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Visual Design Elements for Dyslexia-Friendly Reading Materials: A Systematic Literature Review

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ABSTRACT

Dyslexia is a specific learning disorder that affects word recognition, reading fluency, and text comprehension. Although previous systematic reviews have discussed dyslexia-related reading interventions and typographic factors, limited synthesis has integrated typography, layout, color contrast, and illustrations into practical visual design guidelines for children's reading materials. This study aimed to identify visual design elements that support reading accessibility for children with dyslexia and to formulate evidence-based guidelines for classroom use. A Systematic Literature Review was conducted using the PICO framework and PRISMA protocol. Articles published between 2010 and 2025 were searched in five reputable international academic databases. Studies were included when they examined visual design elements in relation to dyslexia, child readers, readability, reading orientation, visual comfort, or comprehension. Studies were excluded when they were not empirical, did not focus on dyslexia, involved adult participants only, or were unavailable in full text. The quality of eligible studies was appraised using predefined criteria covering relevance, methodological clarity, data validity, and reporting transparency. Twenty-one articles met the inclusion criteria. The most consistent findings indicate that increased font spacing, adequate line spacing, simple layouts, clear text hierarchy, and moderate contrast improve readability, reading orientation, and visual comfort. Color and illustrations showed supportive effects when used selectively and without visual distraction. This review proposes Visual Design Guidelines for Dyslexia-Friendly Reading Materials that can guide teachers, designers, and publishers in preparing worksheets, classroom handouts, textbooks, and digital reading materials. The review also identifies research gaps related to classroom implementation and empirical validation of these design guidelines.

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1. INTRODUCTION

Dyslexia is a specific learning disorder that primarily affects accurate and fluent word recognition, spelling, and decoding skills, despite adequate intelligence and educational opportunity (American Psychiatric Association, 2022; Lyon et al., 2003). It is widely recognized as one of the most common learning difficulties, with estimates suggesting that approximately 5–10% of children experience dyslexia or dyslexia-related reading difficulties, although prevalence varies depending on language, diagnostic criteria, and assessment methods (Peterson & Pennington, 2015; Snowling, 2019). Because reading is central to almost all school subjects, dyslexia not only affects literacy achievement but also influences students' access to curriculum content, classroom participation, self-confidence, and long-term educational opportunities. In inclusive education systems, this makes dyslexia a significant concern for teachers, curriculum designers, textbook developers, and policymakers who are responsible for providing accessible learning materials for diverse learners (UNESCO, 2020).

Research on dyslexia has traditionally emphasized phonological processing, decoding, and language-based intervention. Evidence shows that structured literacy instruction, explicit phonics, and systematic reading interventions are important for supporting children with reading difficulties (Castles et al., 2018; Galuschka et al., 2014). However, reading performance is also shaped by how written information is visually presented. For children with dyslexia, visual barriers such as dense text, insufficient spacing, complex page organization, low readability, and distracting visual elements may increase cognitive load and reduce reading comfort. Studies on visual crowding and spacing suggest that the perceptual organization of letters and words can influence reading fluency, particularly among children with dyslexia (Martelli et al., 2009; Zorzi et al., 2012). Therefore, reading accessibility should not be understood only as a matter of instructional strategy, but also as a design issue embedded in textbooks, worksheets, digital learning platforms, and classroom reading materials.

Visual design elements such as typography, spacing, layout, color contrast, and illustrations can either support or hinder the reading process. For example, increased letter and word spacing has been associated with improved reading performance in some dyslexic readers, while overly decorative or unfamiliar fonts may interfere with word recognition (Rello & Baeza-Yates, 2013; Zorzi et al., 2012). At the same time, evidence on dyslexia-specific fonts remains mixed, with some studies showing limited or no advantage of specialized fonts over conventional, highly legible typefaces (Kuster et al., 2018). These findings indicate that accessible reading design cannot rely on a single feature, such as font choice, but should consider the combined effects of spacing, layout consistency, text hierarchy, contrast, and visual simplicity. In educational settings, these design decisions are highly relevant because students encounter reading materials daily in printed textbooks, classroom handouts, assessment sheets, slides, and digital resources.

Previous reviews on dyslexia have made important contributions, but they have tended to focus on different aspects of the problem. Some reviews synthesize evidence on the cognitive, linguistic, or neurological basis of dyslexia, while others evaluate the effectiveness of reading interventions and instructional approaches (Galuschka et al., 2014; Peterson & Pennington, 2015; Snowling, 2019). Design-related studies, meanwhile, often examine specific variables such as font type, letter spacing, or screen readability in isolation. As a result, the evidence remains fragmented and difficult to translate into practical guidance for educational material development. Compared with prior dyslexia and reading intervention reviews, the present study focuses specifically on the visual design of reading materials. Compared with narrower design studies, it integrates multiple visual elements—typography, layout, color contrast, and illustrations—into a broader framework for dyslexia-friendly reading accessibility. This distinction is important because teachers and material developers rarely make isolated design decisions; instead, they must combine several visual features within one learning resource.

The educational urgency of this issue is increasing as schools adopt inclusive curriculum practices and expand the use of digital and multimodal learning materials. Poorly designed materials may

unintentionally exclude children with dyslexia from meaningful participation in literacy activities, even when appropriate teaching strategies are available. Conversely, accessible design can support classroom literacy interventions by reducing unnecessary visual barriers, improving reading orientation, and allowing students to focus more effectively on comprehension. Dyslexia-friendly design guidelines may therefore help teachers adapt worksheets, simplify textbook pages, prepare readable slides, and select or develop digital materials that align with inclusive education principles. Such guidelines are not a replacement for evidence-based reading instruction, but they can complement pedagogical interventions by improving the accessibility of the learning environment.

