WORD WONDERS VIA GAME-BASED LEARNING

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Article Info	Abstract
	This project, Word Wonders via Game-Based Learning, addresses the challenges faced by children with dyslexia by developing a 2D game-based learning application. Because of lack of awareness on the clinch between parents and educators, Dyslexia is another condition that is often diagnosed too late. The idea behind this project is that children, aged from 7 to 12, learn better and faster when using Game-Based Learning (GBL), thus needs a fun and interactive environment that is able to assess the skills of reading, spelling and listening. Our application was designed, developed and evaluated using a Waterfall approach. The application was developed using Construct 3, which is a powerful framework for interactive 2D game development, incorporating colorful graphics, an easy-to-use UI, and clear positive reinforcement. These factors are designed to make learning enjoyable and to detect dyslexic tendencies at an early age. The application was created and usability testing was conducted to assess if it was serving the needs of dyslexic children. It was the game-based approach that led to the increase in user engagement and it has been proven to help parents connect with their children about understanding dyslexia better. By using interactive technology, this project demonstrates the possibility for early diagnosis, leading to positive impacts on the education and well-being of dyslexic children. Future enhancements could include incorporating multilanguage support to broaden accessibility and reach a wider audience.

INTRODUCTION

Dyslexia is not a disease. Dyslexia is a learning difficulty which makes it hard to read, primarily because it impacts the person's capability of discriminating among speech sounds and comprehension of the relations that exist among letters and words. Research attributes its causes to certain differences of a person's brain structures, especially those dealing with language cognition (M. J. Snowling et al., 2020). This condition is hereditary. Dyslexic children are not lazy or lack intelligence. They generally have higher than average IQ and work extremely hard to gain competence in reading (Cynthia M. Zettler-Greeley, 2022). Dyslexia is sometimes not diagnosed until a person hits puberty or adulthood. Symptoms may include reading slowly, misspelling words, and difficulties with memorising (Mayo Clinic Staff, 2022). Parents and teachers frequently lack knowledge about dyslexia, which can lead to delayed diagnosis and intervention, eventually impacts children with dyslexia in their academic and personal development (Mather et al., 2020). Addressing the gaps is critical to assure children with dyslexia get necessary support and intervention from early childhood. Identification of the symptoms of dyslexia and the impact it has on children's education is important (Emeaka Francisca, 2021).

Children with dyslexia require intervention tools like Game-Based Learning (GBL) system to enhance their education. Throughout the research, evidence has shown that testing dyslexia can be simpler using Game-Based Learning. Gamification is one way that teaching strategies can use games to increase student engagement, motivation, and knowledge retention by including gamification into learning activities (T. Bigueras, 2020). Learning through Gamification: Integrating games into the curriculum not only helps teach the lesson but also helps teachers make the learning process active, where learners respond and hence discover their course material (Bigueras, 2020).

Furthermore, Game-Based Learning (GBL) provides plenty of advantages like higher motivation, better knowledge retention, and practicing important skills like problem-solving and cooperation. Most GBL systems offer personalized learning experiences, which can be especially advantageous for students who are struggling in conventional setting (T. Bigueras, 2020). Moreover, Game-Based Learning (GBL) is regarded appropriate for dyslexic children, addressing their unique learning needs, and helping manage their reading difficulties. Specific

game features tailored for dyslexic learners can improve their motivation and reading skills while reducing psychological stress, making learning more enjoyable (Bigueras, 2020).

Therefore, this project to development of 2D game designed for parents to find out if their children show symptoms of dyslexia to take an early action regarding their development as a children. This game is also targets primary school children age between 7 to 12 years old to test them in spelling, reading, and listening if they show symptoms of dyslexic.

OBJECTIVES

This objective of this project is to address the challenges of identifying dyslexia in children and provide an interactive, engaging learning tool. To achieve this primary goal, the following specific objectives must be met. Firstly, to design a 2D game to help determining whether a kids have dyslexia or not. Second, to develop a 2D game based-learning application to finding out dyslexia kids using game technology. Lastly, to evaluate the usability among dyslexia kids using 2D game-based learning application.

