



Multimedia Learning in Enhancing Reading Abilities Among Dyslexia Students: A Review

Professional paper

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Abstract

Dyslexia is a neurological disorder that primarily affects reading abilities. It is usually known as a reading disorder; is one of the most significant problems among young learners. Reading disabilities in dyslexic learners affect poor performance in reading, spelling words, word comprehension, identifying words, and phonological decoding. On that note, Multimedia is an excellent and useful teaching tool for dyslexics who can engage in regular language activities to overcome their neurological learning deficit. The purpose of this paper is to review the use of multimedia applications and tools to enhance reading difficulties among dyslexic students. The paper further discusses findings from empirical studies, case studies, and review studies in psychology on aspects of dyslexia learning. This study aims to identify various multimedia tools, applications, teaching and learning methods, and approaches presenting themselves among readers with dyslexia in developing learning abilities. The review of the article showed that overall, there is an improvement in using multimedia tools and applications to enhance the ability to read for dyslexics.

Keywords: *Dyslexia, reading difficulties, multimedia applications and tools, multimedia learning*

Dyslexia is a type of learning disorder that includes a serious problem in reading ability that affects and impairs

a learner's language development and behaviour (Spafford & Grosser, 1996). Individuals with Dyslexia may experience

difficulty with reading due to a significant impairment of their reading ability, which can have a negative impact on their language development and behavioural patterns. This is due to the fact that they may become disoriented when given multiple language instructions simultaneously, as well as poor short-term memory, difficulty with directional instructions, and difficulty with reading (Reid, 2019). In India, Dyslexia is estimated to affect between 5% and 17% of school-age children. Reading, like other skills, is something that children learn and develop at their own speed. It is typical for students in schools to find reading difficult at some point. However, if learning to read becomes a continuing difficulty that causes an individual to fall behind in comparison to others, it is conceivable that they have dyslexia, a learning disorder (Snowling, 2013). The academic, social, psychological, physical, and employment challenges that these children will face in the future are a result of their learning difficulties. For young children, the long-term consequences of failing in school are particularly concerning.

In today's digital age, information is largely delivered in written form; thus, reading comprehension abilities are among the most crucial educational requirements in contemporary society. Reading literacy focuses on the word chain and understanding phrases that develop meaning (Snowling, 2013). Reading is a cognitive ability that involves factors such as interpreting, understanding, comprehending, and identifying word chains, as well as word processing. On that note, many factors of reading must be considered, especially during developmental stages and the beginning years of learning (Falahati et al., 2020). Students with specific learning disabilities, like dyslexia, are among those who require special education (Hallahan et al., 2013). In today's era, many researchers have conducted various research to look at the potential development of multimedia learning resources (Mayer, & Pilegard, 2005; Mayer & Fiorella, 2014). The definition of multimedia learning is learning from both verbal and visual information. In the teaching and learning process, multimedia is a collection of pictures, diagrams, graphics, animations, films, videos, and other components that incorporate both textual and visual information (Mayer &

Fiorella 2014). In many studies' empirical findings, educational researchers as well as educators have insufficient knowledge of how multimedia learning influences dyslexic learning. Knoop-van Campen (2022), in his dissertation, discusses multimedia learning and dyslexia and investigates the implications of using multimedia for learning disorders such as dyslexia. Campen investigated how multimedia can effectively help students develop their reading skills, especially among dyslexic students. Thus, the main objective of this review study is to examine original articles, empirical studies, case studies, and peer-reviewed articles on effectively helping dyslexia improve reading abilities using multimedia learning. The following objectives will be used in this paper:

- a) To understand difficulties in reading dyslexic students.
- b) To identify multimedia tools and applications for aiding dyslexic learners with reading abilities.
- c) To understand the effectiveness of multimedia learning among dyslexic students.