Based on this background, the present study aims to conduct a Systematic Literature Review to identify visual design elements that support reading accessibility for children with dyslexia. Specifically, the review examines how typography, layout, color and contrast, and illustrations influence readability, reading orientation, visual comfort, and text comprehension. The study seeks to synthesize fragmented findings into practical Visual Design Guidelines for Dyslexia-Friendly Reading Materials that can be used in school and classroom contexts.

This study offers three main contributions. Theoretically, it extends dyslexia research by positioning visual design as an accessibility factor that interacts with cognitive and linguistic reading processes. Practically, it provides guidance for teachers, designers, publishers, and educational technology developers in preparing curriculum materials, textbooks, worksheets, and classroom literacy resources. From a policy perspective, the findings may support inclusive education initiatives by informing standards for accessible learning materials, particularly for students with specific learning disorders. The review also identifies research gaps related to classroom implementation and empirical validation of dyslexia-friendly design guidelines.

2. METHOD

This study applies the Systematic Literature Review (SLR) method to map visual design elements that contribute to reading accessibility for children with dyslexia. The SLR approach was chosen because it is capable of synthesizing empirical findings in a systematic, transparent, and replicable manner, particularly on multidisciplinary topics involving visual design, education, and cognitive psychology (Enco-Jáuregui et al., 2023). The SLR protocol in this study was developed by integrating the PICO (Population, Intervention, Comparison, Outcome) framework as a conceptual basis for formulating research questions, literature search strategies, and article selection and analysis processes. The literature sources used came from reputable international academic databases, namely Scopus, ScienceDirect (Elsevier), Taylor & Francis Online, SpringerLink, and Emerald Insight. The selection of these five databases was based on their reputation and broad multidisciplinary coverage, covering the fields of design, educational psychology, and dyslexia studies.

Within the PICO framework, Population (P) refers to children with dyslexia or reading difficulties, who are known to have impairments in visual and linguistic processing (Snowling, 2019; Shaywitz, 2003; Wery & Diliberto, 2017). Intervention (I) includes the application of visual design elements to reading materials, including typography, layout, color, and illustrations. Comparison (C) refers to conventional reading materials that are not specifically designed for the needs of dyslexic readers. Meanwhile, Outcome (O) focuses on readability, visual comfort, reading orientation, and text comprehension, which are key indicators of visual accessibility success (Rello & Baeza-Yates, 2016; Wilkins, 2003; Paivio, 1990). The integration of PICO into this SLR protocol ensures that each stage of the methodology directly supports the research objectives.

Table 1. PICO Framework

PICO Components	Description	Relevance to Research
Population (P)	Children with dyslexia	This population was selected because dyslexia is a specific learning disorder characterized by difficulties in word recognition, reading fluency, and text comprehension, even though individuals have adequate intelligence levels. In addition to phonological factors, neurocognitive research shows that children with dyslexia also experience differences in visual processing and visual-linguistic integration during reading (Snowling, 2019; Shaywitz, 2003; Pugh et al., 2013).
Intervention (I)	Customized visual design elements (typography, layout, color, illustrations)	The intervention focused on visual design elements that have been empirically reported to affect readability, reading orientation, and visual comfort for dyslexic readers (Rello & Baeza-Yates, 2016; Wilkins, 2003; Bigelow, 2019; Zorzi et al., 2012).
Comparison (C)	Conventional reading material design without special adjustments	Conventional reading materials generally use standard text configurations without considering the visual needs of dyslexic readers. Studies show that the use of standard fonts without adjustments, high text density, and suboptimal visual structure can increase reading anxiety and cognitive load (Kuster et al., 2018; Plakopiti & Bellou, 2019; Sweller, 2011).
Outcome (O)	Readability, visual comfort, and ease of reading	This outcome is used as the primary indicator of visual accessibility and serves as the basis for mapping SLR findings according to RQ1–RQ4. This indicator reflects how visual design affects reading performance, perceptual comfort, and cognitive processing during reading (Rello & Baeza-Yates, 2016; Wilkins, 2003; Rayner, 2009; Mayer & Moreno, 2003).

Based on Table 1 PICO, it can be concluded that the focus of this systematic literature review is consistently directed at the relationship between the characteristics of dyslexic readers and the application of visual design elements as a form of intervention. The research population (P) confirms that reading difficulties in dyslexia do not only stem from linguistic aspects but are also closely related to visual processing and spatial attention, making visual design a relevant factor to examine. Intervention (I) in the form of typography, layout, color, contrast, and illustrations is positioned as a design strategy that has the potential to reduce visual barriers such as crowding and cognitive load, especially when considering Comparison (C), which compares conventional reading materials that are not designed to be accessible. The targeted outcomes (O), namely readability, visual comfort, reading orientation, and text comprehension, provide a clear evaluative framework for assessing the effectiveness of visual design for dyslexic readers, as well as a basis for grouping research findings according to the research sub-questions (RQ1–RQ4) in the SLR results analysis.

