BRIDGING EDUCATIONAL EQUITY GAPS IN ENGINEERING FOR STUDENTS WITH ATTENTION DISORDERS

KEVIN SHAO, RUIQI CHEN, ERIC CHO, HANLIN MA, SOPHIA TANG

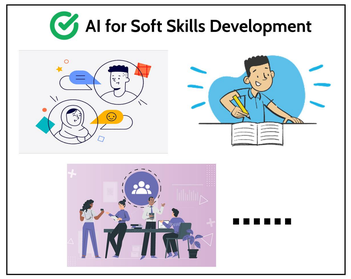
AUTONOMY, ROBOTICS, & CONNECTIVITY

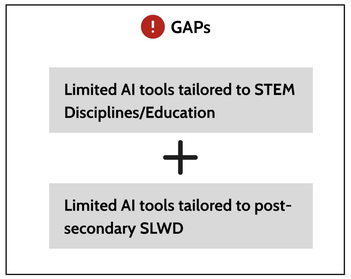
Background

In recent years, AI-driven tools have been transforming how the field educates and assesses students and demonstrated sufficient adaptability to meet a range of educational needs for students living with disabilities (SLWD).

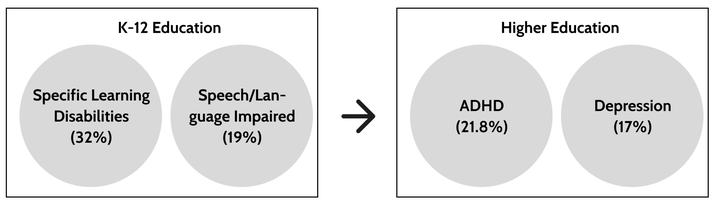
Technological innovations and policy reforms have increased the enrollment of SLWD in undergraduate programs from 11% in 2011 – 2012 to 20% in 2019 – 2020 [1][2]. However, SLWD remain critically underserved, with completion rates 18.2% lower than their non-disabled peers, underscoring a significant gap in support systems and resources tailored to their needs.

Research Gaps – Motivations





Limited AI-driven technologies tailored to college SLWD in STEM Education.



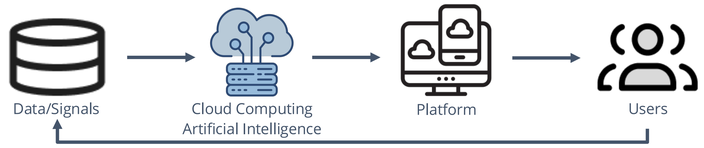
Shift in disability prevalence between K-12 Education and Higher Education.

Our preliminary systematic literature review was published and presented at the 2025 Collaborative Network for Engineering and Computing Diversity (CoNECD) conference.

Kevin Shao, Denise Wilson, Eric Cho, Sophia Tang, Hanlin Ma, Sep Makhsous, "Bridging Educational Equity Gaps: A Systematic Review of AI-Driven and New Technologies for Students Living with Disabilities in STEM Education," ASEE CoNECD (Collaborative Network for Engineering and Computing Diversity) 2025, 2025.

Proposed Solution – Objectives

- Develop an AI-driven and adaptive learning platform tailored to engineering students with attention disorders.
- Design personalized, data-driven interventions to enhance students' engagement and motivation and improve their self-agency, educational outcomes, and mental well-being.



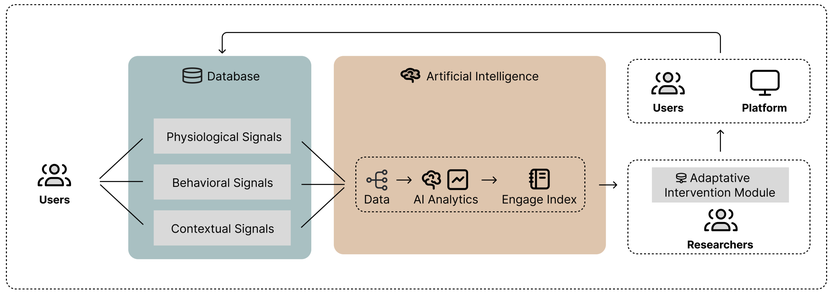
Targeted Population – Attention Disorders

ADHD is the most common condition associated with attention disorders, affecting 21.8% of the SLWD population and up to 13.8% of college students reported in Spring 2024. In addition, students with major depressive disorder also face substantial concentration challenges.

Spring 2012: 6.7% → Spring 2024: 13.8%

of U.S. college students reported a diagnosis of ADHD (American College Health Association) [3][4]

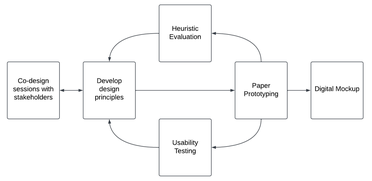
Proposed Artificial Intelligence Framework



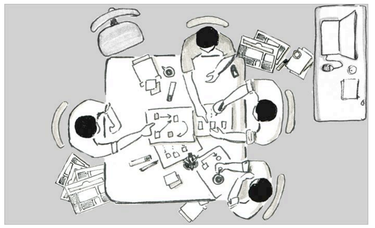
Three-dimensional real-time data will be measured to guide our Adaptive Intervention Module:
- Physiological Signals (e.g., heart-rate, eye-tracking),
- Behavioral Signals (e.g., click frequency, tab-switching, facial expression),
- Contextual Signals (e.g., assignment difficulty, pop-up responses).

Based on these real-time measures, the system will generate an Engagement Index. This index is then fed into a tiered decision logic that determines the interventions (e.g., micro-prompts, task adjustment, contextual re-engagement).

Methodology

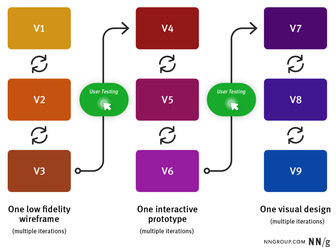


Integration of the participatory design and iterative design approach



Participatory Design Approach

Actively involving SLWD, educators, and other stakeholders in the co-design process to establish evidence-based design principles and collect more comprehensive feedback and insights.



Iterative Design Approach

1) Create low-fidelity paper prototype based on the design principles,
2) Use the Heuristics Evaluation and deploy the Usability Testing to refine the paper prototype before next iteration of design.

References and Acknowledgments

Faculty: Denise Wilson, Sep Makhsous
Graduate Students: Kevin Shao (ECE), Ruiqi Chen (HCDE)
Undergraduate Students: Eric Cho (ECE), Hanlin Ma (ECE), Sophia Tang (HCDE)

[1] "Number and percentage distribution of students enrolled in postsecondary institutions, by level, disability status, and selected student characteristics: Academic year," U.S. Department of Education, Institute of Education Sciences, 2023.
[2] "Characteristics and Outcomes of Undergraduates With Disabilities," U.S. Department of Education, National Center for Education Statistics, 2017.
[3] American College Health Association, NCHA-IIIb Spring 2012 Reference Group Data Report, American College Health Association, 2012.
[4] American College Health Association, NCHA-IIIb Spring 2024 Reference Group Data Report, American College Health Association, 2024.

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