# Improving the online learning experience for adults with ADHD

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# Report Contents

# Project Introduction

Over the past few years, I've seen several people close to me — intelligent, creative, and charismatic individuals — struggle through their higher education experience. Many were deeply affected by the switch to online learning during the COVID-19 pandemic. Those who could afford to seek help often found out that their struggles were the symptoms of attention-deficit/hyperactivity disorder or ADHD. The aim of my project is to develop a learning design framework grounded in the principles of Universal Design for Learning, andragogy, and inclusive design that supports the needs of adults with ADHD in online learning environments. My project will ask all of us to reimagine what online learning could look like if we changed the system to embrace the unique needs and skills of students with ADHD instead of asking students with ADHD to change to fit the system.

## Problem Space

In the age of technology, we are regularly inundated with new information, companies and advertisers are constantly vying for our attention, and we are always accompanied by smart devices ripe with distractions. This environment makes it challenging for anyone to focus on work, school, family time, etc. However, this problem is especially acute for those living with attention-deficit/hyperactivity disorder or ADHD. ADHD is identified as an ongoing pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development (National Institute of Mental Health, 2023).

ADHD has been categorized as a cognitive or learning disability and as a neurodivergent condition. *Neurodivergence* and *neurodiversity* are overarching terms that refer to the diversity that views differences in brain function and behavior as normal variations in the human population and includes conditions like autism, ADHD, dyslexia, dyspraxia, dyscalculia, dysphonia, and Tourette's syndrome (Fung, 2023, p.11). (I will use both terms interchangeably throughout this paper.)

In the educational space, there exists substantial research and best practices for educating children with ADHD: how to design lesson plans, how to manage disruptive behavior, etc. However, ADHD in adulthood is far less understood, and its impacts in higher education even less so. For decades, psychiatrists have been taught to consider ADHD as a "childhood" disease, but in recent years, with the COVID-19 pandemic and the move to remote work, there has been a shift in how we understand ADHD's effect on adults (Ducharme, 2023). Despite the growing prevalence of this diagnosis, ADHD continues to be an "invisible disability," and management of ADHD symptoms in adults is a burden carried by the individual. Ashley Shew (2023), the author of *Against Technoabelism: Rethinking Who Needs Improvement,* describes how almost everyone

will experience disability at some point in their lives, yet the abled persistently frame disability as an individual's problem rather than a social one. Adults with ADHD are expected to manage their symptoms through habits, time-management rituals, medication, etc. But when we live in an economy designed to constantly capture and commoditize our attention, it is no longer acceptable to place the onus of managing attention on the individual. It requires systemic change and safeguards to protect our attention autonomy.

So, how can we begin to redesign higher education to be more accessible to adults with ADHD? Online learning has been seen as the beacon for more inclusive and accessible education because of its increased flexibility. However, like all digital technologies, accessibility for neurodiverse audiences is frequently an afterthought. I believe that by designing online courses that center the needs of students who struggle to regulate their attention, we can create better virtual learning experiences for all students living in the attention economy.

# Literature Review

## Understanding ADHD in Adults

Take a moment to picture someone with attention-deficit/hyperactivity disorder or ADHD. *Who do you picture? What do they look like? What are they doing?* Julia Schechter, co-director of the Duke Center for Girls and Women with ADHD, wagers that nine out of ten times, people will picture a little boy running around a classroom, making lots of noise, and getting into trouble (Ducharme, 2023). But this can be a deeply misleading picture of what ADHD looks like across spectrums of age and gender.

