

Original Article

Proposal of a Web Design for Students with Dyslexia Problems in the English Course

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Abstract - The capacity to read, write, and speak words correctly is the main symptom of dyslexia. This learning disorder has a detrimental effect on academic performance, particularly in rural areas where identification is scarce. Due to the frequent impact on phonological and visual abilities, which are often compromised in these pupils, this condition presents an additional challenge when learning English. Despite their widespread use, there are few digital resources created especially to meet their needs. Thus, the objective is to create and demonstrate a prototype web application that helps dyslexic students learn English inclusively and efficiently by giving them access to individualized learning resources and encouraging their motivation throughout the process. Through teacher interviews and parent surveys, the Design Thinking technique was used to collect the required data. From these data, a semantic map was constructed that allowed the identification of five types of dyslexia: phonological, superficial, mixed, visual, and developmental. Among the results, it was found that developmental dyslexia was the most frequently mentioned (17 mentions), indicating a close relationship with students' demotivation. In addition, a web prototype was developed that includes activities focused on phonological and visual awareness, such as word formation, games, and visual resources. This work represents an initial step towards the creation of an expert system capable of recognizing the type of dyslexia of each student and adapting the teaching of English according to their specific needs. The next step is to validate the prototype in real school environments to optimize and improve its effectiveness.

Keywords - Dyslexia, Design Thinking, Educational Web Application, English Language, Learning Disabilities.

1. Introduction

A neurological disorder known as dyslexia has a substantial impact on the reading process, causing confusion or changes in letter order that have an adverse effect on a person's academic and social performance [1]. Dyslexia affects reading, writing, spelling, and oral expression, which can be frustrating and negatively impact self-esteem, even though it has nothing to do with IQ [2]. This disorder, which is classified as a distinct learning challenge, typically appears in school-age children and frequently lasts a lifetime [3]. Dyslexics may have trouble following written instructions, reading fluently, distinguishing similar sounds, and remembering word or letter sequences [4].

Despite the growing awareness of learning disabilities, there is still a notable gap in the quality and inclusivity of education for students with dyslexia. Educational systems often fail to implement appropriate accessibility parameters, which prevents the achievement of sustainable and equitable education for these learners [5]. All pupils should have equal access to high-quality education that values their uniqueness and promotes equality of opportunity [6]. Students with

learning disabilities, including dyslexia, are still excluded from contemporary educational procedures, which hinders their academic advancement and social integration [7]. There have been several suggestions for technological solutions to help kids with dyslexia, such as virtual reality platforms, mobile reading apps that use text-to-speech technologies, and interactive games that help them read better [9]. Additionally, 3D virtual labs are available to improve science students' cognitive abilities [10]. The potential of Information and Communication Technologies (ICT) to assist dyslexic kids' learning is demonstrated by these efforts.

Nonetheless, there is still a significant lack of resources created especially to help dyslexic pupils acquire the English language. The majority of currently available resources concentrate on scientific topics or general reading comprehension, undervaluing the field of English language teaching. Given the significance of English as a global language in academic and professional contexts, this is a serious limitation. In this regard, the current study suggests a web-based prototype designed especially to help dyslexic kids learn English. This concept is novel in that it uses easily



accessible digital tools to modify English training to meet the cognitive and emotional demands of dyslexic students. The tool is made to be used both at home and at school, enabling flexible, individualized learning based on the skills and pace of each individual student.

Surveys were conducted with parents and teachers to gather information on the specific needs and preferences of users, to ensure the effectiveness of the proposed solution. The objective of this research is to create and demonstrate a prototype web application that facilitates inclusive and effective English language teaching for children with dyslexia, thereby promoting their academic development and emotional well-being.

2. Literature Review

Despite being a very common language impairment, dyslexia is frequently misdiagnosed, particularly in rural areas with limited access to expert resources. The authors [9] claim that this disorder can have a major impact on children's learning and can lead to violent or school-dropout behaviors. Numerous studies have suggested technology-based ways to deal with this issue, including digital platforms and mobile applications that can assist in identifying and supporting kids with dyslexia. It has been demonstrated that platforms with educational games and activities help these students become better readers and writers. For example, the authors' proposal consists of a web and mobile application that relies on user-centered design and prototyping to ensure that the application fulfills the necessary functions. To evaluate its quality, the Mobile App Rating Scale (MARS), which analyzes usability, performance, visual design, and content quality, was used. This app can be a useful tool for children with dyslexia to improve their academic performance, increase their self-esteem, and fully develop to contribute positively to society.

Compared to their peers, students with dyslexia have more difficulties. With the intention of using the findings to support foreign language teachers in Spain, the authors [11] compared dyslexic Spanish and British students using a pre-experimental *ex post facto* design and a quantitative methodology to identify the unique linguistic challenges they encountered when learning their respective languages. There were 19 British and 29 Spanish students in the sample. The results demonstrate that phonological processing and grapheme-phoneme correlation provide unique challenges for native UK pupils. It seems that native Spanish speakers who are enrolled in foreign language courses face comparable challenges. Current foreign language programs must take into account the knowledge gathered about the unique language literacy issues faced by dyslexic students in order to guarantee the efficacy of Spain's inclusive education laws.

