Field of Interest Discussion Essay:

Bridging Cognitive Accessibility Gaps Through Neuro-Informed Instructional Design

As I complete my first year in the Learning Technologies Design Research doctoral program and move into my second year, I find myself at the crossroads of three emerging movements transforming education: the urgent need for inclusive instructional design, the transformative power of artificial intelligence, and the ongoing marginalization of neurodivergent learners in higher education. My research journey has been heavily influenced by coursework that has provided me with theoretical frameworks, methodological skills, and a growing dedication to creating digitally accessible, cognitively friendly learning environments. This essay combines my coursework understanding with my current research focus, highlights key themes and connections from my coursework, and reflects on how my academic experiences have led me to develop the Neuro-Embracing Education Design (NEED) Framework (Burris, 2025d), a comprehensive approach to instructional design that prioritizes neurodiversity as a central element rather than an afterthought.

Understanding the Field: Cognitive Accessibility and Neurodivergent Learners

My research focuses on instructional design for neurodivergent learners, especially those with ADHD and autism, in digital learning environments within higher education. This field combines cognitive psychology, educational technology, and inclusive design. At its core, my work addresses a significant gap: despite decades of research demonstrating the connections between cognitive load, executive function management, self-regulated learning, and academic success (Figueroa et al., 2017; Meijs et al., 2021), higher education has largely failed to apply these insights to support neurodivergent students.

The existing body of literature reveals several key insights. First, as Le Cunff et al. (2024) documented in their systematic review of 90 studies across 21 countries, a staggering 92% of cognitive

load research in online learning overlooks neurodiversity as a factor. This historical exclusion has created a fundamental gap in understanding how neurodivergent learners uniquely experience and manage cognitive load in digital environments. Second, researchers have established strong links between cognitive load and emotional well-being, academic achievement (Atiomo, 2020; Hamilton & Petty, 2023; Yu et al., 2018), executive function management (Figueroa et al., 2017; Jones et al., 2016), self-regulation (Meijs et al., 2021; Ng et al., 2024), and self-determination (Alamri et al., 2020). Third, post-secondary education lacks sufficient learning theories, pedagogical approaches, and instructional design frameworks specifically created for neurodivergent learners (Burris, 2025a; Friedman & Nash-Luckenbach, 2023; Kelly, 2024; Hamilton & Petty, 2023).

The field is also dealing with the rapid rise of generative AI technologies. As Siemens et al. (2022) noted that "learning, sensemaking, and decision-making (complex knowledge processes)" (p. 1) represent the overlapping areas between artificial and human cognition. This overlap creates transformative possibilities for supporting neurodivergent learners through personalized, strengths-based approaches that lower cognitive load and improve executive function (Laudato & Zaugg, 2025). However, integrating AI in education raises important ethical concerns regarding data protection, algorithmic bias, and learner autonomy that must be carefully addressed (Mishra, 2024; U.S. Department of Education, 2023).

Major Themes and Connections Across Coursework

My first-year coursework has laid a solid foundation for understanding these complex issues through six interconnected courses: EDIT 802, Cognition and Technology; EDIT 895, Emerging Trends in Learning Technologies; EDUC 800, Epistemological Foundations; EDRS 810, Education Research Methods; EDRS 812, Qualitative Methods in Educational Research; and AIT 790, AI in Education. Throughout these courses, several key themes have emerged that directly influence my research direction.

From Constructivism to Hermeneutics: Understanding Learner Experience

EDUC 800 introduced a philosophical shift from constructivism (learning as active knowledge construction) to hermeneutics (interpretation in context). The hermeneutical circle, ”the principle that one must understand the whole to understand the parts and the parts to understand the whole” (George, 2020), became central to my approach by emphasizing that designing effective interventions requires a deep engagement with the design process (Linkov, 2018) and neurodivergent learners.

Technology-Supported Learning Environments and Accessibility

The evaluation of Canvas LMS in EDIT 802 highlighted strengths in usability and feedback but identified notable gaps in scaffolding and synchronous interactions (Burris, Zhong, & Lugo, 2024). Additionally, an affordance analysis of the GoblinTools website demonstrated how AI-powered technology can utilize learner-centered tools (e.g., Magic ToDo, Formalizer) to support executive function and enhance cognitive accessibility (Burris & Lipman, 2024). The following semester, these experiences directly informed the scaffolding component of my NEED Framework (Burris, 2025d).