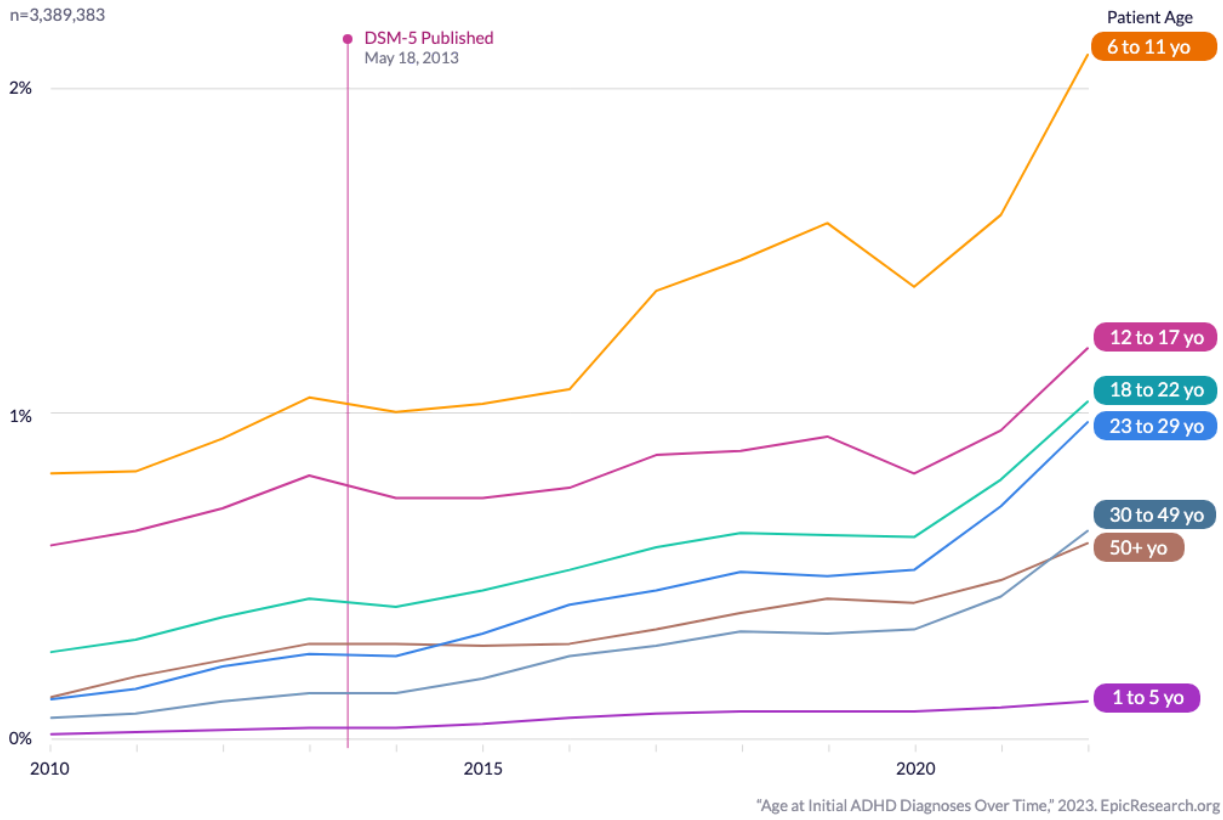
The National Institute of Mental Health (2021) states that ADHD can manifest in three different ways: inattention, hyperactivity, and/or impulsivity. For adults with untreated ADHD, it may feel impossible to get organized, stick to a job, or remember to keep appointments. Adults with ADHD may seem restless and can be pulled in multiple directions — trying to do several things at the same time, often unsuccessfully. There are many reasons why a person may not get diagnosed with ADHD until adulthood: teachers or family members did not recognize the condition at a younger age, their family did not have the resources to seek out treatment, they had a mild form of ADHD, or they managed fairly well until they experienced the demands of adulthood, especially at work. Young adults with undiagnosed ADHD may face academic problems in college because of the intense concentration needed for college courses.

ADHD diagnoses have been increasing over the past decade[1], especially among demographics that have been historically underdiagnosed, like women and adults. An analysis by

[1] *The Diagnostic and Statistical Manual of Mental Disorders, Fifth Editio*n (DSM 5), released in 2013, updated the diagnostic criteria for ADHD and may be a contributing factor to this increase in diagnoses.

the health records company Epic found that from 2020 to 2022, nearly twice as many women ages 23 to 49 received a new diagnosis for ADHD (Russell et al., 2023).[2]

Figure 1:
**ADHD Diagnoses Over Time, an analysis by Epic Research**




While most studies agree that approximately five percent of the global population has ADHD, it is likely that as many as 25 percent of the population have significant symptoms of ADHD (Hallowell, 2023, p. 43). Adult ADHD expert Dr. Lenard Adler, believes that 80 percent of adults with ADHD don't know they have the condition and thus go untreated (pg. 47).

[2] I personally know several women who were diagnosed with ADHD in adulthood, ranging from ages 21 to 60 at the time of diagnosis.