From the PICO framework, this study formulated one main Research Question (RQ), which was broken down into sub-RQs, namely: (1) How does typography affect the readability of reading materials for children with dyslexia? (RQ1), (2) How does layout play a role in helping reading orientation and text comprehension? (RQ2), (3) How does the use of color and contrast affect visual comfort when reading? (RQ3), (4) How do illustrations contribute to reading comprehension without causing visual distractions? (RQ4). These four sub-RQs enable systematic mapping of SLR findings based on visual design elements and facilitate the development of evidence-based design guidelines (Rello & Baeza-Yates, 2016; Mayer, 2009; Bigelow, 2019). Furthermore, the literature search strategy was designed by adjusting the characteristics and scope of each database, so that the keywords used were not standardized but tailored

to the focus of the RQ and PICO. This approach aims to increase the relevance of search results while avoiding bias due to indexing system limitations (Enco-Jáuregui et al., 2023).

Table 2. Keyword Strategy for Database Searches

Database	Keyword Strategy	The Reason
ScienceDirect (Elsevier)	dyslexia AND (typography OR layout OR "visual presentation") AND readability	These keywords were selected because ScienceDirect contains many experimental studies related to typography, text configuration, and readability of reading materials (Rello et al., 2012; Plakopiti & Bellou, 2019; Tarasov et al., 2015)
SpringerLink	dyslexia AND (design OR typography OR layout) AND dyslexic readers	This strategy was used to identify studies linking visual design to dyslexic readers in the context of cognitive and educational contexts (Kuster et al., 2018; Verhoeven et al., 2011)
Taylor & Francis Online	dyslexia AND reading AND design	More general keywords used to capture cross-disciplinary studies discussing design and reading experience (Hejres & Tinker, 2022; Coggins, 2021)
Emerald Insight	dyslexia AND accessibility AND design	Emerald has strength in research accessibility and inclusive environments, so the keywords focus on visual accessibility visual accessibility (Watchorn et al., 2022; Lundh, 2021; Yamaguchi & Suzuki, 2022)
Scopus	(dyslexia AND ("visual design" OR typography OR layout OR "graphic design") AND (readability OR legibility OR accessibility))	This keyword combination is used to obtain a broad multidisciplinary coverage and strict indexing (Enco-Jáuregui et al., 2023).

The keyword strategy in Table 2 was systematically developed with reference to the PICO framework and research question formulation. The term dyslexia was used as the main keyword to represent the population, while keyword variations related to typography, layout, color, visual design, and accessibility reflected the intervention components explored in RQ1–RQ4. The differences in keyword formulation in each database were adjusted to the indexing characteristics and disciplinary focus of each platform, enabling a more comprehensive and relevant literature search. This approach aimed to minimize the risk of search bias and ensure that the identified studies covered cross-disciplinary perspectives, including visual design, education, and reading accessibility for dyslexic readers.

Table 3. Inclusion Criteria and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Articles published between 2010–2025.	Articles published before outside 2010-2025.
Articles discussing the impact or effectiveness of visual design elements (*typography, layout, color*, illustration, or related aspects) on readability and visual comfort for dyslexic children.	Duplicate studies retrieved from multiple databases or document types other than research papers (e.g., reports, editorials, book chapters).
Articles that are peer-reviewed and can be accessed in full text.	Articles written in languages other than English

Table 3 discusses the inclusion and exclusion criteria in this study, which were formulated to ensure the relevance, quality, and consistency of the findings analyzed. The publication year range of 2010–2026 was set to ensure that the included studies reflect the latest developments in dyslexia research, visual design, and evidence-based accessibility approaches (Enco-Jáuregui et al., 2023). The focus on peer-reviewed journal articles with full-text access aims to maintain scientific validity and enable in-depth methodological analysis of research findings, particularly regarding typography, layout, color, and illustrations as elements of visual design (Rello & Baeza-Yates, 2016; Tarasov et al., 2015; Bigelow, 2019). Articles that did not directly discuss the relationship between visual design and readability or visual comfort for dyslexic readers were excluded to maintain the focus of the study. In addition, English-language publications were selected to avoid differences in the interpretation of key terms and concepts, as well as to maintain consistency in the analysis between studies. Thus, these criteria serve as a filtering tool that helps ensure that the analyzed literature provides relevant and meaningful contributions to the mapping of visual design elements in the context of reading accessibility for individuals with dyslexia.

Figure 1 shows the article selection flow using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach, which was applied in stages in this study. At the identification stage, literature searches were conducted through five major databases, namely Scopus, Emerald Insight, Taylor & Francis Online, SpringerLink, and ScienceDirect, with a total of 12,012 articles. This number reflects the breadth of studies related to dyslexia, visual design, and reading accessibility.