Another branch of research has explored Virtual Reality (VR) as a tool to promote inclusion and engagement among students aged 10–16 with dyslexia. In order to stimulate

cognitive functions and lessen the anxiety frequently associated with traditional classroom learning, a qualitative, interpretive, and descriptive study developed a virtual reality application with interactive and sensory-rich surroundings [7]. This method demonstrated how VR may offer a secure, inspiring environment that supports various learning preferences. However, VR frequently necessitates expensive infrastructure and technology, which restricts its scalability and accessibility in public school systems, particularly in low-income or rural locations. This makes room for more affordable, easily accessible web-based solutions, like the one this study suggests.

Other research has examined the use of artificial intelligence to tailor support for dyslexic pupils from a more technical standpoint. The authors [12] investigated how recommendation algorithms might be used to make recommendations for digital resources according to the tastes of specific learners. A weighted hybrid model, a user-centered model, and an item-based model were the three collaborative filtering models that were created and trained. In order to give appropriate support that is customized for each cognitive profile, these models were tested using a comprehensive database that included data from 1,2,3,7 students who completed a self-assessment questionnaire on the usage of digital methods and tools. Similar to this, intelligent agents have been used to personalize digital content.

From a more technical standpoint, some research has looked into the use of AI in classroom settings that are modified for dyslexic pupils. In this context, the authors [13] suggested an intelligent agent-based software architecture that enables the arrangement, characterization, and suggestion of customized learning resources. By taking into account factors like material type, chosen learning medium, and difficulty level, this system may categorize content based on the unique needs of each learner, providing a more appropriate and successful learning environment for those who struggle with reading. In the meantime, the authors [14] identified a major drawback of the majority of digital platforms: their inability to accommodate various varieties of dyslexia, including surface, visual, and phonological dyslexia. In order to close this gap, they created an adaptable virtual learning environment that modifies the contents according to the type of dyslexia that has been detected. They have shown that this kind of customisation greatly enhances both academic achievement and student pleasure.

Furthermore, the findings demonstrated that adjusting information to the dyslexia profile improves comprehension and lessens learning dissatisfaction. These contributions emphasize how crucial it is to include adaptation mechanisms in digital tools. This is taken into account in the current web design proposal, which aims to support dyslexic students' English language learning by providing a more effective, individualized, and accessible learning environment.

The authors [15] used the European ERASMUS+ FORDYSVAR project as a model to study how technology can affect dyslexic students' motivation from a motivational standpoint. The study's main objectives were to evaluate these students' motivation throughout the learning process and ascertain whether technology might serve as a tool to pique their interest and make it easier to create educational settings that are socially viable. The study employed a descriptive, cross-sectional, and correlational methodology to investigate the participants' motivation. Thirty dyslexic students in the previously indicated age range were given a customized questionnaire on learning motivation in order to gather data. The results demonstrated that information and communication technology is a teaching tactic that helps these kids become more motivated. These findings are in line with earlier studies that demonstrated the beneficial effects of technology on student motivation in the classroom. The primary goal of this essay's authors [16] is to pinpoint the difficulties Catalan speakers encounter when learning the language. The main traits of Catalan dyslexic students studying English are discussed in this article. The purpose of this experimental design is to investigate the impact of this reading difficulty on foreign language acquisition through the use of two tests, one in English and one in Catalan. Four distinct exercises are included in each test: dictation, fill-in-the-blanks, choosing the right response, and a rhyming exercise. The intention is to highlight opaque clusters, consonant clusters that convey several sounds in a single letter, as the ones that dyslexic learners find most challenging. Additionally, the English activities produced more significant results than the Catalan exercises because of this opacity.

Web accessibility is another important issue that has been covered in the literature. The authors' study [17] assessed whether the Web Content Accessibility Guidelines (WCAG) could accommodate dyslexic users' needs. They suggested specific enhancements, including spell checking, autocomplete features, streamlined results presentation, and customizable line spacing, based on interviews and research of the literature. Users in general, as well as those with dyslexia, gain from these recommendations. Lastly, the authors [18] examined how a digital support tool affected fluency and reading comprehension, contrasting its efficacy with that of a conventional reading sheet. Each participant completed a comprehension test in two different formats: a digital program made specifically for this purpose and a conventional reading sheet. The impact of technology on reading performance could be ascertained by contrasting the outcomes of the two approaches. The results show that reading fluency and comprehension can be significantly enhanced by using this type of assistive software, particularly when pupils are experiencing high levels of anxiety.