Although ADHD is identified as an "attention deficit" disorder, world-renowned ADHD expert Dr. Edward M. Hallowell (2023) argues that this name is deeply misleading, stating, "We who have ADHD do not suffer from a deficit of attention but rather an abundance of it" (p.19). Hallowell equates ADHD to having a Ferrari for a brain but having to drive it with bike brakes (p. 24). He describes ADHD as being comprised of opposite pairs of attributes — for each positive trait, there is a negative one. Individuals with ADHD can be incredibly curious and easily distractable. The ADHD mind is hyperfocused when interested but wanders when uninterested. Individuals with ADHD can thrive with structure but at the same time resist structure. (p.56)

Figure 2:
**The Dichotomy of ADHD**

| Positive Attribute | | Negative Attribute |
|---|---|---|
| Curious | → | Distractible |
| Creative | → | Impulsive |
| Energetic | → | Hyperactive |
| Unconventional | → | Resists following rules |
| Great (but selective) memory | → | Forgets things that aren't of interest |
| Hyperfocused when interested | → | Mind wanders when not interested |
| Flourishes in high-stress and high-stimulation environments | → | Spaces out without high stimulation |
| Mission-driven, a dreamer or visionary | → | Gets bored without a cause |

In his book *ADHD Explained,* Hallowell (2023) laments the ways ADHD is discussed and treated in the medical community and society as a whole. He states:

> Unfortunately, one thing that is slowing the understanding of ADHD is the stigma that hangs over the entire field of mental health. No one wants to think they have a mental illness, and ADHD is unfortunately classified as a form of mental disorder. This medical classification… ignores all the special talents and strengths that accompany ADHD. (p. 15)

## Reassessing Interventions for Adults with ADHD

Dr. Lawrence Fung (2023), a leading researcher in the field of neurodiversity, supports Hallowell's call to reassess how we address ADHD and other neurodivergent diagnoses. In his book *Neurodiversity: From Phenomenology to Neurobiology and Enhancing Technologies,* Fung advocates for a strengths-based model for neurodiversity (SBMN), especially when working with neurodiverse populations in the workplace and higher education. In collaboration with Fung, research fellow Nancy Doyle states:

> Instead of receiving a negative assessment, neurodiverse students need to be given a "positive assessment"— a diagnostic process that draws out their elements of strength as well as struggle and builds in vocational, career guidance to contextualize realistic, aspirational goals. (p. 83)

Like Hallowell, Fung identifies creativity and divergent thinking as key strengths seen in individuals with ADHD (p. 44).

## Best Practices for Online Learning

Online learning has been seen as the beacon for more inclusive and accessible education because of its increased flexibility. However, like all digital technologies, accessibility for neurodivergent audiences is frequently an afterthought in the design. For example, online learning expert Michelle D. Miller (2016) proposes that "good design" alone can solve for the attention issues faced by individuals with ADHD (p. 76). While I don't agree with Miller's stance that ADHD should not be specially considered when creating online courses, I do believe her tips for optimizing attention in online learning spaces (seen in Figure 3) offer a good base for my project.

Figure 3:
**Miller's four guidelines for designing online courses for attention**