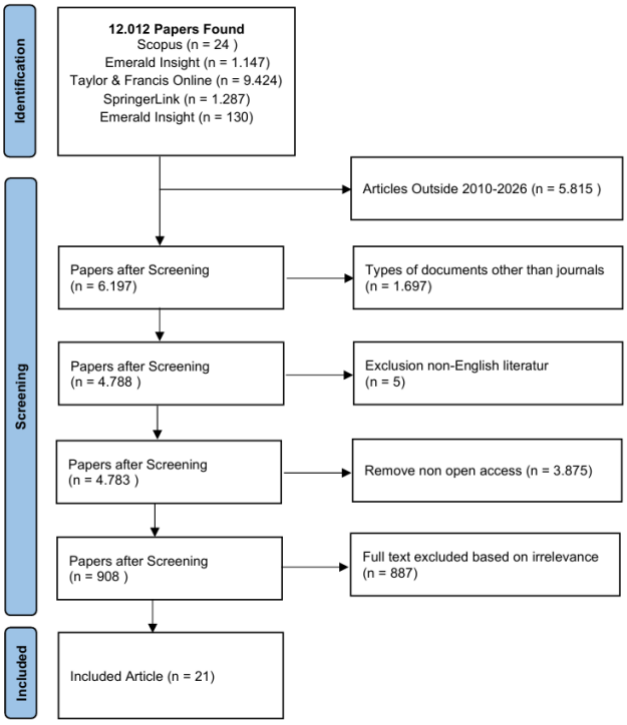

Figure 1. SLR Process With PRISMA

In the initial screening stage of Figure 1, 5,815 articles were excluded because they were outside the specified publication year range (2010–2025). From the remaining articles, screening was carried out based on document type, resulting in the elimination of 1,697 non-scientific journal publications (such as proceedings, reports, editorials, and book chapters). Further screening was conducted based on the language of publication, excluding 5 articles that were not written in English. In addition, 3,875 articles that were not accessible in open-access form were also excluded to ensure the accessibility and completeness of

the full-text analysis. At the eligibility stage, 908 articles successfully entered the full-text review process. However, after an in- depth evaluation of the suitability of the topic, research focus, and contribution to the discussion of visual design elements in the context of readability and visual comfort for dyslexic readers, 887 articles were deemed irrelevant and excluded from the study. Finally, at the inclusion stage, 21 articles met all inclusion criteria and were deemed eligible for further analysis in this Systematic Literature Review. These selected articles then became the basis for mapping visual design elements, including typography, layout, color, and illustration, as well as for compiling evidence-based design guidelines to support reading accessibility for individuals with dyslexia. The article selection process was carried out in stages, starting with screening the titles and abstracts, followed by reading the full text. The results of the article screening in each database are shown in Table 4.

Table 4. Article Screening Result

Database	Article	Article after screening
ScienceDirect (Elsevier)	130	6
SpringerLink	1.287	2
Taylor & Francis Online	9.424	5
Emerald Insight	1.147	6
Scopus	24	2

Table 4 summarizes the results of the article screening process from the five main databases used in this study. Of the total number of articles initially identified, only a small number of articles met the inclusion criteria after undergoing multiple screening stages, including topic relevance, publication year range, document type, language, and full-text access. The significant reduction in the number of articles shows that studies specifically discussing the relationship between visual design elements and reading accessibility for children with dyslexia are still relatively limited. The selected articles were analyzed through a structured data extraction process, covering the research context, methods, visual design elements studied, and key findings related to readability and visual comfort. The data were then synthesized qualitatively and mapped into four main categories, namely typography, layout, color, and illustration, in accordance with RQ1–RQ4. This thematic synthesis approach enabled the identification of consistent patterns of findings and formed the basis for the development of evidence-based visual design guidelines (Chang & Xu, 2020; Paivio, 1990; Mayer & Moreno, 2003).

3. FINDINGS AND DISCUSSION

3.1 Findings

Based on a systematic selection process, 21 articles were deemed relevant and analyzed further. These articles cover various contexts, ranging from reading material design and digital accessibility to perceptual and cognitive aspects that influence the reading experience of individuals with dyslexia. To provide an initial overview of the characteristics of the studies analyzed, Table V presents a summary of the articles based on author, year of publication, and category of visual design elements discussed.

Table 5. Summary of Selected Articles Based on Visual Design Elements

Author(s)	Title	Visual Design Element Category	Main Points/Key Findings
Enco-Jáuregui et al. (2023)	Web accessibility for people with dyslexia: A systematic literature review	Typography, Layout, Color	- There is no single "correct" font for dyslexia - Spacing, layout structure, and visual

			contrast are more influential than special fonts -Accessibility principles should be based on user flexibility
Ikeshita et al. (2020)	Effects of highlighting text on the reading ability of children withdevelopmental dyslexia: A pilot study	Color, Typography	Highlighting certain text can improve reading accuracy, but excessive use of color has the potential to increase visual load and anxiety.
Watchorn et al. (2022)	"A calm space to reset": perceptions of sensory rooms in Australian public buildings	Color, Visual Comfort	A calm visual environment with soft colors aids sensory regulation; relevant for the design of reading materials that avoid visual overstimulation.
Tomczak (2021)	How can the work environment be redesigned to enhance the well-being of individuals with autism?	Layout, Visual Environment	Simple layout and visual consistency enhance comfort and focus; implications for the design of inclusive reading pages inclusive page design.
Lundh (2021)	"I can read, I just can't see": a disability rights-based perspective on reading by listening	Layout, Alternative Access	- Reading barriers are not always linguistic - Poor visual access leads to exclusion - Visual design determines access to text
Tattersall Wallin (2020)	Audiobook routines: identifying everyday reading by listening practices amongst young adults	Layout, Media Format	- Reading is not always visual-based - Visual material should support audio integration - Simple visuals help with the transition text–audio
Yamaguchi & Suzuki (2022)	An accessible STEM editor customizable for various local languages	Typography, Layout	- A flexible system improves accessibility - Users need control over text size and spacing - Personalization principles are relevant for reading books
Ball & Kashoob (2019)	Visual processing skill barriers in students with Arabic as a first language	Typography, Visual Processing	- The complexity of letter shapes increases reading errors - Spacing between characters plays an important role - Visual crowding is a major issue
Hejres & Tinker (2022)	Exploring dyslexic readers' perceptions of dyslexia-friendly Arabic typeface: a focus group study	Typography	- Readers' perceptions are more important than claims about special fonts - Readability is influenced by familiarity and simplicity of form - Special fonts are not always superior
Coggins (2021)	Righting Reading in Middle School: Readable English Helps Underperforming Adolescent Readers	Typography, Layout	- Visual simplification improves reading performance - Clean layouts help struggling readers - Visual consistency boosts confidence