Building on this experience, EDIT 895 gave me two chances to explore developing research-backed frameworks. My first opportunity was my initial and foundational framework, the Neuro-Informed Instructional Design (NI2D) Unified Framework (Burris, 2025e). This framework offers key benefits for improving the learning experience by managing cognitive load and promoting inclusive environments through neurodiversity-informed instructional design. It uses adaptive learning technologies that incorporate AI to personalize support, boost engagement, and protect data privacy. It also applies ongoing assessments to provide real-world insights and identify areas for improvement. Building on this initial framework, my second opportunity resulted in the creation of my Neuro-Embracing Educational Design (NEED) Framework (Burris, 2025d), which emphasizes cognitive diversity

over deficits and personalizes learning with GenAI to close skill gaps and boost abilities. This framework aims to make neurodiversity a primary consideration in educational design.

Research Methodology for Understanding Neurodivergent Experiences

While EDRS 810 provided essential methodological foundations, it also allowed me to develop a qualitative, design-based exploratory study incorporating formative evaluation principles. By combining a phenomenological inquiry approach with Design-Based Research (DBR), I aimed to understand how college students with neurodivergent traits experience and perceive instructional interventions designed to reduce cognitive load (Burris, 2024a). Techniques such as reflexivity, member checking, and triangulation help ensure the results are credible, transferable, and support ongoing design improvements.

In the following semester, I had the opportunity in EDRS 812 to build upon my work in EDRS 810 by conducting three interviews with neurodivergent learners and applying narrative analysis to explore their digital learning experiences, responses to challenges, and strategies for reducing cognitive load. Using a case study approach, qualitative interviews identified five key themes: sensory overload, emotional dysregulation during disorganization, the need for adaptable interfaces, a preference for self-structured frameworks, and frustration with non-intuitive design elements (Burris, 2024b). Although exploratory, it highlighted the need of neurodivergent learner-centered digital learning environments.

AI as a Transformative Tool for Personalization and Inclusion

In AIT 790, I conducted a rapid literature review on GenAI for personalized learning in higher education. This review explored how AI can effectively support instructional design and tailor learning for neurodivergent students (Burris, 2025f). It also provided literature that I integrated into all my courses that semester. Specifically, the work from this course was linked to my NI2D Framework (Burris, 2025e) from EDIT 895. The research behind my presentation on AI and privacy also contributed to two

of the four pillars of digital cognitive accessibility in my NI2D Framework: adaptive learning technologies and ongoing assessment and refinement (Burris, 2025g).

While AI was also considered in my NEED Framework from the EDIT 895 course, it was during my quick literature review (Burris, 2025f) for AIT 790 that I found research highlighting the ethical responsibilities related to data protection, bias mitigation, and learner autonomy. Additionally, this review uncovered Mollick and Mollick's 2023 article, which discussed AI's seven pedagogical roles: "Mentor, Coach, Tutor, Teammate, Student, Simulator, and Tool" (p. 4). I integrated these pedagogical roles to tailor support for Romiszowski's (2016) four skills schema: Cognitive Skills, Psychomotor Skills, Reactive Skills, and Interactive Skills (p. 253).

Integrating Coursework into my Conceptual Framework Graphic

My conceptual framework graphic, created for this portfolio, further clarifies my research focus and depicts the ongoing negotiation of cognitive accessibility gaps among three stakeholder groups: Instructional Designers, Course Instructors, and Neurodivergent Learners (Burris, 2025b). Based on the coursework mentioned above, there are key areas where AI capabilities could potentially address gaps. Instructional designers must negotiate gaps in pedagogy, design, agency, awareness, technology, and resources with course instructors. Course Instructors must also address gaps in pedagogical strategies, environmental support, and cognitive accessibility with the neurodivergent learners in their courses. At the same time, those learners must navigate gaps in cognitive load, agency, accessibility, design, communication, resources, and technology with the instructional design. Together, these overlapping areas form the cognitive accessibility gaps. Given its potential, AI may help facilitate this negotiation and serve as a collaborative mediator rather than a replacement for human expertise. Key areas for AI mediation include Personalized Learning Pathways, Executive Function Support, Cognitive Load Support, Enhanced Flexibility, Collaborative Design, Tailored Content, and Dynamic Engagement (Burris, 2025b).