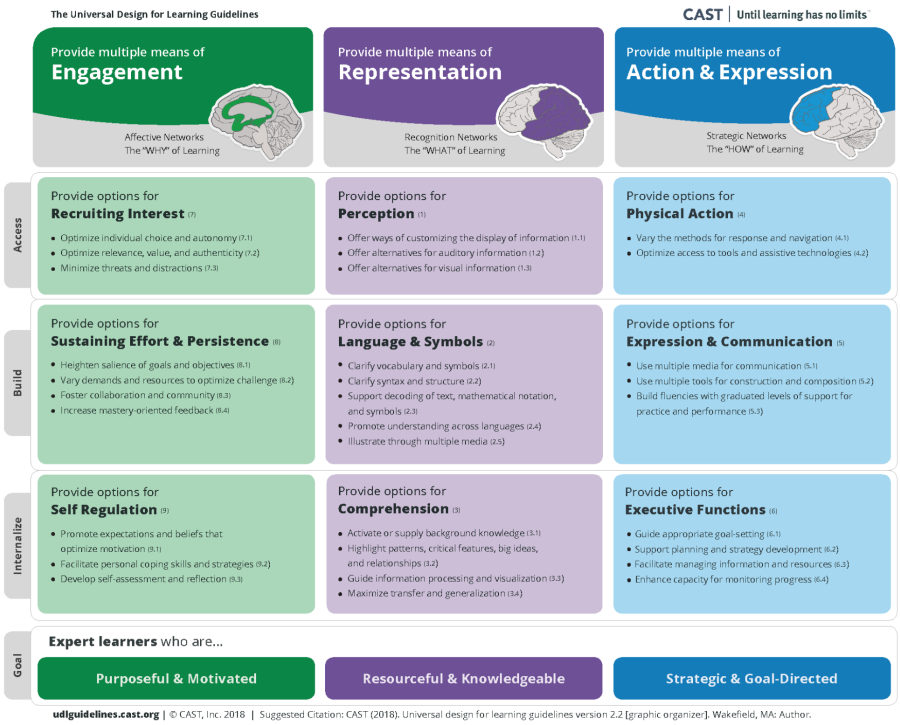
| | |
|---|---|
| **1. Ask students to respond** | Encourage engagement in the online learning environment through online discussions or by requiring active responses to questions within an assigned text or recorded lecture (p. 77). |
| **2. Take advantage of automaticity** | Create space in the course for students to regularly practice basic skills so they become automatic and no longer require focused attention to complete (p. 79). |
| **3. Assess cognitive load** | Reduce cognitive load by maintaining consistent layouts/navigation, using clear instructions, and keeping related materials together (p.83). |
| **4. Discourage divided attention** | In our current digital world, students face endless distractions. Instructors cannot mitigate all of these distractions but can encourage students to be aware of them and try to keep as much content within the learning management system as possible to avoid distractions by directing students outside of the site (p. 85). |

# Theories for Inclusive Learning Design

## Universal Design for Learning

Universal Design for Learning (UDL) offers an inclusive framework for online learning design. UDL stresses the need to create multiple means of engagement, representation, and action/expression in learning. Engagement, the "why" of learning, focuses on ways to stimulate interest and motivate students to learn. Representation, the "what" of learning, centers strategies for presenting information and content in different ways. Action and expression, the "how" of learning, differentiates the ways that students can navigate the learning environment and express what they know. (CAST, 2018) For individuals with ADHD who crave stimulation while needing structure, UDL provides a strong starting point to meet their needs.

Figure 4:
**Universal Design for Learning Guidelines**



## Andragogy: Adult Learning Theory

Andragogy, described as "the art and science of helping adults learn," is a set of principles developed by American educator Malcolm Knowles. These principles can be seen in Figure 5 as summarized by learning designers David Noffs and Krissy Wilson (2021). When considering online learning design for adults with ADHD, it is important to ground coursework in topics and exercises relevant to adults. UDL's multiple means of engagement provide an excellent framework to support these principles of andragogy.

Figure 5:
**Aligning Principles of Andragogy with UDL's Multiple Means of Engagement**

| Principle of Andragogy | | Means of Engagement |
|---|---|---|
| **Self-Concept**<br>Adults believe they are responsible for their lives and want to be treated as capable with the autonomy to self-direct their learning experience.. | → | **Optimize individual choice and autonomy** (7.1) |
| **Life Experiences**<br>Adults come into an educational activity with different experiences than younger learners. These unique experiences should be respected and taken into account when designing learning activities. | → | **Optimize relevance, value, and authenticity** (7.2) |
| **Readiness to Learn**<br>Adults become ready to learn things they need to know and do in order to cope effectively with real-life situations. | → | **Increase mastery-oriented feedback** (8.4)<br>**Facilitate personal coping skills and strategies** (9.2) |
| **Practical**<br>Adults are task-centered/problem-centered in their orientation to learning. | → | **Heighten salience of goals and objectives** (8.1) |
| **Goal Oriented**<br>Adults want to know why they need to learn something before undertaking to learn. | → | **Heighten salience of goals and objectives** (8.1) |
| **Motivation**<br>Adults are responsive to some external motivators (e.g., a better job, higher salaries), but the most potent motivators are internal (e.g., desire for increased job satisfaction, self-esteem). | → | **Promote expectations and beliefs that heighten motivation** (9.1)<br>**Develop self-assessment and reflection** (9.3) |