In conclusion, the analysis demonstrates notable progress in the creation of digital dyslexia solutions, particularly in the areas of augmented reality, mobile applications, and AI-based

technologies. Nonetheless, there are still chances for creativity, especially when it comes to creating websites that are especially targeted to the needs and traits of dyslexic children. Therefore, the current study suggests an inclusive online platform that enhances this student group's motivation and active engagement while also optimizing access to and comprehension of the content.

3. Materials and Methods

The research work employed a design thinking methodology, a human-centered approach to innovation that changes the way goods, services, processes, and even entire companies are created by emphasizing knowledge of customer demands, rapid prototyping, and idea generation. Instead of basing decisions solely on past data or making untested bets based on hunches, design thinking helps companies focus on what their customers really want [19].

In this study, four English teachers and several parents of students with dyslexia participated, selected through purposive sampling based on their experience with inclusive education and digital learning environments. All participants were informed about the objectives of the research and voluntarily agreed to collaborate. The data collection was carried out through semi-structured interviews, surveys, and brainstorming sessions corresponding to the different stages of the design thinking process.

The information obtained was analyzed using a qualitative content approach, identifying recurring themes related to accessibility, comprehension, monitoring, and motivation. These categories served as the basis for synthesizing the participants' contributions and proposing design solutions adapted to the needs of students with dyslexia. The design thinking methodology consists of 5 phases (see Figure 1).

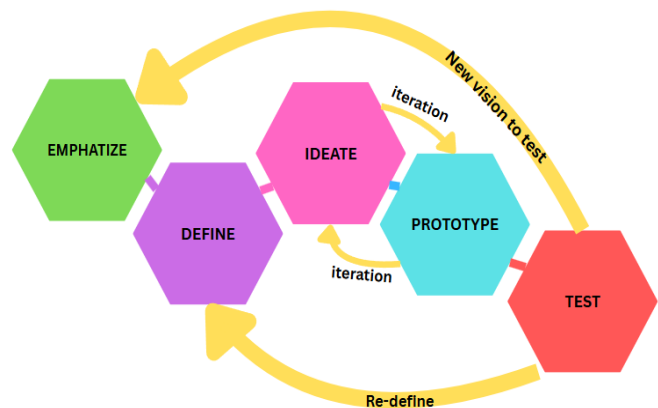


Fig. 1 Phases of the design thinking methodology

3.1. Emphasize

In this case, conducting user research is useful for developing a comprehensive understanding of the problem at

hand. Empathy is essential to a human-centered design process, such as design thinking, because it helps you set aside your own preconceived ideas about the world and the users'

needs [20]. In Table 1, a 5-question interview was conducted with the 4 teachers regarding the problems faced by students with dyslexia in the English course.

Table 1. Interview with 4 teachers about students with dyslexia

Types of dyslexia	Questions
Phonological Dyslexia	Do you find it difficult to associate English sounds with letters or letter combinations when reading on the web?
Superficial Dyslexia	Do you have trouble recognizing common English words at a glance, even if you have seen them before?
Mixed Dyslexia	Do you have difficulty both identifying sounds and recognizing words visually on the course website?
Visual Dyslexia	Does it confuse or reverse letters (such as “b” and “d”) when reading on the screen?
Developmental Dyslexia	Have you felt that reading in English is more difficult for you than for your peers, even with visual aids?

3.2. Define

The data collected during the empathy phase can now be compiled and analyzed. Once the data are collected, you and your team should analyze and synthesize them to identify the root causes of the problems [21]. Problem statements are concise explanations of the issues at hand. Before moving to the ideation phase, you can create personas to help you focus on the people [22].

In Table 2, a 4-question survey of parents and teachers was conducted on the importance of the Web Design Approach for Students with Dyslexia Issues. The current situation faced by teachers when using educational platforms with students with dyslexia is visualized, including a lack of accessibility, poor interactive content, inadequate follow-up, and low motivation.

The proposed situation is also presented, where improvements are suggested, including the design of an

accessible login, a clear and structured interface, the use of phonetic tools to reinforce reading, and an analytical approach that allows for breaking down words. These proposals aim to tailor the digital environment to meet the specific needs of students with dyslexia, thereby facilitating their learning and active participation.

3.3. Idear

You are now in a position to think creatively. Having laid the groundwork in the first two steps, you can begin to “think outside the box,” exploring different perspectives on the issue and looking for novel approaches to solving the problem [23]. This is a situation where brainstorming comes in handy. Since design thinking is a framework for finding effective solutions, it broadly prioritizes brainstorming [24]. One of the most important parts of the method is the ideation phase. Participants in the ideation phase are encouraged to place less emphasis on the quality of their ideas and more on the number of ideas.

