Original Article
ISSN (Online): 2582-7472

ShodhKosh: Journal of Visual and Performing Arts
Special Issue on Art, Design, and Media Convergence in the Digital Era: An Analytical Study of Creative Practices 7(7s)

ARTIFICIAL INTELLIGENCE IN ADDRESSING ENGLISH LEARNING DISABILITIES: A COMPREHENSIVE STUDY ON DYSLEXIA, ADHD, DEAFNESS AND VISUAL IMPAIRMENT

Sabin Kumar S [1], Dr. R. Vasuhi [2]

[1] Research Scholar, Department of English, Manonmaniam Sundaranar University, Tirunelveli - 627012, Tamil Nadu, India
[2] Assistant Professor, Department of English, Manonmaniam Sundaranar University, Tirunelveli – 627012, Tamil Nadu, India

Check for updates

Received 22 January 2026
Accepted 27 March 2026
Published 29 April 2026

Corresponding Author
Sabin Kumar S,
Sabin.Kumar@outlook.com

DOI
10.29121/shodhkosh.v7.i7s.2026.7894

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Copyright: © 2026 The Author(s). This work is licensed under a Creative Commons Attribution 4.0 International License.

With the license CC-BY, authors retain the copyright, allowing anyone to download, reuse, re-print, modify, distribute, and/or copy their contribution. The work must be properly attributed to its author.

OPEN ACCESS

ABSTRACT

Background: English language acquisition, involving reading, writing, listening, and speaking, presents significant cognitive and sensory challenges for children with disabilities such as dyslexia, Attention Deficit Hyperactivity Disorder (ADHD), deafness, and visual impairment. Traditional pedagogical methods often assume uniform cognitive abilities, marginalizing these learners.
Objectives: This paper critically examines the role of Artificial Intelligence (AI) in creating inclusive, adaptive, and personalized English learning environments for these four disability groups.
Methods: Adopting a qualitative systematic review approach, the study synthesizes findings from peer-reviewed journal articles (2018–2026), AI in education research, and assistive technology studies, grounded in Cognitive Load Theory, Baddeley's Model of Working Memory, and Universal Design for Learning (UDL).
Findings: AI-driven technologies including Natural Language Processing (NLP), speech recognition, computer vision, and adaptive learning systems significantly enhance early diagnosis, individualized instruction, and multimodal learning. For dyslexia, AI improves phonological decoding; for ADHD, it segments content to manage attention; for deaf learners, real-time captioning bridges auditory gaps; and for blind learners, screen readers and OCR enable text access.
Conclusion: AI, when aligned with inclusive pedagogy and human-centered design, holds transformative potential for equitable English language education. However, success depends on addressing ethical concerns (data privacy, algorithmic bias), technological inequities (digital divide), and pedagogical integration (teacher training). AI should empower, not replace, educators.

Keywords: Artificial Intelligence, Dyslexia, ADHD, Deaf Education, Blind Learners, Inclusive Education, English Language Teaching, Assistive Technology, Universal Design for Learning

1. INTRODUCTION

English language learning is a complex cognitive process involving the coordinated functioning of phonological processing, semantic comprehension, working memory, and attentional control. For children with learning disabilities such as dyslexia, ADHD, deafness, and visual impairment, this process becomes significantly more challenging due to neurological, sensory, or perceptual barriers. Traditional teaching methods often assume uniform cognitive abilities and sensory access, thereby marginalizing students with disabilities. While inclusive education frameworks attempt to address these gaps, they frequently lack scalable, personalized solutions.

Artificial Intelligence (AI) has emerged as a powerful intervention in this context. AI systems can process large amounts of learner data, adapt content in real-time, and provide multimodal learning experiences. Research indicates that AI-based assistive technologies significantly improve accessibility, engagement, and autonomy among learners with disabilities. This paper investigates how AI can address English learning disabilities across four key groups: (1) dyslexic learners, (2) learners with ADHD, (3) deaf and hard-of-hearing learners, and (4) blind and visually impaired learners. It also evaluates the pedagogical, technological, and ethical implications of AI integration. f

2. THEORETICAL FRAMEWORK: INCLUSIVE EDUCATION AND COGNITIVE THEORY

This study is grounded in two complementary frameworks: Universal Design for Learning (UDL) and Cognitive Load Theory (CLT).

2.1. UNIVERSAL DESIGN FOR LEARNING (UDL)

Inclusive education is founded on the principle that all learners, regardless of ability, should have equal access to education. The UDL framework, formulated by David H. Rose and the Center for Applied Special Technology (CAST) in the 1990s, calls for creating curricula that provide:

- Multiple means of representation (various ways of acquiring information),
- Multiple means of expression (alternatives for demonstrating knowledge),
- Multiple means of engagement (tapping into learners' interests and motivation).

As Rose (2002) defines, curriculum has four parts: instructional goals, methods, materials, and assessments. UDL reduces physical, cognitive, and organizational barriers. Empirical evidence supports its efficacy: Baumann and Melle (2019) found that UDL-enhanced learning environments improved both academic performance and enjoyment among 89 students, including 16 with specific educational needs. AI aligns closely with UDL by offering adaptive and multimodal learning pathways.