Zhang (2022)	One Site for All: Using Universal Design Principles to Create an Inclusive Law Library Website for Neurodivergent Students	Layout, Accessibility	- Visual hierarchy facilitates navigation - Inclusive design is not one size fits all
Timke (2021)	The ABILITY to Represent Respectfully: Chet Cooper and the Fight for Disability Media Inclusion	Illustration, Visual Representation	- Visual representation influences the sense of inclusion - Visuals must respect diversity of abilities - Visual ethics are relevant in educational design
Melin (2020)	Academic knowing in/through double perspectives	Visual Framing, Cognitive Perspective	- Learning is influenced by visual experiences - Visuals can support or hinder understanding - Design must consider the user's perspective
Kuster et al. (2018)	Dyslexie font does not benefit reading in children with or without dyslexia	Typography	Special dyslexia fonts do not always improve reading performance; spacing and size are more influential factors.
Verhoeven et al. (2011)	Cognitive and linguistic factors in reading acquisition	Reading Cognition	- Reading is a multidimensional process - Visual load affects cognitive processing - Visual clarity supports decoding
Rello et al. (2012)	A mobile application for displaying more accessible eBooks for people with dyslexia	Typography, Layout	- Visual simplicity improves focus - Visual elements should be relevant to the reading task - Overdesign reduces effectiveness
Rello (2014)	Design of word exercises for children with dyslexia	Typography	- Visual simplicity improves focus - Visual elements should be relevant to the reading task - Overdesign reduces effectiveness
Plakopiti & Bellou (2019)	Text configuration and the impact of anxiety on pupils with dyslexia	Layout, Typography	- Layout affects reading anxiety - Dense text increases stress - White space is important for comfort
Tarasov et al. (2015)	Legibility of textbooks: A literature review	Typography, Layout	- Legibility is influenced by a combination of visual elements - Book standards often ignore special needs - Research-based visual guidelines are needed
Bigelow (2019)	Typeface features and legibility research	Typography	Characteristics of letterforms determine the level of legibility across reader groups.
Veszeli & Shepherd (2018)	A comparison of the effects of the colour and size of coloured overlays on young children's reading	Color	- Certain colors reduce visual stress - Color response is individual - Flexibility in color choice is recommended

Table 5 shows that most studies focus on typography and layout, while color elements and illustrations are relatively less discussed in detail. These findings reveal an imbalance in research focus, which reinforces the urgency of systematically mapping all elements of visual design in the context of dyslexia. Based on Research Questions (RQ1–RQ4), the articles in the Systematic Literature Review results are mapped according to visual design elements and their contribution to the readability and visual comfort of reading materials for children with dyslexia. Cross-study mapping of the SLR results shows that typography and layout are the most dominant visual elements discussed in relation to the readability of reading materials for children with dyslexia, thus directly answering RQ 1 and RQ 2. Experimental and system development studies confirm that character shape, text size, spacing, and page structure affect the ease of visual processing and reading orientation. Several studies emphasize that overly decorative fonts or dense text arrangements can increase visual load and reading anxiety, while simpler and more consistent text arrangements support reading fluency (Ikeshita et al., 2020; Hejres & Tinker, 2022; Kuster et al., 2018; Rello et al., 2012; Plakopiti & Bellou, 2019; Tarasov et al., 2015; Bigelow, 2019). In addition, studies on digital accessibility and learning media show that structured and predictable layouts help dyslexic readers maintain focus and understand the flow of information, both in print and digital media (Enco-Jáuregui et al., 2023; Yamaguchi & Suzuki, 2022; Zhang, 2022).

Meanwhile, color, contrast, and illustrations emerged as supporting elements that played an important role in answering RQ 3 and RQ 4, particularly in relation to visual comfort and reading comprehension. A number of studies report that uncontrolled use of color and text highlighting can cause visual fatigue, while the selection of softer background colors and moderate contrast tends to increase reading comfort (Ikeshita et al., 2020; Veszeli & Shepherd, 2018). In the context of illustrations and non-text visual elements, research shows that illustrations can aid comprehension when they are directly related to the text content and do not dominate the reader's visual attention (Lundh, 2021; Tattersall Wallin, 2020; Ball & Kashoob, 2019; Timke, 2021). However, illustrations that are too complex or decorative have the potential to be distracting, especially for readers with visual processing limitations. Overall, this mapping confirms that the four elements of visual design typography, layout, color, and illustration need to be designed in an integrated manner in order to effectively and contextually support reading accessibility for children with dyslexia.