Table 2. Current situation and proposal according to the teacher

Teacher	Current Status	Proposed Situation
Teacher 1	Educational web platforms are not adapted for people with dyslexia, making access and use difficult.	Design an accessible login with clear visual elements, large buttons, accessibility through icons or images, and a read-aloud feature for the form content.
Teacher 2	The content on the platforms is dense, linear, and not very interactive, making it difficult for students with dyslexia to understand.	Create a clear, clean, and structured web environment with simple navigation, visual menus, consistent labels, and immediate feedback.
Teacher 3	There is no systematic monitoring of students' progress, which makes it difficult to identify their learning needs.	Incorporate phonetic tools that relate letters to sounds (e.g., by hovering over words, sounding out phonemes), as well as interactive grapheme-phoneme correspondence exercises.
Teacher 4	The digital environment does not offer positive stimuli or gamification elements, which can demotivate students.	Design an interface that allows for visually decomposing words, identifying roots, prefixes, and suffixes, and working with orthographic patterns.

Table 3 shows the result of a brainstorming session with four teachers, where possible technological solutions to improve learning for students with dyslexia were proposed. The table shows the current situation of interest on the part of the teaching team, aimed at exploring inclusive digital tools.

The ideas revolve around the development of a mobile application that is easy to use, with visual and auditory support; an application with games that reinforces learning through interactive and motivating dynamics; an educational web system that facilitates navigation, progress monitoring

and content customization; and a web design with a phonetic and analytical approach, which allows working on reading from different strategies according to the type of dyslexia. The

proposed situation, then, is oriented to the design of accessible, dynamic, and adapted digital environments that respond to the specific needs of these students.

Table 3. Proposals were developed together with teachers to promote the educational integration of students with dyslexia

Brainstorming	Teacher 1	Teacher 2	Teacher 3	Teacher 4
Mobile application	Create a simple app with read-aloud and pictograms.	An app with voice navigation and study reminders.	Application with monitoring of student progress.	An app to review content with visual and audio support.
Application with games	Reading games with visual rewards.	Mini-games to associate words with images.	Phonetic games to practice sounds. And letters.	Trivia-type game with word decomposition.
Web System Design	Accessible system with adapted login and visual menus.	A web with a clean interface and clear organization of content.	System with progress logging and reporting for teachers.	A platform with a rewards section and daily challenges.
Web design with a focus	Phonetic focus: letters with sounds when hovering the cursor.	Visual approach: words highlighted and separated by syllables.	Analytical approach: roots, prefixes, and suffixes highlighted.	Phonetic-analytical combination adapted to the student's rhythm.

Table 4 shows the activities agreed upon around four main areas aimed at supporting students with dyslexia in digital environments. In the area of accessibility, it is recommended to create a login system with clear visual elements, large buttons, icons, and the option to read aloud to facilitate access. In terms of comprehension, a simple and easy-to-navigate web design is suggested, complemented with multimedia resources that help with reading and better

understanding the content. For progress monitoring, a method based on the relationship between letters and sounds is proposed to monitor the student's progress.

Finally, in the motivational aspect, it is recommended to include gamification elements and an analytical approach, such as word division, positive feedback, and visual rewards, to encourage active and meaningful learning.

Table 4. Consensus activities to support students with dyslexia

Thematic Axis	Consensual activities
accessibility	Design an accessible login with clear visual elements, large buttons, use of icons, and read aloud to facilitate login for students with dyslexia.
Compression	Develop an intuitive web design, with simple navigation, an organized visual structure, and multimedia resources that favor reading comprehension.
Monitoring	Implement a phonetic approach on the web page, integrating tools that associate letters with sounds, and allow tracking student progress.
Motivation	Incorporate an analytical approach and gamification elements, such as word decomposition (roots, prefixes, suffixes), positive feedback, and visual rewards.

4. Results

4.1. Prototype

A testing period is underway with the goal of identifying the optimal answer to each challenge. To test your hypotheses, your team must create some small-scale, low-cost copies of the product (or of features within the product). This requires implementing them as prototypes, subjecting them to user testing, and modifying them accordingly [25].

Given the iterative nature of design thinking, it is expected that certain processes will be repeated as insights are gained about what works and what does not in the initial iterations of the solution. In Figure 2, the prototype of a Login page is shown, along with an interactive section dedicated to learning vowel sounds in an English course. This interface has been designed so that users can easily access the system and, once inside, practice the correct pronunciation of vowels

through visual and auditory resources. Section (a) shows the login screen, where users enter their data to access the application. This stage is essential to verify the user's identity and enable the use of the system's exclusive functions. In addition, the user's initial environment is configured from this screen, which may include the assignment of permissions and the loading of the platform's main navigation menu.

On the other hand, section (b) presents an activity designed to help students identify repeated patterns in the pronunciation of vowels. This feature facilitates children's recognition of letter combinations with similar sounds in different words, which contributes to language learning. Through lists of words grouped according to phonetic patterns, visual and auditory skills are developed simultaneously through reading, spelling, and active listening exercises.

