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DIGITAL MEDIA IN EDUCATIONAL THERAPY (DMEDTX) FOR SCHOOL-AGE LEARNERS WITH DYSLEXIA

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ABSTRACT

The historical understanding of dyslexia can be traced back to 1676, with early accounts of reading difficulties not linked to vision problems. Over centuries, the term dyslexia has gradually evolved through multiple phases and terminologies: from that of word blindness to specific learning disorder. The prevailing definition - endorsed by the International Dyslexia Association (IDA) - constructs the condition of dyslexia as a neurobiological disorder marked by phonological deficits affecting fluency in word recognition, decoding and spelling. Intervention strategies for individuals with dyslexia have transformed from foundational methods (e.g., the Orton-Gillingham approach) to contemporary evidence-based practices that incorporate Digital Media (DM). The integration of Digital Media in Educational Therapy (DMEDTX) now plays a pivotal role in supporting learners with dysexia through multisensory engagement, adaptive/assistive technologies (AT), and holistic interventions. This short paper outlines 10 guiding principles for effective DMEDTX, each backed by research, and explores the DM tools that align with these principles to optimize learning. The convergence of cognitive science, assistive technologies, and culturally responsive teaching positions Digital Media as a vital component in personalized dyslexia support.

Keywords: Assistive Technology (AT), Digital Media (DM), Dyslexia, Educational Therapy (EDTX), Multisensory Learning

1. INTRODUCTION

1.1. TRACING THE ORIGIN OF DYSLEXIA

The historical origin of dyslexia can be traced back to around 1676, when a German linguist, Johannes Schmidt, published the first account in Europe of a person unable to read for non-optical reasons (cited in Elliott and Grigorenko (2014)) - the loss of reading ability that was also termed as word blindess (see Chia (2016), for detail). In 1825, Professor Lordat of Montpelier in France described about the temporal loss of his ability to comprehend or make sense of print (cited in Guardiola (2001)). Since then, through many decades with six phases of historical

development (see Table 1) in dyslexia research (see Chia (2016), also see Guardiola (2001), for a four-phase historical development of research studies in dyslexia), the term *dyslexia* with its other varied labels (e.g., *reading blindness* Kussmaul (1877), *dyslexia* Berlin (1884), *reading disability* Dejerine (1892) … *strephosymbolia* Orton (1925), Orton (1928), *brain injury* Strauss (1943), *psycho-neurological learning disability* Johnson and Myklebust (1967), *central processing dysfunction* Chalfant and Scheffelin (1969) … *specific learning difficuties* or *direct dyslexia* Tyre and Young (1994), *dyslexic syndrome* Chia (1996), *specific learning disability* (IDEA, 2004), *reading disability* (Moats and Tolman, 2009) and *specific learning disorder* American Psychiatric Association (2013) has been evolving, defined and re-defined. Today, "[D]yslexia, as the behavioural manifestation of a difference in brain development and cognitive functioning, has likely existed for far longer than modern science has imagined" Kirby and Snowling (2022), para. 1).

Table 1

Table 1 Six Phases of Dyslexia Research (Chia (2016), p. 179)

Phase	Duration (Years)	Description
1	1676-1895	The enigma of dyslexia
2	1895-1899	Deciphering the dyslexia code
3	1931-1960	The search for an answer
4	1961-1980	Armada of terms, definitions and theories of dyslexia
5	1981-1990	From divided opinions to consensus
6	1991-beyond	The operating definition of dyslexia

Today, the operating definition of dyslexia that is still widely used is one adopted by the International Dyslexia (IDA) Board of Directors on November 12, 2002. The IDA's operating definition of dyslexia is stated as follows: "Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequence may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and background knowledge" Lyon et al. (2003), p. 2).

2. INTERVENTION STRATEGIES FOR DYSLEXIA

Intervention strategies for individuals (both children and adults) diagnosed with dyslexia have been evolving significantly over the past century, even as we enter the new millennium, witnessing the emergence of Artifical Intelligence (AI), transitioning from rudimentary methods to evidence-based, AI technology-enhanced approaches. In the early 20th century, Samuel Orton (b.1879-d.1948), a neuropsychiatrist and pathologist at the Columbia University, and Anna Gillingham (b.1878-d.1963), an educator and psychologist, developed the Orton-Gillingham (OG) approach Orton (1966), Peavler and Rooney (2019), which is a multisensory, structured, and sequential method that remains foundational in dyslexia instruction. This intervention approach integrates visual-spatial, auditory-linguistic, and kinesthetic-tactile (or VAK for short) modalities to reinforce learning as well as memory. Over the past decades, the OG approach has been adapted into various commercial programs with the main emphasis on phonemic awareness, decoding skills, and spelling.