Cross-study findings in this SLR indicate that design implications for inclusive reading materials for children with dyslexia need to focus on managing visual elements that can reduce cognitive load while improving readability and visual comfort. In terms of typography and Layout, inclusive reading design needs to prioritize simple fonts, adequate text size, and consistent spacing and page structure. Various studies confirm that the visual characteristics of text including letter spacing, line length, and clarity of information hierarchy directly affect the ease of visual processing and reading orientation for readers with dyslexia (Ikeshita et al., 2020; Hejres & Tinker, 2022; Kuster et al., 2018; Rello et al., 2012; Plakopiti & Bellou, 2019; Tarasov et al., 2015; Bigelow, 2019). Therefore, the design implications that can be drawn are the need for a visual approach that prioritizes clarity, regularity, and predictability of layout, both in print and digital media, as also emphasized in system- and interface-based accessibility studies (Enco-Jáuregui et al., 2023; Yamaguchi & Suzuki, 2022; Zhang, 2022).

In addition to text elements, the SLR results confirm that color and illustrations function as supporting elements that must be carefully designed to avoid causing visual distractions. The use of soft background colors with moderate contrast and limited text highlighting has been shown to improve visual comfort, while overly strong color combinations or extreme contrasts have the potential to increase visual fatigue when reading (Ikeshita et al., 2020; Veszeli & Shepherd, 2018). In the context of illustrations, the design implication that emerges is the importance of ensuring a direct link between illustrations and text content, so that illustrations serve as a tool for understanding, not merely as decorative elements (Lundh, 2021; Tattersall Wallin, 2020; Ball & Kashoob, 2019; Timke, 2021). Overall, the design implications of this study

emphasize that inclusive reading materials for children with dyslexia need to be designed through the balanced, contextual, and reader-centered integration of typography, layout, color, and illustrations, as a basis for developing more accessible and applicable visual design guidelines in inclusive education practices.

Based on the results of cross-study mapping and synthesis of findings from selected articles, this study formulates a set of visual design guidelines that focus on improving readability and visual comfort for children with dyslexia. These guidelines are compiled by integrating empirical findings from various design contexts, both print and digital media, and linking them directly to Research Questions (RQ 1–RQ 4). Each segment of the guidelines represents the contribution of key and supporting visual design elements that are consistently reported in the literature as factors that influence the reading experience of dyslexic readers. Thus, the following table serves as an operational synthesis that bridges the results of the SLR with applicable design implications.

Table 6. Visual Design Guideline for Dyslexia Friendly Reading Materials

Typography
(RQ 1 – The Influence of Typography on Readability)

Aspect	Design Guideline	SLR-Based Rationale	Reference
Font Type	Use a simple sans-serif font with clear, non-decorative letterforms (e.g., Arial, Verdana, Open Sans)	The perception of dyslexic readers shows a preference for stable, consistent, and visually distinguishable letterforms; decorative fonts increase cognitive load	(Hejres & Tinker, 2022; Coggins, 2021; Kuster et al., 2018; Bigelow, 2019)
Dyslexia-Specific Fonts	It is not mandatory to use dyslexia-friendly fonts as the sole solution	Empirical studies show that dyslexia fonts do not always improve reading speed or accuracy compared to standard fonts that are well-designed	(Kuster et al., 2018; Tarasov et al., 2015)
Text Size	Minimum text size of 12–14 pt for children, with flexibility for enlargement	Text size that is too small worsens visual processing and increases reading fatigue	(Ball & Kashoob, 2019; Coggins, 2021; Tarasov et al., 2015; Verhoeven et al., 2011)
Letter & Line Spacing	Use sufficient letter and line spacing (line spacing ≥1.4)	Adequate spacing helps with visual separation between words and lines, reducing the crowding effect	(Plakopiti & Bellou, 2019; Rello, 2014; Rello et al., 2012)
Avoided Typography	Avoid decorative, condensed, script, and complex serif fonts	Complex and tightly spaced letterforms increase visual confusion and reading anxiety	(Hejres & Tinker, 2022; Kuster et al., 2018; Plakopiti & Bellou, 2019; Bigelow, 2019)

Overall, typography is the most crucial element in supporting readability for readers with dyslexia because it is directly related to visual processing and spatial attention. Neurocognitive literature shows that reading difficulties in dyslexia are closely related to the crowding effect and visual attention limitations, rather than solely phonological disorders (Vidyasagar & Pammer, 2010; Zorzi et al., 2012). Therefore, it is recommended to use sans-serif fonts with simple and open shapes, such as Arial, Verdana, Helvetica, or Open Sans, with a minimum size of 12–14 pt for printed text and 16–18 px for digital screens, as well as +2–5% letter spacing and 1.4–1.6 line spacing. This approach is in line with findings that visually friendly typography settings have a greater effect on reading fluency than the use of "dyslexia-specific" fonts, the results of which are not always consistent (Bernard et al., 2003; Snowling, 2019; Wery & Diliberto, 2017).

Layout
(RQ 2 – Layout and Reading Orientation)

Aspect	Design Guideline	SLR-Based Rationale	Reference
Text Alignment	Use left alignment, avoid justified text	Justified text creates inconsistent spacing that is distracting reading orientation	(Enco-Jáuregui et al., 2023; Ball & Kashoob, 2019; Zhang, 2022; Plakopiti & Bellou, 2019)
Text Density	Avoid overly dense pages; use sufficient white space	Excessive visual density increases sensory load and reading fatigue	(Watchorn et al., 2022; Tomczak, 2021; Ball & Kashoob, 2019)
Page Structure	Layout simple, consistent, and predictable	A stable visual structure helps dyslexic readers maintain focus and information flow	(Enco-Jáuregui et al., 2023; Yamaguchi & Suzuki, 2022; Zhang, 2022; Melin, 2020)
Visual Navigation	Use headings clear, consistent visual hierarchy	Clear visual orientation supports content comprehension and reading navigation	(Yamaguchi & Suzuki, 2022; Zhang, 2022; Melin, 2020)