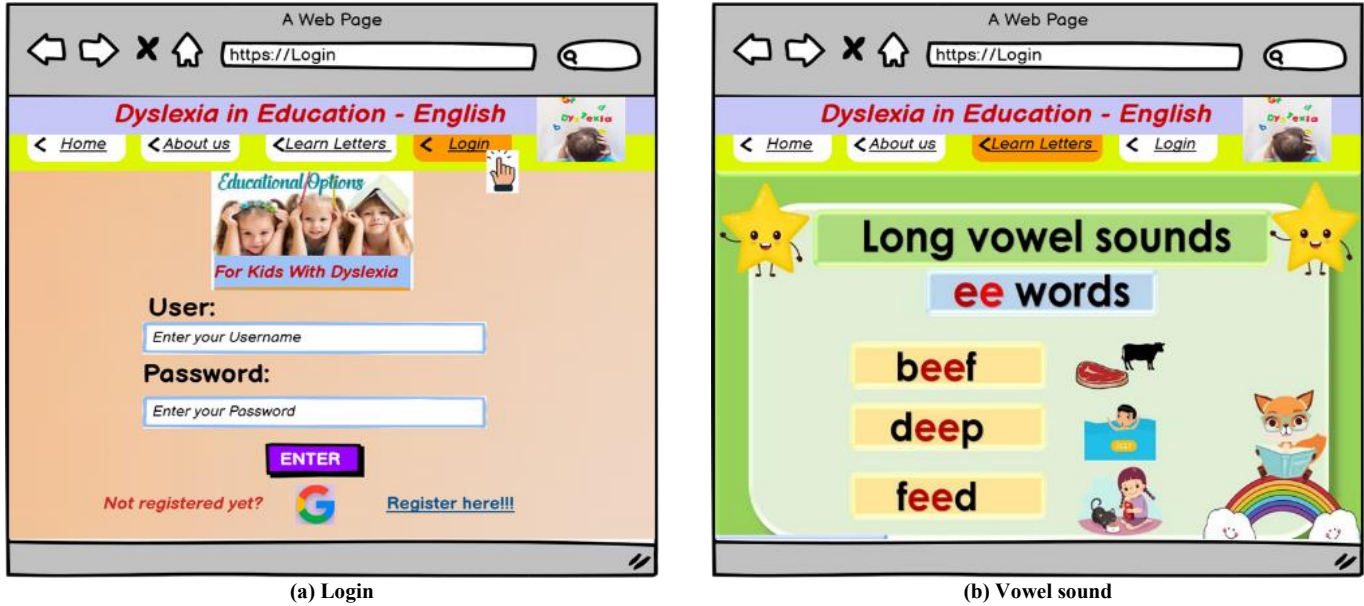


Fig. 2 Prototype initial design of web interface for user access and vowel recognition activities in the English language area

Figure 3 presents the prototype of a web page designed to form words using a phonetic approach. This section allows users to build words from basic sounds, which is key to strengthening phonological awareness, especially in students with reading difficulties. The interface was created to be interactive and visually appealing, facilitating learning through constant practice and auditory support. This approach enhances word decoding skills, which are essential to the literacy process. Similar to this, section (a) demonstrates how employing images associated with word meanings can help children acquire and retain new vocabulary more quickly and efficiently. A fun and effective way to help young children

learn English is to introduce them to the language through activities that promote social interaction. All exercises should be presented in a fun and instructive manner, such as through word-forming games, to keep kids interested. A phonetic approach to teaching reading, which emphasizes learning individual letter sounds before combining those sounds to form words, is highlighted in Section (b). Students may "decode" and read unknown words on their first try thanks to this methodology. Children with dyslexia can use this technique to recognize and take advantage of word phonological patterns, leading to more accurate and thorough reading.



Fig. 3 The phonetic approach to word creation was the main emphasis of the web interface prototype design

A web page prototype designed to assist dyslexic pupils utilizing a combination of mixed and analytical methods is depicted in Figure 4. An analytical approach that helps the student recognize words as complete units rather than as individual letters is provided in section (a). This method helps the dyslexic youngster visually recall language blocks and rapidly recognize common words, which increases reading fluency and confidence.

This approach specifically concentrates on the analysis of vocabulary and lexical categories that frequently occur

together. However, section (b) Presents a prototype that integrates both quantitative and qualitative data in order to approach dyslexia from a mixed perspective.

The platform provides exercises that enable the evaluation of fundamental reading abilities, such as auditory discrimination and letter completion. Descriptive observations of student performance are added to the numerical data collected, allowing for a more thorough analysis that is customized to each student's needs during the learning process.



(a) Analytical approach



(b) Blended approach

Fig. 4 Prototype web interface design that helps students with dyslexia by combining global analysis techniques

A summary of the many techniques for identifying a student's type of dyslexia is provided in Table 5, including phonological and visual skill evaluations, specialized reading tests, and mistake analysis. In addition, it contemplates interviews with teachers and family members, observations in

the school environment, review of the student's developmental history, and the application of digital tools. These actions help to distinguish between phonological, superficial, visual, mixed, or developmental dyslexia, thus facilitating an appropriate and personalized intervention.