2.2. COGNITIVE THEORIES OF LANGUAGE ACQUISITION

Language acquisition depends on internal cognitive mechanisms and external scaffolding. Foundational models such as Atkinson and Shiffrin's (1968) Information Processing Theory and Baddeley's (2000) Model of Working Memory emphasize that linguistic input must be encoded, stored, and retrieved through limited-capacity systems. However, for learners with disabilities, these processes are often disrupted. Dyslexia impairs phonological awareness; ADHD affects sustained attention and executive control; sensory impairments block auditory or visual input channels.

According to Sweller's (1988) Cognitive Load Theory, learning effectiveness depends on managing the limited capacity of working memory. AI functions as an adaptive cognitive scaffold that compensates for these deficits by (a) simplifying input via NLP, (b) reinforcing output through conversational agents, and (c) providing real-time feedback, thereby reducing extraneous cognitive load and enhancing learning efficiency.

3. METHODOLOGY

This study adopts a qualitative systematic review approach, synthesizing findings from:

- Peer-reviewed journal articles published between 2018 and 2026,
- AI in education research and assistive technology studies,
- Cognitive psychology and special education literature.

Inclusion criteria required studies to: (a) focus on AI-driven interventions for English language learning, (b) target at least one of the four disability groups (dyslexia, ADHD, deafness, visual impairment), and (c) report outcomes related to accessibility, engagement, or learning achievement. A total of 47 studies were included in the final synthesis.

4. RESULTS: AI-BASED SOLUTIONS BY DISABILITY GROUP
4.1. AI-BASED SOLUTIONS FOR DYSLEXIA

Dyslexia, characterized by deficits in phonological awareness and grapheme-phoneme mapping, severely impairs reading fluency and comprehension. AI addresses these challenges through:

- **Early Detection:** Machine learning models analyze eye-tracking patterns, reading fluency, and error distributions to identify dyslexic tendencies early, enabling timely intervention.
- **Adaptive Reading Systems:** NLP-powered platforms dynamically modify text complexity, font size, spacing, and vocabulary levels, reducing decoding difficulty and improving comprehension.
- **Text Simplification & Annotation:** AI restructures complex sentences, provides contextual meanings, and highlights key linguistic elements, allowing learners to focus on meaning rather than structural complexity.
- **Multisensory Learning:** Integration of text-to-speech, visual supports, and interactive feedback aligns with cognitive theories emphasizing multiple sensory inputs for enhanced retention.
- **Writing Support:** Speech-to-text systems and AI-based grammar correction reduce spelling errors and improve syntactic accuracy, fostering confidence in written expression.

4.2. AI AND ADHD

Learners with ADHD face difficulties in sustained attention, working memory, and executive functioning. AI-driven educational systems address these challenges by:

- Content Segmentation: Dynamic division of instructional content into shorter, manageable units reduces extraneous cognitive load and improves focus.
- Real-Time Engagement Analytics: Adaptive platforms monitor response latency, task completion, and interaction patterns, adjusting instructional strategies to sustain attention without causing frustration.
- Gamified Environments: Immediate feedback, rewards, and progress tracking enhance motivation and support the gradual development of self-regulation skills.
- Intelligent Tutoring Systems: Complex language tasks (e.g., writing) are broken into structured stages (planning, drafting, revision), with real-time feedback informed by formative assessment frameworks (Black & Wiliam, 1998).

However, caution is required: overly stimulating interfaces may exacerbate distraction. AI must balance interactivity with cognitive clarity.

4.3. AI FOR DEAF AND HARD-OF-HEARING LEARNERS

Deaf learners face barriers in phonological processing, listening comprehension, and spoken language development. AI-based interventions bridge the gap between sign language and spoken/written English through:

- **Real-Time Captioning:** Speech recognition systems convert spoken language into text instantaneously, enabling access to classroom discourse.
- **Sign Language Recognition:** Computer vision facilitates translation between sign language and text, enhancing communication between deaf and hearing individuals.
- **AI-Powered Chatbots:** These provide structured opportunities for grammar practice, vocabulary building, and writing feedback in a low-anxiety environment.
- **Visual Learning Interfaces:** Interactive simulations and gesture-based systems leverage the visual strengths of deaf learners.
- **Critical Perspective:** Over-reliance on technological solutions risks undermining the linguistic and cultural significance of sign language. AI should function as a complementary tool that supports, rather than replaces, Deaf culture and human-mediated communication.

4.4. AI FOR BLIND AND VISUALLY IMPAIRED LEARNERS

For learners with visual impairments, access to written and visual content is a fundamental barrier. AI-driven assistive technologies include:

- **Screen Readers & Voice Assistants:** Convert written text to speech, enabling independent reading.
- **Optical Character Recognition (OCR):** Transforms printed and handwritten documents into digital text that can be read aloud.
- **Computer Vision for Image Description:** Provides contextual explanations of diagrams, illustrations, and other visual content.
- **Adaptive Audio Learning Systems:** Personalize pace, content delivery, and feedback according to individual learner needs.
- **Haptic & Tactile Interfaces:** Support Braille learning and spatial understanding, enriching sensory dimensions of language acquisition.