In current best practice of dyslexia interventions, the phonologically based approach has been extended to include individualized, technology-assisted, and emotionally supportive strategies. For instance, the Structured Literacy Programs (SLPs) continue to be main focus of the dyslexia intervention, offering systematic instruction in phonics (reading), spelling, and written expression Fallon and Katz (2020). Generally, these programs incorporate multisensory techniques to reinforce learning to read, spell and/or write. Additionally, assistive technologies (AT), e.g., text-to-speech software, speech-to-text applications (or apps for short), and specialized dyslexia-friendly fonts (e.g., OpenDyslexic or Lexie Readable) to improve readability through the provision of distinct letter shapes, have already been integrated to support reading, spelling and writing skills. Furthermore, the Cognitive Behavioral Therapy (CBT) is also used to address the emotional aspects of dyslexia, helping individuals manage frustration, anxiety, and self-esteem issues associated with reading difficulties Mohammadpour et al. (2023), Swargiary (2024). This holistic intervention approach ensures that every individual with dyslexia should receive comprehensive support that encompasses academic, technological, and emotional dimensions.

3. WHAT IS DIGITAL MEDIA (DM)?

The term *Digital Media* (DM) refers to the application of digital technologies to create, store and distribute content, which includes printed text, audio and video records, graphics, and interactive content, transmitted through digital platforms, e.g., computers, laptops, notebooks/tablets, smartphones, and the internet (also see Smith (2013). Some of the examples include websites, e-books, podcasts, digital games, and social media.

In the context of educational therapy (EDTX), Digital Media (DM) refers to the application of technology-based tools (or tech-tools for short) and resources (e.g., Kanga platform; see Presence (2022), for detail) to support individualized learning, cognitive development, and socio-emotional growth of learners with dyslexia (see Total Communication (2024), for examples of three EdTx techniques). In this regard, Digital Media in Educational Therapy (DMEDTX, Stringer (2025)) includes the following: (1) Educational applications (apps) and games for skill-building (e.g., phonics, math, executive functioning); (2) Multisensory learning tools, e.g., interactive whiteboards or tablets; (3) Video modeling and social stories to teach socially acceptable behavior or demonstrate how to perform social skills; (4) Digital storytelling to support language and literacy development; (5) Assistive technology, including AAC devices or speech-to-text software; and (6) Virtual Reality (VR) based environments for practicing real-world tasks in a safe, controlled setting.

When put into practice in the field of EdTx, DM is carefully chosen by an educational therapist to adapt it to match the developmental level, learning profile, and therapeutic goals of a learner with dyslexia. In this way, it can help to enhance engagement, provide immediate feedback, elucidate complex concepts, and allow for personalized, adaptive instruction (see National Institute of Child Health and Human Development (2024), for detail).

4. THE 10 GUIDING PRINCIPLES OF DIGITAL MEDIA IN EDUCATIONAL THERAPY (DMEDTX)

There are 10 key guiding principles in the application of Digital Media (DM) in Educational Therapy (EDTX), or DMEDTX for short, especially when applied to children with dyslexia, with supporting research-based tools and digital

interventions that are aligned with these guiding principles (see Figure 1 for a simplified model). Table 2 provides a summary of the 10 guiding principles of DMEDTX.

