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AI as an Inclusive Tool for Persons with Dyslexia in Education

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Abstract: Dyslexia is a reading, writing, and learning problem that affects 5-10 % of the population worldwide. Assistive technologies (AT) are supportive tools that improve learning outcomes and make an inclusive classroom. This paper focuses on finding different AI tools that could be beneficial for persons with dyslexia in engaging them effectively in the teaching-learning process and the limitations of ATs that may need future consideration. This paper uses a qualitative approach, collecting data from literature reviews and some special educator's opinions. The findings will be discussed throughout the paper.

Key words: Dyslexia, assistive technology (AT), AI tools, reading aids, inclusive education, learning tools, educational technology, digital accessibility, learning disabilities.

1. Introduction:

Dyslexia is a neurological condition that affects around 10% of the worldwide population. Despite individuals with Dyslexia often having average or above-average intelligence, they struggle significantly with reading, writing, and spelling. "Dyslexia is a common type of learning disability, affecting 3 to 15% of school-age children. Individuals with dyslexia have specific impairments in the development of expert reading skills. Dyslexia is characterized by difficulties with correct and/or fluent word recognition and poor spelling and decoding abilities. Individuals with dyslexia have been shown to have differences in functional brain imaging compared to non-dyslexic individuals, for example, reduced neural adaptation to repetitive stimuli. Children with dyslexia can have other specific learning deficits, low self-confidence, anxiety, and depression." (Barua et al., 2022).Recent studies demonstrate that up to 20% of the worldwide population may have a SLD and that dyslexia is the most common among them. Despite this, the phenomenon has only gained attention in the last decade. For example, almost 7000 scientific papers, indexed in Web of Science, addressed the topic of dyslexia since 2013, and approximately the same number addressed it in the previous 20 years, namely in a double time span. Although, as mentioned above, dyslexia is associated with issues related to reading, as a direct consequence, people also experience difficulties comprehending and memorizing concepts and taking notes during lessons. It is thus clear that specific and effective support interventions are needed to ensure equal opportunities for dyslexic students. Traditional methods of teaching-learning process for persons with dyslexia typically depend on trained human recourses, which can be both costly and time-consuming. In response to these challenges, a growing interest has been in leveraging technology to assist individuals with dyslexia. Advanced AI tools for dyslexia offer personalized and efficient solutions, including text-to-speech and vice-versa applications. These technologies provide support, helping individuals with Dyslexia overcome their difficulties more effectively, enabling them to overcome barriers and reach their educational and personal goals. "Our study revealed the Augmenta11y -

application's effectiveness in assisting dyslexic children by providing affordable and accessible reading practices. We offer comprehensive suggestions and guidelines for designing future assisted reading applications. We foresee the opportunity for Augmenta11y to be an accessible, low-cost assistive reading solution for dyslexic children with little to no access to educational specialists or after-school practices / programs. The Augmenta11y application is available on iOS and android" (Gupta et al., 2021).

Dyslexia is a neurodevelopmental condition characterised by persistent difficulties in reading accuracy, fluency, spelling, and decoding, despite average or above-average intelligence. It is one of the most prevalent specific learning disabilities worldwide (Barua et al.) Learners with dyslexia often experience secondary challenges such as reduced academic self-esteem, anxiety, and disengagement from formal education. Inclusive education frameworks therefore emphasise the need for targeted interventions that address diverse learning needs.

Traditional support for dyslexia relies heavily on specialised human resources, structured remediation programmes, and individualised instruction. However, such approaches are often resource-intensive and unevenly available, particularly in low-income or rural contexts. Recent advances in artificial intelligence have enabled the development of assistive technologies capable of providing personalised, adaptive, and scalable learning support. AI-based tools such as text-to-speech systems, intelligent writing assistants, and adaptive reading platforms offer new possibilities for enhancing accessibility and learner independence. This study empirically examines selected AI-based assistive tools to assess their potential contribution to inclusive education for persons with dyslexia. AI tools may be very useful in establishing an inclusive environment for people with Dyslexia. Approximately 10% of individuals worldwide suffer from this problem. There are several assistive technologies available to assist people overcome these obstacles. Thus, this paper contributes to understanding the three main AI tools, assistive technology, their features, and the implementation method for creating a successful inclusive classroom. It also finds the best, most affordable, and most accessible AI tools for persons with dyslexia.