Collectively, these technologies enhance accessibility, promote learner autonomy, and improve academic participation among visually impaired students.

4.5. CROSS-DISABILITY BENEFITS OF AI

Across disability groups, AI demonstrates shared advantages:

- Personalization: Adaptation based on cognitive abilities, sensory needs, and learning pace.
- Multimodal Engagement: Integration of visual, auditory, and tactile inputs.
- Increased Motivation: Interactive and gamified environments.
- Learner Autonomy: Self-paced, independent learning.
- Early Diagnosis: Data-driven identification of learning challenges before they become entrenched.

5. DISCUSSION

5.1. SYNTHESIS WITH THEORETICAL FRAMEWORKS

The findings demonstrate that AI operationalizes key principles from both UDL and Cognitive Load Theory. By providing multiple means of representation (e.g., text-to-speech for blind learners, captions for deaf learners), expression (e.g., speech-to-text for dyslexic writers), and engagement (e.g., gamified tasks for ADHD learners), AI directly implements UDL's core tenets. Simultaneously, by reducing extraneous cognitive load through content segmentation, text simplification, and real-time feedback, AI aligns with Sweller's CLT, enabling learners to allocate cognitive resources to meaning-making rather than decoding.

5.2. CHALLENGES AND LIMITATIONS

Category	Specific Challenges
Technological	High costs, limited infrastructure, persistent digital divide (especially in developing regions)
Ethical	Data privacy concerns, algorithmic bias, unequal accessibility, lack of transparency
Pedagogical	Inadequate teacher training, risk of overdependence on technology, passive learning
Contextual	Many AI systems fail to incorporate multilingual and cultural contexts (e.g., India's linguistic diversity)

5.3. IMPLICATIONS FOR ENGLISH LANGUAGE TEACHING (ELT)

AI enables differentiated instruction, continuous formative assessment, and inclusive classroom environments. However, the role of teachers remains indispensable. Educators must act as:

- Facilitators who integrate AI tools thoughtfully,

- Ethical mediators who address bias and privacy,
- Critical users who ensure technology serves pedagogical goals, not vice versa.

Rather than replacing educators, AI should empower them to create more responsive learning environments.

5.4. FUTURE RESEARCH AND POLICY DIRECTIONS

1) **Inclusive Design:** Actively involve disabled users in the creation of AI systems (participatory design).
2) **Multilingual AI Tools:** Develop solutions for linguistically diverse contexts (e.g., Indian regional languages alongside English).
3) **Policy Interventions:** Ensure funding, accessibility standards, and equitable distribution of resources.
4) **Teacher Training:** Implement comprehensive professional development programs for AI integration.
5) **Low-Cost Solutions:** Develop affordable AI tools for resource-constrained environments.

6. CONCLUSION

Artificial Intelligence represents a paradigm shift in addressing English language learning disabilities across dyslexic, ADHD, deaf, visually impaired, and other disabled populations. By aligning with cognitive theories (Working Memory Model, Cognitive Load Theory) and inclusive frameworks (UDL), AI enables adaptive, personalized, and multimodal learning experiences that bridge gaps inherent in traditional pedagogy. Nevertheless, its success depends on ethical implementation, accessibility, and meaningful pedagogical integration. AI does not replace educators; rather, it empowers them to create more inclusive, equitable, and responsive learning environments, ensuring that all learners regardless of neurological or sensory profile have the opportunity to succeed in English language acquisition.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

REFERENCES

Rose, D. H., & Meyer, A. (2002). Teaching every student in the digital age: Universal Learning Design. Alexandria, VA: ASCD. (p. 75)

Baumann, T., & Melle, I. (2019). Evaluation of a digital UDL-based learning environment in inclusive chemistry education. Chemistry Teacher International, 1 (2), 20180026. https://doi.org/10.1515/cti-2018-0026

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), The psychology of learning and motivation (Vol. 2, pp. 89-195). Academic Press.

Baddeley, A. D. (2000). The episodic buffer: A new component of working memory. Trends in Cognitive Sciences, 4 (11), 417–423. https://doi.org/10.1016/S1364-6613(00)01538-2

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. Assessment in Education: Principles, Policy & Practice, 5 (1), 7–74. https://doi.org/10.1080/0969595980050102

Chomsky, N. (1965). Aspects of the theory of syntax. MIT Press.

Coppola, R., et al. (2019). Combining UDL and culturally sustaining pedagogy. [Phenomenological evidence].

DeKeyser, R. M. (2007). Skill acquisition theory. In B. VanPatten & J. Williams (Eds.), Theories in second language acquisition (pp. 97–113). Lawrence Erlbaum.

Faisal, K., & Fortino, A. (2025). STEM With Generative AI: Fundamentals of Data Warehousing. In 2025 IEEE Integrated STEM Education Conference (ISEC) (1–8). IEEE. https://doi.org/10.1109/ISEC64801.2025.11147378

Phuong, Y. H., & Berkeley, D. (2017). Adaptive equity-oriented pedagogy. [Randomized controlled trial].

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. Cognitive Science, 12 (2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.