Table 5. Suggestions for identifying the type of dyslexia in students

Proposal	Description	A utility to identify
Specific reading tests	Evaluation with regular, irregular, and pseudowords.	Differentiate between phonological, superficial, or mixed dyslexia.
Reading and writing error analysis	Observation of errors (phonological, visual, semantic, orthographic).	Classify the type of dyslexia according to the pattern of error.
Phonological and visual assessment	Tests of phonological awareness and visual orthographic memory tasks.	Detect phonological or visual deficits.
Interviews with teachers and families	Collect background information, reading and writing development, and daily observations.	Confirm signs from early stages.
Classroom observation	Record actual performance in reading and writing activities.	Detect functional and spontaneous signs.
Developmental and language history	Inquiry about linguistic development and family background.	Identify developmental dyslexia.

Table 6 organizes the different types of dyslexia according to their characteristics and assessment methods. Phonological dyslexia manifests as difficulty in associating letters with their sounds, detected through phonological awareness tests. Superficial dyslexia affects the ability to visually recognize words and is assessed by dictation and reading words that do not follow regular rules.

Mixed dyslexia combines phonological and visual difficulties, requiring an extensive reading assessment. Visual dyslexia is related to errors caused by letter confusion and is diagnosed with visual perception tests. Finally, developmental dyslexia has a neurobiological origin and is identified from infancy through comprehensive psycho-pedagogical evaluations.

Table 6. Classification of types of dyslexia according to their distinctive features and corresponding assessment methods

Type of Dyslexia	Diagnosis / Characteristics	Common Evaluation Instruments
Phonological Dyslexia	- Difficulty decoding sounds. - Problems with new words.	- Reading pseudowords. - Reading speed tests.
Superficial Dyslexia	- Difficulty with irregular words. - Slow reading, letter by letter.	- Reading irregular words. - Spelling dictation. - Visual vocabulary assessment.
Mixed Dyslexia	- Affects both phonological and visual pathways. - General difficulties with all types of words.	- Complete reading assessment. - Pseudoword and irregular word tests. - Semantic evaluation.
Visual Dyslexia	- Problems with visual word recognition. - Confusion of similar letters (b/d, p/q).	- Reading visually similar words. - Visual orthographic evaluation.
Developmental Dyslexia	- Dyslexia has been present since childhood. - Not acquired by injury.	Complete psycho-pedagogical evaluations. - Standardized reading and writing tests.

```
def has_dyslexia(student, dyslexia_type):
    s = symptoms.get(student, set())
    if dyslexia_type == "phonological_dyslexia":
        return (
            "phonological_errors" in s and
            "difficulty_with_pseudowords" in s and
            "irregular_word_errors" not in s
        )
    elif dyslexia_type == "surface_dyslexia":
        return (
            "irregular_word_errors" in s and
            "spelling_by_sound" in s and
            "difficulty_with_pseudowords" not in s
        )
    elif dyslexia_type == "mixed_dyslexia":
        return (
            "both_phonological_and_visual_errors" in s or
            "semantic_confusions" in s
        )
    elif dyslexia_type == "visual_dyslexia":
        return (
            "visual_confusions" in s and
            "letter_reversals" in s and
            "slow_reading" in s
        )
    elif dyslexia_type == "developmental_dyslexia":
        return (
            "early_reading_difficulties" in s and
            "language_delay" in s and
            "family_history_dyslexia" in s
        )
    return False
for student in symptoms:
    for dyslexia in [
        "phonological_dyslexia", "surface_dyslexia",
        "mixed_dyslexia", "visual_dyslexia", "developmental_dyslexia"
    ]:
```

Fig. 5 Representation of an inference rule implemented in Prolog for the detection of dyslexia types

In Figure 5, the inference rule in Prolog is used to identify the type of dyslexia that a student presents from the detected

symptoms, through a logical and automated process. This tool makes it easier for teachers, educational psychologists, and educational software developers to make an initial diagnosis in a clear and orderly manner, reducing possible errors of interpretation and supporting the creation of personalized interventions. By representing symptoms as facts and applying logical rules, the system can classify dyslexia into categories such as phonological, surface, visual, mixed, or developmental, thus contributing to data-driven educational decisions.



Fig. 6 Prototype of a website with an expert system

4.2. Expert Web System Prototype

Figure 6 presents a prototype of a web page with an expert system dedicated to dyslexia, designed to facilitate the identification and understanding of its different types. Five main categories are described: phonological dyslexia, which

makes it difficult to segment words into sounds, affecting the reading of new vocabulary; surface dyslexia, which causes difficulties in recognizing whole words visually, forcing letter-by-letter reading; mixed dyslexia, which combines both phonological and visual difficulties, further complicating reading and comprehension; visual dyslexia, characterized by problems in visual processing that generate frequent confusion with letters and words; and finally, developmental dyslexia, which appears from childhood due to genetic or neurological causes, affecting reading learning from its earliest stages.