Evolution of Research Focus

My trajectory evolved from broad explorations of TSLEs and epistemology to focused investigations of cognitive load and multimodal scaffolding. Culminating in AI-enhanced, neuro-informed frameworks, this progression reflects my intellectual journey from understanding what digital environments offer to how these environments can be designed and refined to support neurodivergent learners effectively.

The NEED Framework: A Synthesis

The Neuro-Embracing Education Design (NEED) Framework (Burris, 2025e) synthesizes these insights into three components:

1. Learner-Centered Profiles: Aligns Romiszowski's four skills schema (2016) with the learning challenges and strengths of neurodivergent learners.
2. Learner-Centered Scaffolding: Uses Reigeluth, Myers, and Lee's (2017) learner-centered education with GenAI supports to scaffolding that aligns with the learner-centered profile.
3. Learner-Centered Workflow: A four-phase approach to integrate AI into the workflow cycle to establish and assess the learner-centered profile.

Rooted in educational psychology, learning technologies, emerging technologies, and learner-centered research methodologies, the NEED Framework leverages AI to bridge continuous accessibility gaps while centering on the strengths of neurodivergent individuals.

Future Directions

As I move into Year 2, I plan to conduct studies with instructional designers, neurodivergent learners, and course instructors at George Mason University to explore how AI can be used in instructional design and its effect on the academic success of neurodivergent learners. While I am

currently enrolled in EDIT 891-1 AI Approaches to Learning Gaps to understand how instructional designers address the needs of neurodivergent students, I also intend to add two more courses in this series: EDIT 891-2 AI Approaches to Course Design and Instruction and EDIT 891-3 AI Approaches to Learner-Centered Design. These courses collectively cover the three main components of my conceptual framework (Burris, 2025b).

To deepen my understanding of learners' cognitive needs, I am currently taking EDEP 820, Teaching, Learning, and Cognition, and I plan to enroll in EDEP 822, Advanced Learning, Motivation, and Self-Regulation, in the spring semester. To strengthen my methodological approaches, I am currently taking EDRS 811, Quantitative Methods in Educational Research, and have plans to take EDRS 824, Mixed Methods Research. When combined with EDIT 801, Nature and Process of Design; EDIT 803, Design-Based Research; and at least one advanced methodology course, I believe I am building a comprehensive program of study.

Conclusion

My coursework has provided me with both theoretical knowledge and practical skills, while also shaping my vision for a neuro-inclusive future in education. By integrating what I have learned, am learning, and will learn across all my courses, I aim to develop digital learning environments that consistently close accessibility gaps faced by neurodivergent students. Though I want to promote cognitive accessibility by removing barriers in instructional design that affect understanding, memory, attention, and problem-solving, I am committed to creating environments and systems that are universally supportive and empowering for a diverse range of neurocognitive styles. In doing so, instructional design will consider how different minds process information, thus moving instructional design considerations beyond just specific disabilities.

References

Alamri, H., Lowell, V., Watson, W., & Watson, S. L. (2020). Using personalized learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation. *Journal of Research on Technology in Education*, 52(3), 322-352. https://doi.org/10.1080/15391523.2020.1728449

Atiomo, W. (2020). Emotional well-being, cognitive load and academic attainment. *MedEdPublish*, 9(118). https://doi.org/10.15694/mep.2020.000118.1

Burris, C. (2023). *Personal goal statement* [Unpublished paper]. Admissions Packet. George Mason University. https://cherylanneburrisac .wixsite.com/cheryl-a-burris/statement-of-professional-goals - original-goal-statement

Burris, C. (2024a). *Enhancing digital learning for neurodivergent college students: Exploring the role of multimodal instruction and scaffolding in managing cognitive load* [Unpublished paper submitted for EDRS 810]. School of Education. George Mason University. https://cheryl anneburrisac.wixsite.com/cheryl-a-burris/about-3-3 - research-proposal-paper---qual

