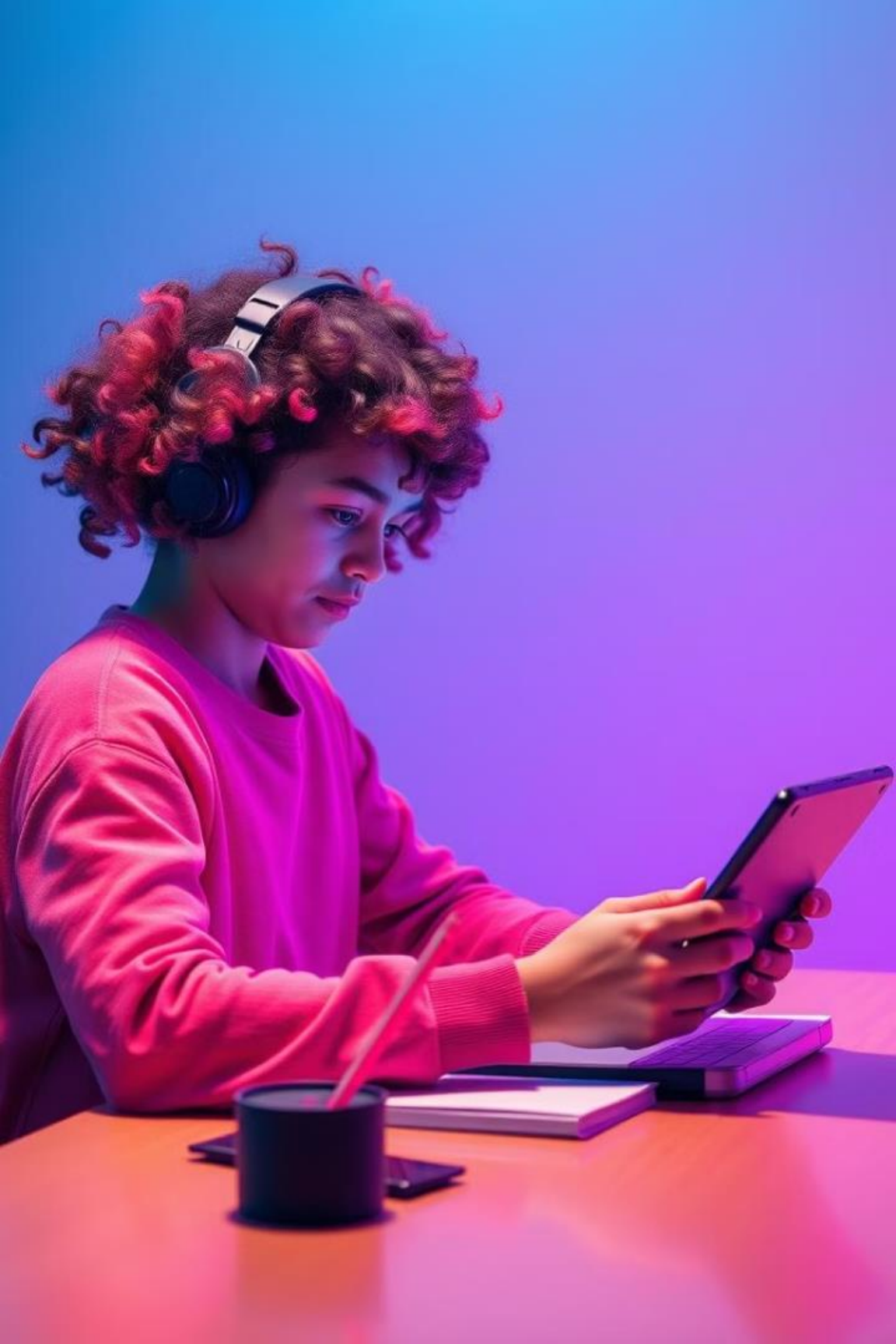




Bridging the Gap: Cognitive Accessibility in Digital Learning for Neurodiverse Learners

This presentation outlines the urgent need for cognitive accessibility in digital learning environments for neurodiverse learners, and proposes a framework to address this critical challenge. This framework integrates evidence-based cognitive strategies with personalized instructional design, powered by AI-driven adaptive learning technologies.

by Cheryl Burris 

The Call

Neurodiversity Challenges

Students with neurodiverse traits face greater challenges in college, lower motivation, and increased risks of success impairment under cognitive load.

These issues are worsened by digital learning environments that often overlook their unique needs.

Cognitive Load and Success

Cognitive load and emotional well-being are closely linked to academic achievement.

When learners struggle to manage cognitive load, they experience increased stress and anxiety, which can negatively impact their motivation and performance.

The Cause

1

Context

Overwhelmed by...

- inconsistent interfaces
- poor navigation structures
- lack of integrated assistive technology

2

Significance

Caused by the lack of...

- neuro-informed cognitive load tests
- pedagogical approaches
- instructional design theories
- paradigms for integrated assistance

3

Issue

A framework does not exist that bridges...