2. Objective of the study
The study was guided by the following objectives:

2.1. To identify AI-based assistive technologies commonly used to support learners with dyslexia.

2.2. To analyze the educational benefits of selected AI tools in improving reading and writing skills.

2.3. To examine the challenges and limitations associated with the use of AI-based assistive technologies in inclusive educational settings.

3. Methodology
This study employed a qualitative exploratory research design. Data were collected from three sources: (a) a systematic review of peer-reviewed journal articles and conference proceedings published between 2013 and 2024; (b) structured analysis of web-based and mobile AI assistive tools designed for dyslexic learners; and (c) expert consultation with twenty special educators with professional experience in inclusive and special education. The selection of AI tools was based on explicit criteria, including accessibility, relevance to

literacy support, affordability, and representation in existing scholarly literature. The collected data were analysed thematically to identify recurring patterns related to educational benefits, usability, and challenges.

4. Data collection methods

Data on assistive technology for Dyslexia were gathered via document analysis of current literature and web resources and discussions with twenty special educators.

4.1. Systematic Literature Review on Artificial Intelligence–Based Assistive Technologies for Learners with Dyslexia

Dyslexia is one of the most prevalent specific learning disabilities, primarily affecting reading, writing, and spelling skills across the lifespan. With the rapid advancement of artificial intelligence (AI), assistive technologies (ATs) have increasingly been adopted to support learners with dyslexia by enhancing accessibility, personalization, and learner autonomy. A growing body of research has explored AI-enabled tools such as text-to-speech systems, speech-to-text applications, conversational AI, and machine learning–based personalization frameworks. This systematic literature review synthesizes existing empirical and conceptual studies to examine how AI-based assistive technologies support learners with dyslexia, their educational benefits, limitations, and implications for inclusive education.This systematic literature review followed established guidelines for qualitative synthesis. Peer-reviewed journal articles, conference proceedings, and scholarly book chapters published between 2013 and 2024 were identified through academic databases such as Scopus, Web of Science, SpringerLink, Taylor & Francis Online, and Google Scholar. Keywords used for the search included dyslexia, artificial intelligence, assistive technology, inclusive education, machine learning, text-to-speech, and conversational AI. Studies were included if they (a) focused on dyslexia or learning disabilities, (b) examined AI-based or digital assistive technologies, and (c) reported educational, cognitive, or usability outcomes. After screening abstracts and full texts, relevant studies were thematically analysed and categorised.

4.1.1. AI-Based Assistive Technologies for Dyslexia
Text-to-Speech and Speech-to-Text Technologies

Text-to-speech (TTS) and speech-to-text (STT) systems are among the most widely researched assistive technologies for learners with dyslexia. Longitudinal evidence suggests that such tools support written language development and reading comprehension when integrated into academic contexts (Almgren Bäck et al., 2024). Similarly, Wang et al. (2022) demonstrated that AI-driven augmentative and alternative communication systems can enhance reading accuracy and spelling performance by reducing cognitive load and enabling multimodal interaction. These findings highlight the role of AI-based auditory scaffolding in improving literacy outcomes.

4.1.2. Conversational AI and Writing Support Tools

Recent studies have explored conversational AI tools, including large language models, as writing and comprehension aids for individuals with dyslexia. Botchu et al. (2024) argued that tools such as ChatGPT can empower learners with dyslexia by assisting with idea generation, sentence structuring, and language correction, provided ethical and

pedagogical safeguards are maintained. Ogunlade et al. (2023) further reported that conversational AI tools improved reading and spelling skills among dyslexic learners in Nigerian schools, indicating potential applicability across diverse educational contexts.

4.1.3. AI-Based Reading Applications and Mobile Tools

Several studies have focused on the design and evaluation of AI-powered reading applications. Gupta et al. (2021) evaluated a mobile reading assistant for children with dyslexia and found improvements in engagement and reading confidence. Such tools often combine optical character recognition, TTS, and adaptive feedback mechanisms. However, the effectiveness of these applications depends heavily on usability, contextual support, and sustained access.