SIGNIFICANCE

This project aims to aims to design 2D game-based learning platform to help estimate dyslexia symptoms in children. In the gadget-driven, internet-obsessed universe we live in today, game technology served as a powerful tool for parents to understand dyslexia and help their children achieve a better future. This study has tried to enhance the knowledge about dyslexia for parents. Children with dyslexia can do much better if they have the right support and technology.

This project covers parents' concerns about their children showing dyslexia symptoms such as challenges in spelling, reading, and listening (Yanti et al., 2023). It was meant to determine whether a child truly showed signs of undetected dyslexia, especially in spelling, reading, or listening. These tools allowed parents to recognize possible symptoms of dyslexia in their children before seeing a specialist early on. This had a great impact on parents and primary school students aged 7–12 years old. With its interactive plays, this game served as a great means for parents to understand Dyslexia and identify early symptoms of Dyslexia in children. Such early detection helped parents take important steps in seeking appropriate support and resources needed to better meet their child's learning and growth needs.

Games provided parents with a fun and stimulating way to assess their children's abilities, and thus promote working together to tackle dyslexia. The purpose of a fun learning environment for children is to help them learn new concepts while having fun support in developing necessary skills, working on spelling, reading, and listening skills the fun way boosting their confidence and motivating them to learn new things. Gaming technology was introduced to support children's learning and overall wellness based on unique needs.

METHODOLOGY

Waterfall methodology, unlike Agile, follows a sequential approach to software development where each phase must be completed before moving on to the next. This methodology was initially introduced by Winston Royce in 1970 and is characterized by its rigid and structured nature, with a focus on detailed planning and documentation at the beginning of the project. (Mccormick, 2012)

In the chosen project, the Waterfall methodology was selected as the sole approach due to its suitability for projects with well-defined and stable requirements. For instance, in developing a system where the requirements are known upfront and unlikely to change much thereafter, the Waterfall model offers a structured approach to moving through the stages of requirements specification, design, creation, testing and maintenance (Mccormick, 2012)

The Waterfall methodology guarantees that every step is finished thoroughly before proceeding, which works well when the vision of the project is clear and will not change, such as building the traditional accounting system or infrastructure software. In an aim to minimize changes made during the development process, the waterfall approach follows a direct path from each phase forward. This can be beneficial for projects where deviating from the original design may incur costs or be difficult (Mccormick, 2012).

Therefore, the structured and methodical approach of the Waterfall Methodology is best suited for projects with constant needs and a clear vision of the ultimate outcome. The waterfall approach is a good option for projects where control and predictability are crucial since it places a strong emphasis on careful planning and documenting up front, which helps to reduce the risks related to changes made during the development process. Figure 1 shows phases of Waterfall Methodology.
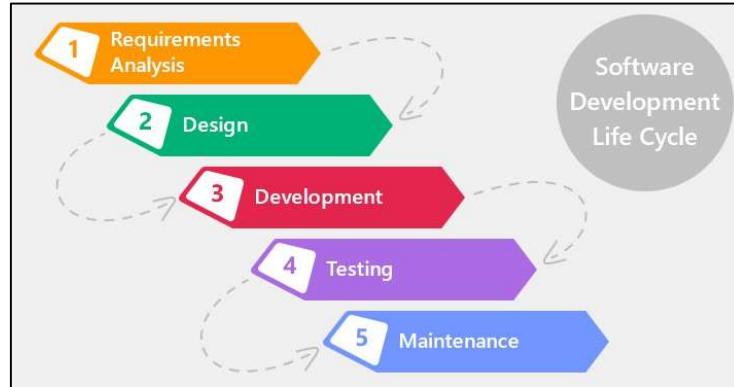
Figure 1: Phases of Waterfall Methodology

RESULT AND DISCUSSION

Demography respondent

For the usability evaluation of the "Word Wonders via Game-Based Learning" application, a total of 21 participants were sampled. Among them, 14 (66.7%) were male, and 7 (33.3%) were female. Most of participants were between 9 and 10 years old, with 9 participants (42.9%) falling into this age group. Additionally, 7 participants (33.3%) were aged 7 to 8 years, and 5 participants (23.8%) were aged 11 to 12 years. The diversity of age distribution was intentionally designed to assess the application's usability across different cognitive and literacy development stages among children. This demographic breakdown provides valuable insights into how the game interacts with various user groups. Table 1 displays the demographic characteristics of the participants involved in the evaluation.