Figure 1

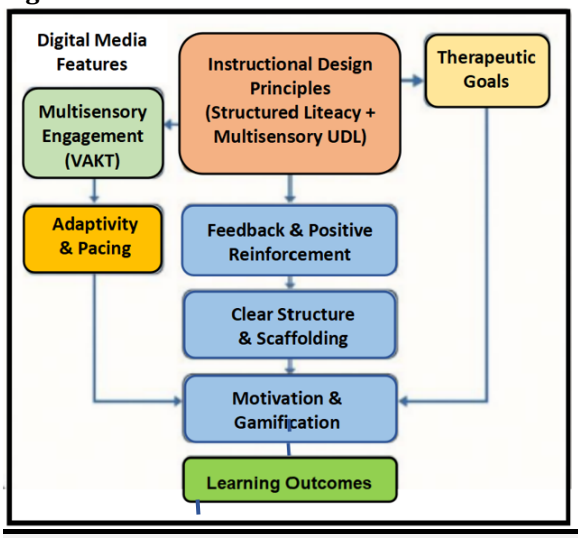

Figure 1 The DMEDTX Model

Each of the 10 guiding principles of the DMEDTX model is briefly described as follows:

4.1. GUIDING PRINCIPLE #1: MULTISENSORY ENGAGEMENT (VAKT PRINCIPLES)

- *Why it matters:* Dyslexia involves phonological processing deficits, and these school-age learners (used interchangeably with children and students, or simply, learners) often benefit from engaging multiple sensory pathways.
- *How it applies:* Use of apps or software that integrate visual (V), auditory (A), kinesthetic (K), and tactile (T) elements, e.g., tracing letters, hearing phonemes, and matching sounds to symbols.
- *Examples of DM tools:* GraphoGame, Nessy Reading & Spelling, LetterSchool
- *Brief description:* Integrates visual, auditory, and kinesthetic inputs to reinforce letter-sound correspondence and word recognition.
- *Supporting evidence (if any):* Lyytinen et al. (2007) demonstrated that multisensory training programs can significantly improve reading accuracy as well as fluency in school-age learners at risk for dyslexia by enhancing phonological processing through integrated sensory experiences.

4.2. GUIDING PRINCIPLE #2: PERSONALIZATION AND ADAPTIVITY

- *Why it matters:* Learners with dyslexia vary in profile; some of them may struggle more with decoding, others with fluency.

- *How it applies:* Application of digital platforms that adapts to individual skill levels can provide differentiated instruction, and adjust pacing based on learner responses.
- *Examples of DM tools:* Lexia Core5, MindPlay Virtual Reading Coach
- *Brief description:* Adaptive platforms that customize instruction based on user progress and error patterns.
- *Supporting evidence:* Macaruso and Rodman (2011) found that adaptive reading programs can significantly improve reading skills in at-risk elementary learners, particularly when these programs tailored instruction to each learner's individual needs. Their research supports the effectiveness of technology-based, differentiated instruction in promoting literacy gains among learners with dyslexia.

4.3. GUIDING PRINCIPLE #3: IMMEDIATE FEEDBACK AND POSITIVE REINFORCEMENT

- *Why it matters:* Learners with dyslexia often face repeated failure in traditional settings.
- *How it applies:* Programs should offer instant feedback, encouraging cues, and incremental success to boost confidence and learning momentum.
- *Example of DM tool:* Reading Assistant Plus
- *Brief description:* Application of speech recognition can provide immediate feedback on oral reading, helping learners self-correct in real-time.
- *Supporting evidence:* Slattery et al. (2011) have stressed the importance of immediate feedback in reading tasks, noting that timely correction can support and strengthen the development of fluent reading by enabling rapid integration of phonological and orthographic information. The findings of their study suggested that immediate feedback mechanisms can help learners with dyslexia reduce decoding errors, and, at the same time, improve their reading comprehension.

4.4. GUIDING PRINCIPLE #4: SCAFFOLDED LEARNING WITH CLEAR STRUCTURE

- *Why it matters:* Learners with dyslexia benefit from explicit instruction with step-by-step support.
- *How it applies:* Digital tools should follow structured literacy approaches (e.g., Orton-Gillingham) with clearly sequenced phonics instruction and guided practice.
- *Examples of DM tools:* Touch-type Read and Spell (TTRS), OGStar Reading
- *Brief description:* Based on the Orton-Gillingham (OG) principles which include explicit, sequential, and cumulative phonics instruction.
- *Supporting evidence:* Chia and Houghton (2011) found that structured literacy interventions grounded in the OG principles significantly improved phonological and reading skills in learners with dyslexia. Similarly, and Goeke (2006) in their earlier study reviewed empirical

evidence supporting the efficacy of OG-based instruction, noting consistent improvements in reading accuracy and decoding skills among school-age learners with reading disabilities.