A. Importance of Reading

Reading is a language skill. Reading is a process of receiving input and converting information into language symbols in the form of words; it must be explicitly taught. Reading exercises include decoding, word recognition, understanding, and pronunciation (Cooter, 2019). Reading may include subskills such as extensive and intensive reading of symbol and word identification, sentence organisation, inferring, paraphrasing, and text comprehension (Jena, 2013). According to Cooter (2019), the following skills, ideas, and abilities have been identified as predicting reading among the students: (a) understanding of the alphabet; (b) phonological understanding, including phrases and words; (c) Rapid automatic naming (RAN) of letters or numbers, which refers to the ability to figure out and name an ordered sequence of letters; (d) rapid automatic naming (RAN) of things or colours, which refers to the ability to identify items and colours. According to the National Reading Panel, young readers learn five key elements: phonemic awareness, spelling, retention, the alphabet, terminology, and

fluency. There are numerous interconnected theories to help teachers understand how students read, such as behaviour theory (which focuses on texts such as letters, words, and sounds), cognitive learning theories (which focus on students' thinking processes), and social learning theories (which believe students have self-control while learning), (Galloway, 2008). Thus, the ability to read is an essential skill to learn at a young age.

B. Importance of Multimedia Learning

Multimedia is described as a cognitive theory of learning that is based on finite capacity and dual concepts (Mayer, 2003). According to the limits-capacity idea, human memory, or working memory, has a limited ability and can only comprehend a specific amount of information at a time. If processing needs are more than this capacity, there is cognitive overload, which limits the learning process (Baddeley, 2000). According to the dual-coding theory, working memory processes both auditory and visual information in different channels, each with unique capabilities. As a result, the learner can process more information at once when these two channels are merged, such as in a multimedia learning environment with both text (the visual channel) and narrative (the auditory channel). Working memory's visual and auditory channels may interact with multimedia that frequently consists of text, images, animations with narration, audio files, and other elements (Knoop-van Campen, 2022; Sweller, 2011). Thus, multimedia can act be an effective tool for enhancing reading skills among dyslexics.

C. Difficulties in Reading with Dyslexia

According to the International Dyslexia Association (2017), Dyslexia is a distinctive learning condition characterised by difficulties in spelling and reading abilities, word identification, and a loss of neurological language phonological components. The fundamental problems of children with dyslexia are a deficiency in sound symbol association (when learning to read), basic reading abilities (identification of phonetics and identifiers), still reading (level and accuracy), and spelling, as well as issues processing information. The information processing cycle is made up of three major components: input, cognition, and output.

Young learners with dyslexia may struggle with all three cycles (Reid, 2019). The most common difficulties that a dyslexic reader may face while attempting to read text are as follows:

- a) Difficulties with visual recognition: such as recognising and identifying words, letters, and numbers. The effect of visual congestion, a perceptual issue that refers to the interference of surrounding letters on the perception of target letters, also slows word identification (Schneps et al., 2013; Breznitz, & Meyler, 2003).
- b) Auditory impairment is difficulty comprehending the basic language sounds. Phonemic awareness refers to our capacity to process simple sounds; if your child struggles with this, they may have aural dyslexia or a related auditory processing issue (Breznitz, & Meyler, 2003).
- c) Phonological and orthographic difficulties appear as problems in identifying written letters, referred to as graphs, with their individual sounds (phonemes) and in relating language sounds to letters and words, resulting in naming delays (Zorzi et al., 2012).

Multimedia is an interactive learning technique that incorporates visual and auditory elements. Multimedia has the opportunity to reduce or eliminate a majority of the difficulties in reading abilities that dyslexics experience (Bolhasan, 2009). The use of text, colour, pictures, sounds, videos, animation, and graphics in multimedia may encourage students it's used to keep students engaged and entertained throughout the learning process. It's also used to teach and understand dyslexia (Ahmad et al., 2012).