Table 1: Demography Characteristics of Word Wonders Evaluation Participants

Gender	7 to 8 Years	9 to 10 Years	11 to 12 Years	Total
Male	5	6	3	14
Female	2	3	2	7
Total	7	9	5	21

Findings

To assess the usability of the "Word Wonders via Game-Based Learning" application, participants provided ratings based on the System Usability Scale (SUS) questionnaire. Each participant evaluated ten usability-related statements on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), and the mean scores for each question were calculated. The results demonstrated a generally positive perception of the application among users. Specifically, the statement "I found the various functions in this system well integrated" received the highest mean score of 4.52, indicating that participants appreciated the seamless integration of the game's components. In contrast, statements regarding the complexity of the system received lower scores, with the statement "I found the system unnecessarily complex" registering a mean score of 1.43. These findings highlight that user found the application not only engaging but also accessible. Table 2 provide a summary of the mean scores for the various usability factors assessed during the evaluation.

Table 2: Mean score for Usability factor in code

Question Codes	Mean Score
Q1	4.48
Q2	1.48
Q3	4.48
Q4	1.57
Q5	4.52
Q6	1.57
Q7	4.48
Q8	1.43
Q9	4.48
Q10	1.48

Findings Summary

The usability evaluation of the "Word Wonders via Game-Based Learning" application yielded a positive response from users, as indicated by a high mean score of 4.58 on the System Usability Scale (SUS), reflecting strong perceptions of ease of use and functionality. Additionally, low mean scores for complexity (1.43) and the necessity for prior knowledge (1.48) demonstrated that users did not view the application as difficult or cumbersome. These results emphasize the application's effectiveness in delivering an engaging and accessible learning experience for children. Figure 3 provides a summary of the mean scores for various assessed usability factors.

Gender	Age	I think that I would li	I found the system unr	I thought the syster	I think that I would r	I found the various	I thought there we	I would image that	I found the system	I felt very confide	I needed to learn a l
Male	11 - 12 years old	5	2	5	2	5	2	5	2	5	2
Female	7 - 8 years old	5	2	5	2	5	2	5	2	5	2
Male	9 - 10 years old	5	2	5	2	5	2	5	2	5	2
Male	9 - 10 years old	5	1	5	2	5	2	5	2	5	2
Male	9 - 10 years old	5	1	4	2	5	2	5	1	5	1
Female	11 - 12 years old	5	2	5	2	5	2	5	2	5	2
Male	11 - 12 years old	5	2	5	2	5	2	5	2	5	2
Female	7 - 8 years old	5	2	5	2	5	2	5	1	5	2
Female	9 - 10 years old	4	1	4	1	4	1	4	2	4	1
Female	9 - 10 years old	4	1	4	1	4	1	4	1	4	1
Male	11 - 12 years old	4	1	4	1	4	1	4	1	4	1
Female	11 - 12 years old	4	1	4	1	4	1	4	1	4	1
Male	7 - 8 years old	4	1	4	1	4	1	4	1	4	1
Male	9 - 10 years old	4	1	4	2	4	2	4	2	4	1
Male	7 - 8 years old	4	1	4	1	4	1	4	1	4	1
Male	9 - 10 years old	4	1	4	1	4	1	4	1	4	1
Male	7 - 8 years old	4	1	4	1	4	1	4	1	4	1
Male	9 - 10 years old	4	1	4	1	4	1	4	1	4	1
Male	7 - 8 years old	4	2	4	2	5	2	4	1	4	2

Figure 3: Overall Respondent

CONCLUSION

In conclusion, the "Word Wonders via Game-Based Learning" project successfully developed a 2D educational game designed to aid in the early detection of dyslexia symptoms among children aged 7 to 12 years. Through engaging gameplay focused on reading, spelling, and listening skills, the application fosters an interactive learning environment that not only makes literacy education enjoyable but also empowers parents to recognize potential learning challenges early on. The positive feedback from usability testing indicates that the game is intuitive and effective, although future enhancements such as adaptive learning features and broader accessibility options could further improve its utility and reach. Overall, this project exemplifies the potential of game-based learning as an innovative solution for supporting dyslexic children and enhancing their educational experience.

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