4.5. GUIDING PRINCIPLE #5: MINIMIZATION OF COGNITIVE LOAD

- *Why it matters:* Working memory is often a challenge for learners with dyslexia.
- *How it applies:* Interfaces should avoid visual clutter and distractions, using clean design, focused tasks, and limited on-screen text.
- *Examples of DM tools:* Dyslexia Quest, ClaroRead
- *Brief description:* Simplified interface, clear fonts, and limited distractions help to support working memory and attention of learners with dyslexia.
- *Supporting evidence:* Sweller (1988) Cognitive Load Theory (CLT) has highlighted the importance of managing intrinsic and extraneous load to optimize one's learning. More recent work by Tricot et al. (2020) has also further reinforced the idea that instructional design should reduce unnecessary mental effort, particularly for learners with learning difficulties, to enhance comprehension and retention.

4.6. GUIDING PRINCIPLE #6: MOTIVATION THROUGH INTERACTIVITY AND GAMIFICATION

- *Why it matters:* Digital games and rewards can sustain attention and increase motivation in learners with dyslexia who are otherwise frustrated.
- *How it applies:* Use gamified learning experiences with achievable goals, visual rewards, and interactive storytelling.
- *Examples of DM tools:* WordWall, Teach Your Monster to Read
- *Brief description:* Application of game-like mechanics to help improve learning through active engagement and long-term retention.
- *Supporting evidence:* Habgood and Ainsworth (2011) found that intrinsically integrated game-based learning, where educational content is meaningfully woven into game mechanics, can significantly enhance learning outcomes and motivation of learners with dyslexia. Their research supports the use of interactive, goal-driven platforms for sustained engagement, particularly among learners with reading difficulties.

4.7. GUIDING PRINCIPLE #7: ACCESSIBILITY AND USABILITY

- *Why it matters:* Learners with dyslexia need tools that are easy to navigate and assist with reading.
- *How it applies:* Features like text-to-speech, dyslexia-friendly fonts, highlighting, and adjustable contrast and spacing are essential.
- *Examples of DM tools:* Read&Write by Texthelp, Voice Dream Reader

- *Brief description:* Offers text-to-speech, highlighting, and customizable fonts and spacing (e.g., OpenDyslexic).
- *Supporting evidence:* Al-Wabil et al. (2007) have stressed on the importance of user-centered design in digital reading tools for users with dyslexia. More imortantly, their research has also highlighted how adaptive interfaces that accommodate user preferences in layout and text presentation can significantly enhance reading efficiency and comprehension for individuals with dyslexia.

4.8. GUIDING PRINCIPLE #8: PROGRESS MONITORING AND DATA TRACKING

- *Why it matters:* Continuous tracking allows educational therapists to adjust instruction and measure gains.
- *How it applies:* Application of digital platforms that provide data dashboards and custom reports for educational therapists, teachers and parents.
- *Examples of DM tools:* Raz-Kids, ReadTheory, LiteracyPlanet
- *Brief description:* Built-in analytics allow educational therapists to track reading fluency, comprehension, and skill progression.
- *Supporting evidence:* Fuchs and Fuchs (2007) placed the emphasis on the importance of Curriculum-Based Measurement (CBM) as a means of formative assessment, highlighting that frequent, brief assessments can significantly enhance learner achievement by informing instructional adjustments. DM tools that incorporate these principles can provide educational therapists with actionable data to refine their intervention strategies/plans effectively.

4.9. GUIDING PRINCIPLE #9: COLLABORATION AND COMMUNICATION TOOLS

- *Why it matters:* Learning is social, and support systems are key in educational therapy.
- *How it applies:* Include features for parent communication, educational therapist feedback, and peer interaction where appropriate.
- *Examples of DM tools:* Seesaw, ClassDojo, Boom Cards
- *Brief description:* Digital platforms that enable sharing progress with parents, teachers and educational therapists, including recorded responses and teacher feedback.
- *Supporting evidence:* Hill and Tyson (2009) conducted a meta-analysis indicating that parental involvement in education, particularly through structured communication, positively influences academic achievement in middle school learners. Digital tools that promote consistent communication between home and school align with these findings, reinforcing learning across various social and academic contexts.