D. Multimedia Learning with Dyslexia

The psychological study of multimedia learning is a way of teaching that looks at how learning can be improved by using text, pictures, moving pictures, or other multimedia materials or apps. It's also known as the "cognitive theory of multimedia learning" because it looks at how learning with multimedia can be improved. For example, it helps primary-level learners learn phonemic awareness and how to use English vocabulary, young learners, and adults with dyslexia. Multimedia can be used as a teaching resource for improving reading with the difficulties of phonemic awareness education, visual impairment,

and auditory difficulties. Multimedia incorporates video, audio, text, graphics, and animation to improve learning, particularly for dyslexic students. The following are some of the advantages of multimedia learning applications and tools for teaching and learning: (1) It assists in the conversion of abstract concepts into concrete content; (2) it may stimulate students' interest in learning; and (3) it can determine their level of learning. In numerous instances, multimedia promotes the process of psychological representation through words and images. They are designed to help students learn by providing tools that may be employed in demonstrations, lectures or laboratory learning, exercises, electronic learning, computer games, and augmented and virtual reality, allowing students to process information both audibly and visually. This includes learning tools and exercises based on the age and skill level of the learners (Beena, 2018).

Methodology

An in-depth review of the relevant literature is crucial to developing reading abilities with multimedia tools and applications among dyslexics. This study not only investigates related studies, but it also brings awareness to dyslexia among young learners and overcoming learning disabilities with multimedia resources. The literature review focuses on developing reading abilities, methodologies, research tools, applications, instruction, and strategies with a focus on multimedia. *Ahmad et al. (2012) conducted a study on developing reading for 7 to 8-year-old children using "Bijak Membaca", a multimedia application, applying a multisensory approach, and using the phonetic reading technique with appropriate multimedia features. The result of the study showed that multimedia applications showed a positive outcome among dyslexics who found them fascinating, user-friendly, appealing, valuable, and helpful. Balakrishnan et al. (2015) developed a mobile multimedia application tool to help dyslexic children develop literacy abilities. They developed a mobile multimedia app for smartphones and tablets that is compatible with both Android and iOS. The effectiveness of the multimedia application tool was tested using a semi-*

experimental approach. The participants in the study were 20 children with dyslexia. The results of the study showed that the mobile multimedia application developed by the researchers improved the reading skills of the participants when compared to the usual methods of instruction that teach dyslexic students literacy skills and improve their learning abilities. *Di Tore et al. (2014) presented a study on using the multimedia application "Madrigale", an educational-oriented action game, to educate dyslexics. The study participants range in age from 7-9. The study further says that 10% of children in society are affected by dyslexia and have difficulties reading. Following the introduction of the multimedia application, the study found that it was motivating, interactive, engaged in phonological education, and improved visual and spatial attention in dyslexic subjects of all ages. Osman et al. (2015) conducted a preliminary study that describes an "app" which is an educational multimedia app that offers information and videos on some of the best practices for performing reading therapy for dyslexia children. The app includes a content expert assessment, a methodological review by instructional materials experts, and a pilot study where several small flaws were identified in the app that were used to improve it. In the pilot study, a pre-test and a post-test were conducted with a randomised, non-randomized, placebo-controlled sample (n = 30). Participants were in their 4th semester as pre-service teachers for dyslexia. They completed two questionnaires (1) before and after they used the app, and (2) about their knowledge and belief in dyslexia reading interventions. The findings showed a significant increase in knowledge and belief in self-efficacy after therapy.*

Abtahi (2012) designed an interactive multimedia learning object (IMLO) for dyslexic youngsters. The objective of this research is to create an interactive multimedia learning object and evaluate how well it works for dyslexic kids. Methods of the study were qualitative. Children with dyslexia are the main subject of this essay. Three dyslexic kids who completed activities utilising the working model under discussion for a preliminary survey. This study demonstrates how the learning object helps dyslexic kids learn better once it passed accessibility testing. A prototype of a learning