4.1.4. Benefits of AI-Based Assistive Technologies

Across studies, AI-based assistive technologies were found to enhance reading fluency, writing accuracy, learner independence, and self-confidence. Barua et al. (2022) noted that AI-enabled personalized tools can adapt to learners' cognitive profiles, thereby supporting inclusive educational practices.

4.1.5. Challenges and Limitations

Despite their potential, several challenges persist. High costs, limited digital infrastructure, and lack of teacher training restrict widespread adoption, particularly in low-resource settings. Over-reliance on AI tools may also hinder the development of foundational literacy skills if not pedagogically guided (Botchu et al., 2024). Additionally, ethical concerns related to data privacy, algorithmic bias, and transparency require careful consideration.

The review reveals a need for more **longitudinal and experimental studies** examining learning outcomes over time. While many studies report positive perceptions and short-term gains, empirical evidence on sustained academic impact remains limited. Future research should focus on large-scale implementations, cross-cultural contexts, and teacher-mediated integration of AI tools to strengthen inclusive education practices.

This systematic literature review demonstrates that AI-based assistive technologies hold significant promise for supporting learners with dyslexia across educational levels. Tools such as TTS, conversational AI, and machine learning–based personalization frameworks contribute to improved accessibility, learner engagement, and academic performance. However, effective implementation requires pedagogical alignment, ethical safeguards, and institutional support. The findings underscore the importance of evidence-based integration of AI to advance inclusive education for learners with dyslexia.

5. Results and findings

The analysis revealed that AI-based assistive technologies play a supportive role in enhancing reading fluency, writing accuracy, and learner autonomy among persons with dyslexia. Three AI tools were identified as representative examples due to their functionality and accessibility. The findings suggest that these tools reduce cognitive load, support independent learning, and increase learner confidence. However, effectiveness varies depending on contextual factors such as pedagogical guidance, digital literacy, and access to resources. The findings align with earlier studies highlighting the potential of

AI-driven assistive technologies in inclusive education (Smith & Hattingh, 2020; Panjwani-Charania & Zhai, 2023). While AI tools provide valuable scaffolding for learners with dyslexia, their role should remain supplementary rather than substitutive. Excessive dependence on AI may hinder the development of foundational literacy skills. Moreover, socio-economic disparities continue to limit equitable access to such technologies. Therefore, institutional support, educator training, and ethical guidelines are essential for effective implementation.

Three AI tools for Dyslexia

Here's a brief overview of each assistive technology, along with a user manual:

1. Dyslexia Buddy (specially designed for persons with Dyslexia):
Dyslexia Buddy is a Premium with realistic voices and an AI tutor specially designed for persons with Dyslexia. Trusted by 5,000+ families worldwide to read better, research has identified that kids have found the app helpful. Dyslexia Buddy is a mobile app designed to assist individuals with Dyslexia, reading difficulties, and learning disabilities.

Key Features of Dyslexia Buddy
Scan and Read Instantly
Use camera to scan text or multiple pages, Instant Detection: Scans pages in seconds. Works offline, no internet connection required.

Read and Listen with Enhanced Tools
Customize your reading experience with dyslexia-friendly fonts, background colors, and adjustable letter spacing. Word-by-Word Highlighting: Helps maintain focus. Automatic scrolling for seamless reading. Control playback with options to play, pause, or revisit any word.

Personalize Your Reading Settings
Select from unique fonts and color schemes designed for dyslexia. Adjust font sizes, spacing, and line height for readability. Choose from six high-qualities, natural voices in various accents.

AI-Powered Virtual Tutor
Chat with an AI tutor available 24/7 for reading assistance. Understand Words: Get definitions and usage examples. Switch to voice chat for an interactive, conversational experience.

Benefits of Dyslexia Buddy
This tool enhances reading and builds confidence for those with dyslexia. Its text-to-speech and speech-to-text features enable independent reading. Features like word prediction, dictionaries, and thesaurus improve vocabulary and comprehension.

Pricing & Availability
Dyslexia Buddy is available on iOS (download from the app store) and Android (available on google play) with a free version and a premium subscription for extra features.