4.3. Interviews

From the examination of interviews held with educators about their views on students with dyslexia in English classes, a semantic relationship map was created to grasp the interaction between the recognized categories and the emerging codes. The core of the analysis revolves around the broad category of Dyslexia, which gives rise to five distinct subcategories: Phonological Dyslexia, Surface Dyslexia, Mixed Dyslexia, Visual Dyslexia, and Developmental Dyslexia. Developmental dyslexia has the highest density of these (17 citations) and is specifically linked to the newly formed category EC1: Motivational, suggesting that early reading difficulties have a lasting effect on students' motivation.

It is acknowledged that phonological dyslexia (12 citations, 2 links) and mixed dyslexia (13 citations, 2 links) are significant causes of pupils' issues with motivation. Crucially, it is shown that Mixed Dyslexia includes both Phonological and Surface Dyslexia, as it represents a combined difficulty in sound decoding and visual word recognition. The idea that different types of dyslexia have a direct impact on student engagement and self-esteem is supported by the fact that visual dyslexia, which is distinguished by a lower density (9 quotes), is likewise linked to the motivational category.

A prominent transversal axis that results from the many dyslexia types and is structurally related to them is the emerging code EC1: Motivational (12 quotations, 5 connections). On the other hand, EC2: Teacher Support (9 quotations, 4 links) seems to be an adaptive and compensatory measure that is strongly associated with both mixed and phonological dyslexia as well as low student motivation. This emphasizes how important it is for teachers to provide both emotional support and educational modifications, as this, in turn, increases student motivation. The qualitative investigation reveals a complex interrelationship between student motivation, teacher impact, and dyslexia kinds. The emerging categories highlight important considerations for inclusive strategy development (see Figure 7).

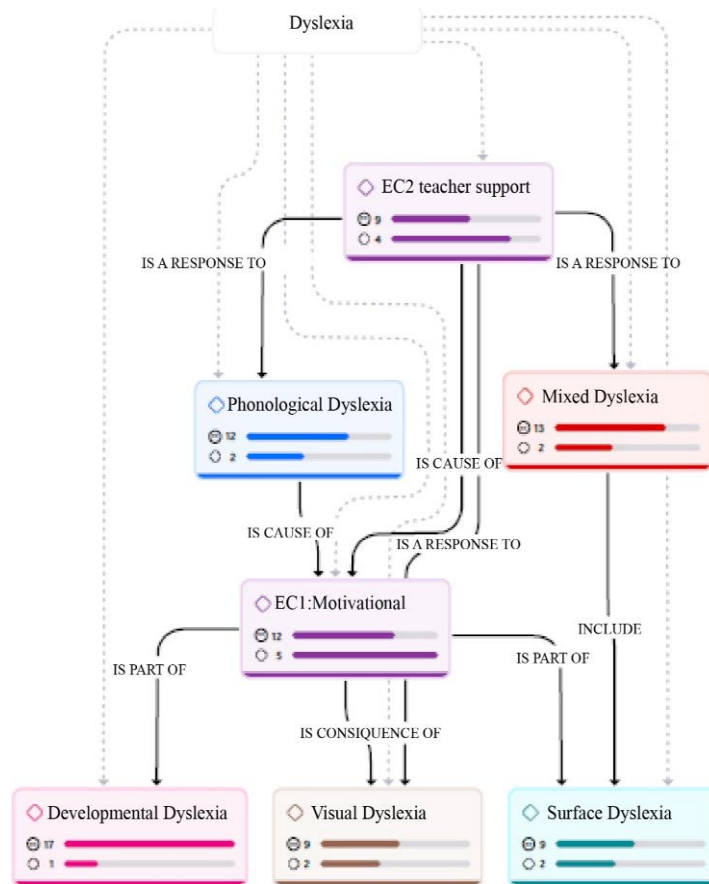


Fig. 7 The classification, subcategories, and emerging

The results demonstrate that dyslexia is a cognitive-linguistic disorder that also affects motivation and emotions. Students who struggle from a young age may internalize failure and lose faith in their capacity to learn, according to the substantial correlation shown between developmental dyslexia and low motivation. As a result, therapies should incorporate motivational and self-efficacy elements that support perseverance and engagement in addition to phonological training and decoding. Teachers are essential to this process because they may reduce frustration and promote resilience through their emotional support and adaptive skills.

Additionally, the connection between the various forms of dyslexia and the newly developed motivating category suggests that customized learning settings are necessary. Universal Design for Learning (UDL)-based digital platforms can offer adaptable, multimodal materials that address a range of needs. This objective is supported by the incorporation of gamified activities, phonetic reinforcement, and progress tracking tools, which were discovered during the prototype stage and have the potential to greatly enhance learning results and student motivation. These ramifications imply that inclusive digital design ought to be seen as a pedagogical and emotional assistance method for students with dyslexia, rather than only a technical advancement.