object, observational charts, dialogues, and video recording were utilised as study methods. Playback observations have been made. Interviews with teachers were also conducted to get further information. The results of responses using IMLO were determined to be satisfactory. *In Kim et al. (2018), the study examined measuring students' eye movements.* The current study investigated how multimedia methods of instruction. Students with or without dyslexia experienced a decrease in the ability to retain and pass on knowledge when using text+picture or audio+picture. Only the text+picture condition separated the dyslexic group from the controls after correcting for verbal ability. When there was no written text (audio+picture), the dyslexic group retained the most information. The study used eye-tracking data, and when audio was used to supplement written information, the dyslexic group spent significantly more time looking at the picture. These findings indicate that students with dyslexia can benefit from multimedia instruction just as much as their peers, and that the impact of multimedia instruction strategies (text + picture, audio + picture, and text + audio + picture) on knowledge retention and transfer in learners with and without dyslexia is identical. After controlling for verbal ability, only the text + picture condition distinguished the dyslexic group from the controls. The dyslexic group's retention performance was best when there was no written text (audio + picture). When audio complemented written text, the dyslexic group spent much longer seeing the picture, according to eye-tracking data. As well as multimedia instruction, it can be modified to optimise instructional results. *Kumar (2019) conducted a comparative study on multimedia electronic storybooks vs. printed textbooks.* This study compared the effects of multimedia (experimental) and traditional print (control) instruction on reading comprehension among dyslexia students enrolled in government-run educational institutions (Chandigarh) in the fifth grade. 15 students (experimental group) were taught the multimedia approach while the remaining 15 (control) students (dyslexia) were taught the traditional approach (print text). The study concludes that there is a positive outcome that encourages and motivates children to use multimedia e-books. *The research of*

Akhundi (2021) focuses on the effectiveness of employing technology and multimedia in a smart classroom to improve students' reading problems, word comprehension, and word chain. They employed a quasi-experimental study, 34 male students with dyslexia from primary schools in Marand City were investigated. Where seventeen participants were selected at random for the experimental and control groups. For a year, the experimental group was taught 12 sessions in smart classrooms, with 90 minutes of each class every day. The data was assessed using an ANOVA test at the end of the academic year, and students from smart classrooms improved their reading disorders, phrase comprehension, and word understanding. *Sari et al. (2021) developed a study on interactive multimedia for young learners.* Interactive multimedia consists of pictures, animation in an electronic system with media and students. The study results show that 96% find multimedia feasible and effective. The study found that using interactive multimedia for young dyslexics is practicable, inclusive, and effective for reading. *Wang et al. (2018) show in their study how multimedia materials highlight the lack of research among dyslexics.* Thus, the study examined the college student's ability to recall and recognise information. The researchers used a multisensory instructional approach. Seventy-three students participated in the study. The study used multimedia, using pictures and screen text. The screen text and pictures used to facilitate the recall and recognition of learners. The findings of the study show an improvement in learners' recall and retention of learning outcomes.

Discussion

The purpose of this review paper is to investigate whether using multimedia tools, applications, instructions, and materials effectively enhances dyslexic reading abilities. After reviewing the relevant scientific articles, empirical studies, and survey studies, the findings of this study show that a significant amount of research articles are based on young adults affected by the dyslexic disorder of learning, indicating that researchers and educators believe it is crucial to identify and address the disorder like dyslexia from a young age to achieve better results in learning abilities. The

major problems that contribute to students' failure to fit into the educational system and educators' lack of understanding of students' cognitive disabilities in schools and colleges. On the other hand, it has come to light that there are several adaptive applications, tools, strategies, and technologies using multimedia that enhance the reading abilities of dyslexics. The previous studies also show that multimedia learning has a positive learning outcome that motivates, encourages, is interactive, and is engaging among dyslexic students. Thus, multimedia learning has a positive effect on learning environments, and educators and researchers should explore more multimedia tools and their applications in developing reading skills among dyslexics.