A structured and consistent layout plays an important role in helping readers with dyslexia orient themselves and reducing their cognitive load. Studies on eye movement show that shorter lines (50– 70 characters per line), sufficient line spacing, and left alignment (ragged-right) can improve fixation stability and reading fluency (Rayner, 2009; Schneps et al., 2013). Practical recommendations include the use of a single-column layout, generous margins (≥15–20 mm in printed books), and a clear visual hierarchy clear visual hierarchy between titles, subtitles, and text content. This principle is in line with cognitive load theory, which emphasizes the importance of simple and predictable visual structures so that readers' attention is focused on understanding the content, not on visual navigation of the page (Sweller, 2011)

Color and Contrast
(RQ 3 – Visual Comfort)

Aspect	Design Guideline	SLR-Based Rationale	Reference
Background Color	Use soft background colors (off-white, cream light, neutral pastels)	Environment visual that calm reduces sensory overstimulation	(Watchorn et al., 2022; Tomczak, 2021; Ball & Kashoob, 2019)
Text Contrast	Use moderate contrast; avoid extreme black-and-white	Extreme contrast can increase glare and visual fatigue	(Ikeshita et al., 2020; Veszeli & Shepherd, 2018)
Text Highlighting	Use highlighting sparingly and consistently	Excessive highlighting can distract focus and increase visual load	(Ikeshita et al., 2020; Rello, 2014; Rello et al., 2012)
Colors to Avoid	Avoid combinations of overly bright colors and high contrast	Aggressive colors may cause visual fatigue and distraction	(Watchorn et al., 2022; Tomczak, 2021; Veszeli & Shepherd, 2018)

The selection of appropriate colors and contrast contributes significantly to visual comfort and reading endurance for individuals with visual sensitivity. Research shows that extreme contrasts such as pure black on pure white (#000000 – #FFFFFF) can trigger visual stress in some dyslexic readers (Wilkins, 2003; Wilkins et al., 2007). Therefore, it is recommended to use soft and warm background colors such as light cream (#F5F5DC), light gray (#F2F2F2), or soft pastels, with dark gray or non- opaque black text colors (#333333–#1A1A1A). These findings are supported by visual perception studies showing that moderate contrast and non-white backgrounds can improve reading performance and reduce eye fatigue during prolonged reading (Chung, 2014; Chang & Xu, 2020).

Illustration
(RQ 4 – Illustrations and Reading Comprehension)

Aspect	Design Guideline	SLR-Based Rationale	Reference
Relevance of Illustrations	Illustrations must have a direct relationship with the text content	Contextual illustrations support understanding and meaning association	(Lundh, 2021; Tattersall Wallin, 2020; Ball & Kashoob, 2019)
Visual Complexity	Use simple illustrations and avoid excessive decoration	Use simple illustrations that are not overly decorative	(Ball & Kashoob, 2019; Timke, 2021)
The Function of Illustrations	Illustrations as support, not page domination	Non-text visual dominance distracts from reading focus	(Lundh, 2021; Tattersall Wallin, 2020; Timke, 2021)
Inclusive Representation	Illustrations need to represent diversity and inclusivity	Visual representation affects the psychological comfort of readers	(Timke, 2021; Melin, 2020)

Illustrations can serve as a support for reading comprehension if they are designed to be functional, relevant, and do not dominate visual attention. Based on dual coding theory, the integration of complementary text and visuals can strengthen conceptual understanding, as long as the illustrations have a direct relationship with the text content (Paivio, 1990). Practical recommendations include the use of simple illustrations, consistent styles, low contrast, and limited details, as well as placing illustrations close to the text they describe. This approach is in line with the principles of multimedia learning, which emphasize the removal of irrelevant visual elements to prevent increased cognitive load and distraction for readers with special visual processing needs (Mayer, 2009; Mayer & Moreno, 2003).

Visual Hierarchy and Information Structuring
(Supporting Elements Across RQ 1–RQ 4)

	Design Guideline	SLR-Based Rationale	Reference
Visual Hierarchy	Use a clear visual hierarchy through text size, headings, and spacing	A consistent hierarchy helps dyslexic readers understand the structure of information and the flow of reading	(Enco-Jáuregui et al., 2023; Yamaguchi & Suzuki, 2022; Zhang, 2022; Melin, 2020)
Information Emphasis	Use bold or simple icons for emphasis, not excessive color variations	Simple visual emphasis is easier to process than complex visual decoration	(Hejres & Tinker, 2022; Rello et al., 2012; Plakopiti & Bellou, 2019)

Content Segmentation	Divide text into small units (chunking)	Segmentation reduces cognitive load and improves reading comprehension	(Ball & Kashoob, 2019; Tarasov et al., 2015; Verhoeven et al., 2011)
Sensory Comfort & Visual Load Management (Visual Environmental Elements – Supporting RQ3)			
Aspect	**Design Guideline**	**SLR-Based Rationale**	**Reference**
Visual Load	Avoid excessive visual elements on a single page	Excessive sensory load increases visual fatigue and reading stress	(Watchorn et al., 2022; Tomczak, 2021; Ball & Kashoob, 2019)
Visual Rhythm	Use consistent and repetitive visual patterns	A stable visual rhythm creates a sense of security and focus	(Watchorn et al., 2022; Tomczak, 2021; Melin, 2020)
Visual Calm	Design supports a calm reading atmosphere	A calm visual environment has been shown to support well- being and concentration	(Watchorn et al., 2022; Tomczak, 2021)

Overall, these guidelines indicate that dyslexia-friendly reading design does not depend on a single visual element in isolation, but rather on the integrated use of typography, layout structure, color management, illustrations, and visual load management. These findings confirm that a consistent, simple, and structured design approach plays a key role in supporting reading accessibility, in line with empirical evidence from selected studies. Thus, the resulting guidelines not only serve as a summary of SLR findings but also as an evidence-based design framework that can be used by designers, educators, and reading material developers in designing inclusive reading media for children with dyslexia.