5. Discussion

According to the authors [9], dyslexia is a prevalent language issue that frequently remains undiagnosed, particularly in rural regions with limited access to professional care and diagnosis. Childhood learning is greatly impacted by this challenge, and in more extreme cases, it may result in issues with self-worth, subpar academic achievement, school dropout, or disruptive behavior in the classroom. Their study suggests developing a web and mobile application that serves as a first aid for identifying and caring for kids with dyslexia in order to address this issue.

However, this work focuses more specifically on the design of a web prototype aimed at students with dyslexia in the subject of English, an area in which many present greater challenges due to the phonological differences between their mother tongue and the foreign language. The idea takes into account educational and phonetic components tailored to the cognitive traits of these children, in addition to technical issues like usability and visual structure. The prototype seeks to be an engaging and approachable didactic resource that is in line with multimodal learning approaches through interactive exercises that incorporate word creation, vowel sound identification, and guided reading.

To determine the particular linguistic difficulties that Spanish and British dyslexic students encountered when learning their respective languages, the authors' study [11] compared the two groups using a quantitative technique and a

pre-experimental ex post facto design. The results demonstrate that native speakers in the UK face unique hurdles in phonological processing and grapheme-phoneme association, while Spanish-speaking students encounter comparable difficulties when learning foreign languages.

The current study, on the other hand, moves beyond the comparative method and concentrates on creating an engaging and useful tool that tackles these issues from a welcoming digital setting. In contrast to earlier research that just identified language issues, this work suggests a web design that combines analytical, visual, and phonetic tactics to improve reading comprehension, phonological awareness, and student motivation. In this approach, the study helps close the gap between theory and reality in inclusive language instruction by offering a technical solution that can be used in an educational setting in addition to empirical knowledge regarding the needs of dyslexic children studying English.

Furthermore, the authors [16] stress that online learning platforms provide real-time monitoring of students' preferences and progress, enabling the development of more individualized educational experiences. Comprehending the aspects that drive dyslexic pupils to utilize these systems is essential for developers to enhance their platforms and for educators to concentrate their efforts on the features that really promote these students' active engagement. The study examines motivation from many psychological, behavioral, and technological perspectives using a composite model that combines qualitative and quantitative methods, demonstrating the interplay between these elements.

However, by suggesting the establishment of an expert web system intended to identify, mentor, and assist children based on the five recognized forms of dyslexia—phonological, surface, mixed, visual, and developmental—this work goes beyond the analysis of motivation. In addition to providing a pertinent technical and pedagogical advancement by incorporating an automatic fundamental diagnostic mechanism based on logical rules, this approach enables precise customization of resources and instructional tactics. The outcomes obtained using the suggested strategy show notable improvements over methods that have already been documented in the literature. The current prototype incorporates phonetic, analytical, and gamified features within an inclusive digital environment, in contrast to standard educational platforms that mostly concentrate on phonological decoding or solitary reading tasks. This multifaceted strategy encourages student enthusiasm and involvement, in addition to reading accuracy, two factors that are sometimes overlooked in current approaches.

Furthermore, although some sophisticated methods have improved reading tasks on their own, they hardly ever apply user-centered and flexible design concepts. The suggested

solution, on the other hand, is built on the design thinking technique and permits ongoing iteration in response to user feedback and actual learning requirements. This explains why the outcomes surpass those of conventional approaches, which blend technology innovation with pedagogical and emotional support specifically designed for dyslexic students.

6. Conclusion

In conclusion, this study used the Design Thinking technique to create a prototype web application that will help kids with dyslexia learn English. Through interviews with teachers and surveys with parents, the main educational needs of this group were identified, which allowed the creation of solutions focused on their requirements. During the analysis, a map of semantic relationships was developed that classified five types of dyslexia: phonological, superficial, mixed, visual, and developmental. Developmental dyslexia was found to have a significant relationship with the emergent code motivation, indicating that difficulties in reading from an early age directly affect student motivation. It was also found

that both Phonological Dyslexia and Mixed Dyslexia have a negative impact on motivation; the latter represents a combination of phonological and visual difficulties, which makes it more complex for learning. The Motivational code emerged as a central axis, while Teacher Support was highlighted as a fundamental factor to compensate for the students' difficulties, reinforcing the emotional and pedagogical aspects.

As a result, a working web prototype was designed that lays the groundwork for the future creation of an expert system capable of identifying the type of dyslexia of each student and adjusting the contents and methods of teaching English according to their particular characteristics. Among the limitations pointed out is the absence of tests in a real school context. As a proposal for future research, it is proposed to integrate the expert system within the web platform, with an updatable database and continuous evaluation mechanisms, with the aim of offering more effective and personalized support in the learning of English for students with dyslexia.

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