Implications for Future Research and Practice

The findings from this review have significant implications for future researchers and practitioners in the field of dyslexia education. Future research should build upon these results by:

1. **Longitudinal studies:** Conducting long-term studies to measure the sustained impact of multimedia interventions on the reading abilities of dyslexic students over multiple years. Recent work by Staels and Van den Broeck (2015) demonstrates the importance of tracking reading fluency development over extended periods to accurately assess intervention efficacy.
2. **Cross-cultural applications:** Investigating how multimedia tools can be adapted for diverse cultural and linguistic contexts, particularly in multilingual settings where dyslexic learners face additional challenges. Pham and Nguyen (2020) highlighted that culturally responsive multimedia interventions produce significantly better results compared to generic approaches, especially in non-Western educational contexts.
3. **Integration with existing curricula:** Researching effective methods to integrate multimedia learning tools within traditional educational frameworks without disrupting established pedagogical practices. As noted by Cidrim and Madeiro (2017), successful integration requires alignment with core curriculum standards while maintaining the specialized adaptations needed by dyslexic learners.
4. **Personalized approaches:** Developing adaptive multimedia systems that can automatically adjust to individual learning profiles based on specific dyslexia manifestations and severity. Tzikopoulos et al. (2022) demonstrated that AI-driven personalization in multimedia applications resulted in 32% greater improvement in reading fluency compared to static multimedia tools.
5. **Teacher training models:** Creating evidence-based training protocols for educators to effectively implement multimedia interventions in both mainstream and special education settings. Björn et al. (2018) found that teacher self-efficacy in using multimedia tools was directly correlated with student reading improvement, emphasizing the need for robust professional development.
6. **Virtual and augmented reality applications:** Exploring immersive technologies for dyslexia intervention, which shows particular promise for engagement and motivation. According to Kalyvioti and Mikropoulos (2020), VR-based reading interventions demonstrated exceptional potential for improving visual attention and reading speed among adolescents with dyslexia.
7. **Mobile learning opportunities:** Expanding research on mobile literacy applications specifically designed for dyslexic learners. Ahmed et al. (2018) found that dedicated mobile applications providing structured, multisensory reading practice significantly improved word recognition skills when used consistently.

These research directions would enrich the existing literature by addressing current gaps in our understanding of how multimedia interventions can be optimized, scaled, and sustained in educational environments. The promising results from current studies suggest that multimedia approaches could fundamentally transform reading instruction for dyslexic learners, potentially reducing educational disparities and improving long-term outcomes. For practitioners, these findings offer practical guidance for immediate

implementation in classrooms and therapy settings. A systematic review by Jamshidifarsani et al. (2019) spanning 42 studies confirmed consistently positive outcomes across digital interventions for dyslexia. This validation supports investment in multimedia resources as an evidence-based approach to supporting dyslexic readers. García-Redondo et al. (2019) further demonstrated that properly designed multimedia tools can simultaneously address multiple learning modalities, reducing cognitive load while enhancing engagement and retention – precisely the areas where dyslexic learners typically struggle. Additionally, Lauricella et al. (2023) found that multimedia approaches that incorporate gamification elements showed remarkable improvements in student motivation and time-on-task, critical factors for sustained progress in reading development.

Recommendation

The future of multimedia learning for dyslexic students demands an innovative approach that integrates technological capabilities with educational understanding. Researchers must develop interdisciplinary frameworks that combine insights from cognitive neuroscience, educational technology, and psychology to create adaptive learning solutions addressing the unique challenges of dyslexic learners. Central to future research is the development of AI-driven multimedia platforms capable of personalized, intelligent interventions. These technologies should dynamically adapt to individual cognitive processing, transforming learning experiences from static to responsive. The goal is to create tools that enhance cognitive capabilities beyond traditional learning methods. Technological innovation must be paired with sophisticated pedagogical strategies. Educators need comprehensive professional development focusing on understanding how multimedia interventions can effectively support dyslexic learning. Ethical design principles must ensure these tools are universally accessible, inclusive, and culturally responsive. The research must adopt a global perspective, developing standardized assessment methodologies and conducting cross-cultural studies. Longitudinal research will be critical in understanding how multimedia interventions

support cognitive development and academic success. Ultimately, these recommendations aim to transform multimedia learning from a supplementary tool to a core component of specialized educational support, creating responsive learning environments that empower dyslexic students to reach their full potential.

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