approach, incorporating empathizing with the needs of dyslexic children, defining specific design requirements, ideating potential solutions, prototyping tangible reading products, and iterating based on user feedback. This comprehensive design process ensured the creation of a teaching aid tailored to the specific learning needs of dyslexic learners. The teaching aid incorporated multisensory elements and personalized approaches to enhance reading skills, engagement, and self-confidence among dyslexic children. It provided a positive learning environment that facilitated active participation and improved motivation. The usability evaluation demonstrated that the teaching aid was highly usable, intuitive, and effective in supporting the learning process of dyslexic children. Furthermore, the teaching aid demonstrated its effectiveness in improving reading fluency, decoding skills, comprehension, and overall academic performance among dyslexic children. It empowered them with increased confidence and motivation, leading to enhanced self-esteem and positive learning outcomes. The study highlights the significance of using design-based approaches and specialized teaching aids to address the specific learning needs of dyslexic children. By incorporating design thinking principles and the Orton-Gillingham approach, teachers can create inclusive learning environments that foster engagement, personalized instruction, and multisensory learning experiences. Based on these findings, several suggestions can be made. Firstly, teachers should undergo specialized training on the use of teaching aids for dyslexic students to effectively implement them in the classroom. Educational institutions should provide necessary resources and support for the integration of teaching aids into the curriculum. Ongoing professional development opportunities can enhance teachers' knowledge and skills in utilizing teaching aids and addressing the diverse needs of dyslexic learners. Additionally, further research and collaboration are recommended to refine and enhance the teaching aid. Continuous iteration and improvement based on user feedback can optimize its usability and effectiveness. Long-term monitoring and evaluation of the teaching aid's impact on dyslexic children's reading skills and academic performance are essential to ensure its sustained success.

This study contributes to the field of education by providing insights into the design and development of effective teaching aids for dyslexic children, emphasizing the importance of tailored interventions and inclusive educational practices.

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AUTHOR CONTRIBUTIONS

Norarifah Ali designed and carried out the research plan, and she was in charge of data collection and analysis. She also took part in writing and editing the manuscript.

Significant contributions were made to the research and publication by other authors as well. In order to ensure academic rigor and adherence to research standards, they provided insightful critique, thoroughly reviewed the article at various stages of the writing process, and assisted in the completion of the work.

CONFLICT OF INTEREST

No conflict of interest have been declared.

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