Burris, C. (2024b). *Exploring the challenges of digital learning environments: Perspectives of neurodivergent learners in higher education* [Unpublished paper submitted for EDRS 812]. School of Education. George Mason University. https://cherylanneburrisac.wixsite.com/cheryl-a-burris/about-3-4case-study-paper

Burris, C. (2025a). *Bridging the gap: Cognitive accessibility in digital learning for neurodiverse learners* [Unpublished presentation submitted for EDIT 895]. School of Education. George Mason University. https://cherylanneburrisac.wixsite.com/cheryl-a-burris/about-3-5roundtable-presentation

Burris, C. (2025b). *Conceptual Framework Graphic* [Unpublished visual created for Portfolio I]. School of Education. George Mason University. https://cherylanneburrisac.wixsite.com/cheryl-a-burris/statement-of-professional-goals - conceptual-framework

Burris, C. (2025c). *Exploring the challenges of digital learning environments: Perspectives of neurodivergent learners in higher education* [Unpublished paper submitted for EDRS 812]. School of Education. George Mason University. https://cherylanneburrisac.wixsite.com/cheryl-a-burris/about-3-4case-study-paper

Burris, C. (2025d). *Neuro-embracing educational design framework: A conceptual approach to bridge cognitive accessibility gaps through GenAI support* [Unpublished paper submitted for EDIT 895]. School of Education. George Mason University. https://cherylanneburrisac. wixsite.com/cheryl-a-burris/about-3-5 - conference-paper

Burris, C. (2025e). *Neuro-informed instructional design: A unified framework* [Unpublished paper submitted for EDIT 895]. School of Education. George Mason University. https://cheryl anneburrisac.wixsite.com/cheryl-a-burris/about-3-5 - roundtable-briefing

Burris, C. (2025f). *The use of gen-AI for personalized learning in higher education for neurodiverse learners: A rapid literature review* [Unpublished paper submitted for AIT 790]. School of Education. George Mason University. https://cherylanneburrisac.wixsite.com/cheryl-a-burris/about-3-6rapid-literature-review

Burris, C. (2025g). *Using AI for privacy to personalize education* [Unpublished presentation submitted for AIT 790]. School of Education. George Mason University. https://cherylanneburrisac. wixsite.com/cheryl-a-burris/ about-3-6#expertise-report-presentation

Burris, C., & Lipman, J. (2024). *Affordance analysis of GoblinTools* [Unpublished paper submitted for EDIT 802]. School of Education. George Mason University. https://cherylanneburrisac.wixsite.com/cheryl-a-burris/about-3-2 - aa-report

Burris, C., Zhong, Y., & Lugo, R. (2024). *Learning design analysis of the technology supported learning environment of EDRS 810 educational research methods in Canvas, a learning management system* [Unpublished paper submitted for EDIT 802]. School of Education. George Mason University. https://cherylanneburrisac.wixsite.com/cheryl-a-burris/about-3-2#tsle-project

Figueroa, A. M., & Juárez-Ramírez, R. (2017). The problem of cognitive load in GUI's: Towards establishing the relationship between cognitive load and our executive functions. *2017 IEEE 41st Annual Computer Software and Applications Conference (COMPSAC)*, 561-565. https://ieeexplore.ieee.org/document/8029990

Friedman, Z. L., & Nash-Luckenbach, D. (2023). Has the time come for heutagogy? Supporting neurodivergent learners in higher education. *Higher Education*, 87, 1905-1920. https://doi.org/10.1007/s10734-023-01097-7

George, T. (2020). Hermeneutics. In E. N. Zalta (Ed.), *Stanford Encyclopedia of Philosophy*. https://plato.stanford.edu/entries/hermeneutics/

Hamilton, L. G., & Petty, S. (2023). Compassionate pedagogy for neurodiversity in higher education: A conceptual analysis. *Frontiers in Psychology*, 14, 1-9. https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2023.1093290/full

Jones, S. M., Bailey, R., Barnes, S. P., & Partee, A. (2016). Executive function mapping project: Untangling the terms and skills related to executive function and self-regulation in early childhood (OPRE Report No. 2016-88). Office of Planning, Research and Evaluation, Administration for Children

and Families, U.S. Department of Health and Human Services. https://acf.gov/sites/default/files/documents/opre/ef_mapping_executivesummary_101416_final_508.pdf