2. Paragraph AI (Writing Tools):
Paragraph AI is an artificial intelligence-powered writing tool that helps users generates

high-quality paragraphs on a given topic, which is helpful for Dyslexia. With Paragraph AI, persons with Dyslexia can easily Input a topic or prompt, select the tone, style, and length of the paragraph, and generate a paragraph based on the input parameters. This AI-powered tool has two main options: write and Reply. The write and reply options are more specific: Automatic, paragraph, custom, List / outline, message, Email, Article, and Custom output. So, with these tools, a person with a writing problem can quickly write in a different format. Thus, this app is beneficial for Dyslexia. Persons with Dyslexia can promptly write and give a reply to any topic within a few minutes. This tool is free, and a premium facility is available for Android and Apple versions. The app can be helpful for content writing and assist students with writing assignments, essays, and research papers. Paragraph AI can help generate ideas, organize thoughts, and improve writing skills.

3. Natural Reader (Reading Tools):

Natural Reader is a text-to-speech app that converts text into spoken words. It offers customizable, natural-sounding voices and supports formats like PDFs and web pages. Key benefits include assisting those with reading challenges, improving comprehension, boosting productivity, and aiding relaxation. Available on desktop, mobile, and web. Natural Reader is a professional text-to-speech (TTS) program that transforms written text into spoken words. It offers free and paid subscription plans for various budgets and user needs. The Plus subscription provides advanced features, including access to cutting-edge Plus and LLM (Large Language Model) Voices and the ability to clone your voice in minutes and use it in over 100 languages. Free users can explore premium Voices for up to 20 minutes daily and Voices for 5 minutes daily or enjoy unlimited use of Free Voices. The mobile app also supports on-the-go listening; physical books and notes can be read using the camera. Users can utilize the Natural Reader AI Voice Generator for non-personal use, such as YouTube videos, e-learning, or other commercial applications. The free Chrome extension also allows seamless listening to WebPages, Google Docs, online Kindle books, and emails directly from the browser.

Advantages of AI Tools for dyslexia

AI tools such as text-to-speech and speech-to-text software help individuals with Dyslexia to: Improve digital text comprehension, write more efficiently and accurately, edit and proofread more effectively, and build more substantial reading and writing habits. Assistive technologies enhance access to education and information by Creating inclusive learning environments, supporting diverse learning styles and needs, and promoting active social engagement.AI tools increase confidence and independence by helping users to build self-esteem, take charge of their learning, and work more autonomously and efficiently, achieve greater independence. Assistive tools help with task organization and time management by Prioritizing tasks and managing time effectively, staying organized and focused, and reducing stress and anxiety. AI-powered tools provide personalized learning by Adapting to individual learning needs and preferences, offering real-time feedback and assessments, supporting various learning styles, and boosting motivation.

Challenges and limitations of AI tools for dyslexia

The high price of assistive technologies and internet packs makes them unaffordable for many individuals with dyslexia. Limited access to these technologies in rural or low-income areas. Compatibility issues with existing devices and software can hinder their use.

Many educators, parents, and individuals with Dyslexia lack knowledge about available assistive technologies and their benefits. More training and support are needed to help users and educators effectively utilize these tools. Lack of funding for professional development and training in assistive technologies. Technical problems, like software bugs or glitches, can disrupt the effective use of assistive technologies. Technical difficulties can be complex and time-consuming. Excessive dependence on assistive tools may hinder the development of essential literacy skills. It can limit alternative strategies like memory aids or organizational skills. Prolonged use of technology may affect social interactions and relationships. Using assistive technologies can carry stigma, leading to feelings of shame and lower self-esteem. Difficulty accepting Dyslexia can result in negative self-image and self-doubt. Lack of self-advocacy can prevent individuals from seeking the support they need.

6. Conclusion

The study demonstrates that AI-based assistive technologies have significant potential to support learners with dyslexia in inclusive educational environments. Tools such as text-to-speech and AI-assisted writing applications can enhance literacy outcomes and learner independence. However, successful integration requires pedagogical alignment, accessibility considerations, and empirical validation. Future research should focus on experimental and longitudinal studies to assess learning outcomes and long-term impacts.

7. Future Direction

These three AI tools may be experiment on persons with dyslexia for getting better and practical feedback.

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