4.10. GUIDING PRINCIPLE #10: CULTURAL AND LINGUISTIC RELEVANCE

- *Why it matters:* Learners with dyslexia can engage more effectively with relatable and accessible content.
- *How it applies:* Use digital media that reflects the learner's language background, cultural context, and educational curriculum.
- *Examples of DM tools:* Book Creator; Epic!
- *Brief description:* Offers multicultural stories and the ability to create personalized books in different languages.
- *Supporting evidence:* Cummins (2000) reiterated the importance of affirming the learners' cultural identities and home languages in educational contexts, arguing that such practices enhance cognitive engagement and academic achievement. His research has strongly supported the integration of culturally relevant materials to bridge learners' linguistic and cultural knowledge with school-based learning.

Table 2

Table 2 A Summary of the Guiding Principles of Digital Media in Educational Therapy for Dyslexia

Guiding Principles	Tool Examples	Application	Key References
1. Multisensory Engagement	GraphoGame; Nessy; LetterSchool	Uses visual-auditory-kinesthetic-tactile integration for decoding	Lyytinen et al. (2007)
Personalization and Adaptivity	Lexia Core5; MindPlay Virtual Reading Coach	Adapts instruction based on learner's needs and progress	Macaruso and Rodman (2011)
Immediate Feedback	Reading Assistant Plus	Real-time correction and fluency coaching using speech recognition	Slattery et al. (2011)
Scaffolded Instruction	TTRS; OGStar Reading	Based on Orton-Gillingham: structured, cumulative phonics teaching	Ritchey and Goeke (2006)
Cognitive Load Reduction	Dyslexia Quest; ClaroRead	Simplified interface, reduced distractions to support working memory	Sweller (1988), Tricot et al. (2020)
Motivation and Gamification	Teach Your Monster to Read; WordWall	Engages learners through interactive, reward-based learning	Habgood and Ainsworth (2011)
Accessibility and Usability	Read&Write, Voice Dream Reader	Features like TTS, dyslexia fonts, spacing options	Al-Wabil et al. (2007)
Progress Monitoring	Raz-Kids; ReadTheory; LiteracyPlanet	Tracks learner performance and learning curves	Fuchs and Fuchs (2007)
Collaboration & Communication	Seesaw; Boom Cards; ClassDojo	Enables sharing work with parents, teachers and educational therapists	Hill and Tyson (2009)
Cultural / Linguistic Relevance	Epic!; Book Creator	Culturally relevant and multilingual content	Cummins (2000)

Digital Media in Educational Therapy (DMEDTX) can effectively support learners with dyslexia through several features that address their unique learning needs as briefly elaborated with examples in Table 3 below:

Table 3

Table 3 Supporting Features of Digital Media in Educational Therapy for Dyslexia

Features in DMEDTX	Examples
Customizable text presentation	• *Font choices:* Dyslexia-friendly fonts like Open Dyslexic or Lexie Readable improve readability by providing distinct letter shapes. • *Adjustable text size & spacing:* Increased line spacing, larger font size, and adjusted character spacing can reduce visual crowding. • *Background & text color:* Changing background colors (e.g., pastel tones) or using high-contrast text can reduce glare & improve focus.
Text-to-speech (TTS) features	• TTS tools read text aloud, supporting decoding & comprehension. • Highlighting each word as it is read reinforces word recognition & tracking.
Audiobooks & podcasts	• Listening options provide access to content without the strain of decoding, helping build vocabulary & comprehension skills.
Interactive features	• Hyperlinks, dictionaries & glossaries allow for quick access to definitions or explanations, aiding comprehension & vocabulary development. • Gamified reading apps can motivate & engage learners with dyslexia.
Multimodal learning	• Digital media can combine text, visuals, & audio to reinforce meaning. • Animated or interactive story elements can enhance understanding and retention.
Reading guides & tools	• Features (e.g., screen masking or reading rulers) help learners with dyslexia focus on specific lines or sections of text.
Adaptive learning platforms	• Some e-learning systems track progress & adapt content difficulty, pacing, or support level to suit the reader's needs.

5. CONCLUSION

In this way, by offering flexibility, personalization, and multisensory engagement, Digital Media in Educational Therapy (DMEDTX) can make a positive impact in those struggling with dyslexia, that is, it has made reading more accessible, less frustrating, and more enjoyable for learners with dyslexia.

CONFLICT OF INTERESTS

None.

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