Kelly, K. (2024). Building scaffolding instead of barriers: Accessibility for neurodivergent law students [Manuscript submitted for publication]. Moritz College of Law, The Ohio State University. http://dx.doi.org/10.2139/ssrn.4958152

Laudato, M., & Zaugg, T. (2025, February 27). Tech InCITIES: AI & inclusive edtech: A deeper dive [Video]. YouTube. https://youtu.be/is60vMnzYrs?si=87NhAU9t8L8isaVC

Le Cunff, A. L., Giampietro, V., & Dommett, E. (2024). Neurodiversity and cognitive load in online learning: A systematic review with narrative synthesis. *Educational Research Review*, 43. https://doi.org/10.1016/j.edurev.2024.100604

Linkov, A. (2018). Hermeneutic grounds for the interpretation of the concept "instructional design." *Academia.edu*. https://www.academia.edu/36808249/Hermeneutic_grounds_for_the_interpretation_of_the_concept_Instructional_Design_

Meijs, C., Gijselaers, H. J., Xu, K. M., Kirschner, P. A., & De Groot, R. H. (2021). The relation between cognitively measured executive functions and reported self-regulated learning strategy use in adult online distance education. *Frontiers in Psychology*, 12, 641972. https://doi.org/10.3389/fpsyg.2021.641972

Mishra, S. (2024). Artificial intelligence in neurodiversity: Advancing diagnosis, treatment, and support. *International Journal of Computer Engineering and Technology*, 15(4), 330-338. https://doi.org/10.5281/zenodo.13236325

Mollick, E., & Mollick, L. (2023). Assigning AI: Seven approaches for students, with prompts. *arXiv* preprint arXiv:2306.10052. https://arxiv.org/pdf/2306.10052

Ng, D. T. K., Tan, C. W., & Leung, J. K. L. (2024). Empowering student self-regulated learning and science education through ChatGPT: A pioneering pilot study. *British Journal of Educational Technology*, 55(4), 1328-1353. https://doi.org/10.1111/bjet.13454

Reigeluth, C. M., Myers, R. D., & Lee, D. (2017). The learner-centered paradigm of education. In C. M. Reigeluth, B. J. Beatty, & R. D. Myers (Eds.), Instructional-design theories and models, Volume IV: The learner-centered paradigms of education (1st ed., pp. 5-32). Routledge. https://doi-org.mutex.gmu.edu/10.4324/9781315795478

Romiszowski, A. (2009). Fostering skill development outcomes. In C. M. Reigeluth & A. A. Carr-Chellman (Eds.), Instructional-design theories and models, Volume III: Building a common knowledge base (1st ed., pp. 199-224). Routledge. https://www.researchgate.net/profile/Charles-Reigeluth/publication/243781058_Instructional_Design_Theories_and_Models_Vol_I_An_Overview_of_Their_Current_Status_17/links/00463535a676514586000000/Instructional-Design-Theories-and-Models-Vol-I-An-Overview-of-Their-Current-Status-17.pdf#page=7.00

Romiszowski, A. J. (2016). Designing instructional systems: Decision making in course planning and curriculum design (1st ed.). Routledge. https://doi.org/10.4324/9780203063446

Siemens, G., Marmolejo-Ramos, F., Gabriel, F., Medeiros, K., Marrone, R., Joksimovic, S., & de Laat, M. (2022). Human and artificial cognition. *Computers and Education: Artificial Intelligence*, 3, 100107. https://doi.org/10.1016/j.caeai.2022.100107

U.S. Department of Education, Office of Educational Technology. (2023). Artificial intelligence and future of teaching and learning: Insights and recommendations. U.S. Department of Education. https://www.ed.gov/sites/ed/files/documents/ai-report/ai-report.pdf

Yu, L., Shek, D. T., & Zhu, X. (2018). The influence of personal well-being on learning achievement in university students over time: Mediating or moderating effects of internal and external university engagement. *Frontiers in Psychology*, 8, 2287. https://doi.org/10.3389/fpsyg.2017.02287