- the needs of the learner
- cognitively accessible digital learning environments



The Action: Create a Framework for Digital Cognitive Accessibility

1

A framework that bridges evidence-based cognitive strategies with personalized instructional design to foster cognitive accessibility in digital learning platforms does not exist.

2

This underscores the pressing need for innovative solutions in this area. We propose a framework that addresses the unique challenges faced by neurodiverse learners in digital learning environments.

3

The framework consists of four interconnected components: Cognitive Load Management, Neurodiversity-Informed Design, Adaptive Learning Technologies, and Continuous Assessment & Refinement.

The 4 Pillars of Digital Cognitive Accessibility



Cognitive Load Management

Focuses on managing cognitive load through evidence-based strategies like chunking information, providing clear instructions, and incorporating visual aids.



Neurodiversity-Informed Design

Emphasizes creating learning environments that are tailored to the specific needs of neurodiverse learners and account their unique learning styles, strengths, & challenges.



Adaptive Learning Technologies

Leverages AI-powered technologies to personalize learning experiences, provide adaptive assistance, and continuously assess learner progress.



Continuous Assessment and Refinement

Involves ongoing evaluation of the framework's effectiveness, collecting feedback from learners and educators, and iteratively refining the framework based on real-world data.



Enhancing Learning Experiences: Benefits of the Framework

Cognitive Load Management

Helps learners manage self-directed learning, executive function, and cognitive load.

Neurodiversity-Informed Design

Creates accessible and inclusive learning environments that meet the unique needs of neurodiverse learners.

Adaptive Learning Technologies

AI enhances personalization, assistance, and data protection, enabling engagement, feedback, and iteration.

Continuous Assessment and Refinement

Ensures the framework is continually improving based on real-world data and feedback.

Building on Existing Frameworks: Foundation for Change

Cognitive Load Theory (CLT)

(Wheeler, 2024)

FEDIS+R Model for Instructional Design

(LeCunff et. al., 2024)

AI-Course Planning Framework

(Schleiss, 2025)

Universal Design for Learning (UDL) Guidelines

(Cast, 2024)

AI-Driven Cognitive Personalization and Assistance Framework

(Ouyang & Jiao, 2021)

Adoption



Potential Benefits

Increased self-regulated learning, executive function management, and self-determination (Figuerola et al., 2017; Le Cunff et al., 2024; Meijs et al., 2021; Ng et al., 2023)

Increased emotional well-being and academic achievement (Atiomo, 2020; Yu, Skek, & Zhu, 2020)

AI can transform education by creating personalized and adaptive learning environments (Halkiopoulou & Gkintoni, 2024).



Examples of Use

AI chatbot to assist with on-demand learner research

AI assistant to manage schedules, attention, assignments, and calendars

Interface options to tailor appearance and options for cognitive accessibility

Adaptive interface to facilitate unique cognitive patterns

Issue 1: Lack of Neuro-Informed Frameworks

A lack of pedagogy for neurodiverse learners exists in higher education

Hamilton & Petty, 2023

The historical lack of representation of neurodiverse individuals resulted in the influence of their traits not being thoroughly documented in cognitive load studies

Le Cunff et al., 2024

Unique cognitive load patterns are exhibited by neurodivergent learners — particularly in online learning contexts

Le Cunff et al., 2024

A lack of learning theories and models exists for post-secondary neurodivergent learners due to the insufficient understanding of the adult neurodivergent experience

Friedman & Nash-Lukenback, 2023

Issue 2: Gaps in Instructional Design Research

Neurodivergent intelligences or culturally relevant methods are not integrated into instructional design in higher education.

Friedman & Nash-Lukenback, 2023

There is scarce research on scaffolding in online learning for higher education.

Doo et. al, 2020

Improved accessibility and accommodations for adults in higher education are required.

Kelly, 2024

Issue 3: Newness of AI-Assisted Learning

There is a lack of pedagogies, models, and theories that support the integration of AI within education and instructional design for the personalization of online learning.

Diaz & Nussbaum, 2024

There are major concerns over the ethical use of AI as an embedded support regarding learners' rights to the following aspects of data collection: awareness, access ownership, and protection.

Johri et al., 2024; Schleiss et al., 2022; Schleiss et al., 2023

Complexities

1

Ethical Adoption

Careful consideration of the ethical implications of using AI in education, ensuring that AI is used responsibly and ethically.

2

Adaptation and Integration

Adapting and integrating AI technologies in a way that respects the rights and needs of neurodiverse learners.

3

Data Protection

Protecting the privacy and security of learner data, ensuring transparency and accountability in the use of AI.

4

Awareness and Ownership

Promoting awareness and understanding of AI among learners, empowering them to engage with AI in a meaningful and responsible way.



Moving Towards Cognitive Accessibility

The proposed framework provides a roadmap for creating more accessible and inclusive digital learning environments for neurodiverse learners.

By prioritizing cognitive load management, neurodiversity-informed design, adaptive learning technologies, and continuous assessment and refinement, we can empower these learners to succeed in their academic pursuits.

As we move forward, it's essential to engage in ongoing dialogue and research to ensure that AI is used responsibly and ethically to support neurodiverse learners in their educational journey.



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References