3.2 Discussion

The findings of this review indicate that dyslexia-friendly reading materials should be understood not only as a matter of visual preference but also as part of accessible literacy design. Across the reviewed studies, typography, spacing, layout simplicity, color contrast, and illustration use were repeatedly associated with readability, reading orientation, visual comfort, and comprehension. These findings are consistent with the principles of Universal Design for Learning (UDL), which emphasize providing flexible means of representation so that learners can access information in ways that reduce unnecessary barriers (CAST, 2018). In this context, dyslexia-friendly visual design can support inclusive literacy pedagogy by ensuring that reading materials are not designed only for typically developing readers but are also accessible for students who experience decoding, fluency, and visual processing difficulties.

The results also align with cognitive load theory, which suggests that learning materials should minimize extraneous cognitive load so that learners can allocate more mental resources to essential processing and comprehension (Sweller et al., 2019). Dense text blocks, inconsistent layouts, insufficient spacing, and distracting illustrations may increase unnecessary visual and cognitive demands for children with dyslexia. Conversely, the reviewed evidence suggests that adequate letter, word, and line spacing; clear text hierarchy; and simple page organization may reduce visual crowding and improve reading orientation. This supports earlier findings that increased spacing can improve reading performance for some dyslexic readers (Zorzi et al., 2012), although the effect may vary depending on age, language, orthography, and individual reading profiles.

Compared with previous systematic reviews and meta-analyses that focused mainly on phonological intervention, decoding instruction, or broader treatment effectiveness, this review confirms that visual design should be considered a complementary factor in reading accessibility rather than a replacement for

structured literacy instruction (Galuschka et al., 2014; Snowling, 2019). The findings also partly support design-focused studies showing that spacing and layout are more consistently helpful than dyslexia-specific fonts alone. For example, evidence questioning the universal benefit of specialized fonts indicates that accessible design should not rely solely on font selection (Kuster et al., 2018). Therefore, this review extends prior literature by integrating several design dimensions—typography, layout, color contrast, and illustrations—into a more comprehensive framework for reading material development.

The practical implications are relevant for textbook design, digital learning modules, and teacher-created materials. Textbook developers may use these findings to structure pages with consistent headings, sufficient spacing, moderate contrast, and limited decorative elements. Digital learning modules can apply similar principles through adjustable font size, spacing, contrast settings, and uncluttered screen layouts. For teachers, the findings suggest practical adaptations such as simplifying worksheets, avoiding dense paragraphs, using clear section divisions, selecting legible fonts, and ensuring that images directly support the text rather than distract from it. These adaptations are especially important in classroom literacy interventions because visual accessibility can help students engage more effectively with phonics, vocabulary, fluency, and comprehension activities.

However, the findings should be interpreted cautiously. The number of studies included in this review was limited, and the available evidence varied in design quality, participant characteristics, reading tasks, and outcome measures. Many studies were conducted in alphabetic and Western-language contexts, which may limit generalizability to languages with different orthographic depth, script systems, or classroom reading practices. In addition, relatively few studies examined the long-term classroom implementation of dyslexia-friendly design or tested visual design guidelines through controlled intervention studies. As a result, the proposed guidelines should be viewed as evidence-informed recommendations rather than definitive universal standards.

Overall, this review suggests that dyslexia-friendly visual design can contribute to more inclusive reading environments when combined with evidence-based literacy instruction. The most consistent evidence supports the use of adequate spacing, simple layouts, clear hierarchy, and moderate contrast, while color and illustrations appear beneficial when used selectively and purposefully. Future research should empirically validate these design guidelines in authentic classroom settings, across languages and cultures, and in both printed and digital learning materials.

4. CONCLUSION

This study concludes that visual design is a relevant accessibility factor in developing dyslexia-friendly reading materials for children. The main findings indicate that typography and layout are the most consistent elements supporting readability and reading orientation, particularly through adequate font spacing, line spacing, clear text hierarchy, and simple page organization. Color contrast and illustrations also appear to support visual comfort and comprehension when applied moderately, consistently, and without creating distraction. Based on these findings, the study proposes evidence-informed visual design guidelines that may assist teachers, designers, and publishers in developing textbooks, worksheets, classroom handouts, and digital learning materials that are more inclusive for children with dyslexia. However, this review has several limitations, including the limited number of selected studies, variation in research methods and outcome measures, possible cultural and language bias, and the limited availability of classroom-based intervention studies that empirically test the effectiveness of visual design guidelines. Therefore, future research should validate these guidelines through experimental and longitudinal studies in authentic classroom settings, across different languages, age groups, and learning contexts, as well as examine how teachers can practically integrate dyslexia-friendly design principles into curriculum materials and literacy interventions.

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