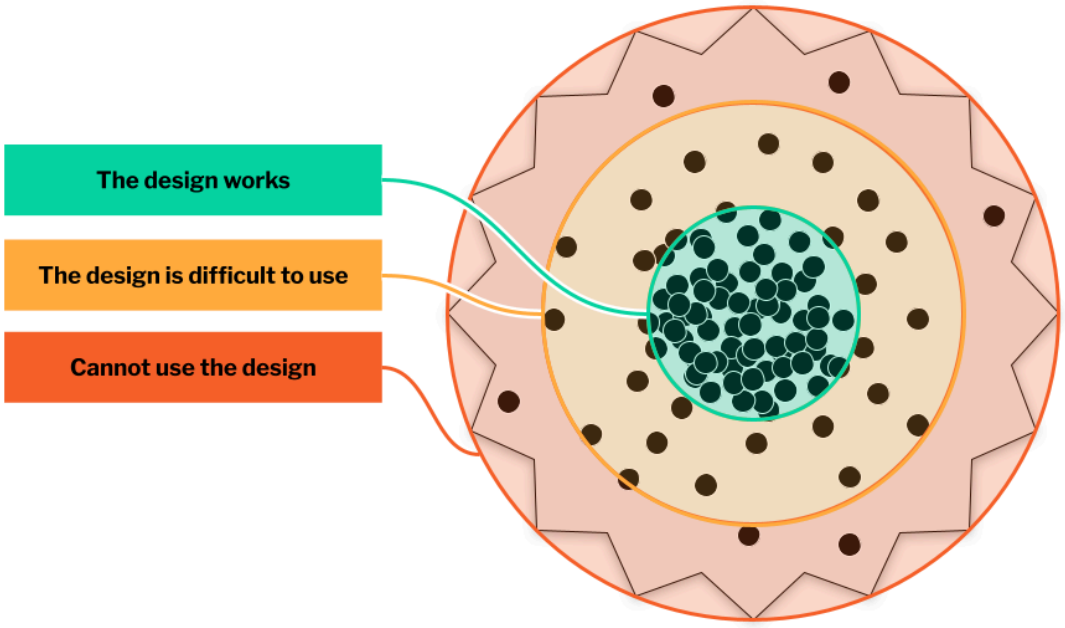
## Inclusive Design

Universal design has a lot of benefits, but in her book *Mismatch: How Inclusion Shapes Design* designer Kat Holmes (2023) argues that it may focus too much on the "end result," and offers inclusive design as an alternative design framework. Inclusive design focuses on the process of design and how a designer arrives at the end result. In the race to create a "one-size-fits-all" product, designers may fail to consult historically excluded audiences in their design process. Inclusive design focuses on bringing excluded audiences into the design process to remedy the "mismatches" they experience when trying to use a product, service, or other designed experience. "Inclusive design doesn't mean you're designing one thing for all people. You're designing a diversity of ways to participate so everyone has a sense of belonging." (p. 53)

In their research, both Holmes and Fung outline how Pareto's Principle, also known as the 80/20 rule and its derivative "normal distribution," as visualized by a bell curve, have served to perpetuate mismatches in product design. The 80/20 rule proposes that the most efficient way to develop products and services is to focus on 80% of a population that falls within a 20% range of needs — thus ignoring the final 20% of people (the "outliers") who cover the remaining 80% of the spectrum (Fung et al., 2021, p. 106). Holmes (2021) cites the ways the 80/20 principle misleads designers by incentivizing them to target a mythical "average" human in an effort to reach the greatest number of people (p. 95). In creating for this "average" person, designers fail to see the nuanced experiences of their individual users and end up creating a static product that can't accommodate their users' unique needs.[3]

[3] In her book *Mismatch: How Inclusion Shapes Design,* Kat Holmes (2021) shares an example from the the United States Air Force (USAF) where designing for the "average" led to an unusable design. In the 1940's the USAF measured the bodily dimensions of thousands of pilots and used the average of that data to design the instruments of a fighter jet's flight deck. Every element of the flight deck was fixed in place based on these dimensions and could not be adjusted. The assumption was that "any individual pilot could adjust himself to overcome the gap in reaching any element of the flight deck that wasn't a perfect fit for him." However the USAF began experiencing a high rate

Figure 6:
**80/20 Principle, starburst visualization**




In the case of higher education, Fung's collaborator, Jutta Treviranus, a professor at the Inclusive Design Research Centre at OCAD University, states:

> Effects of applying the 80/20 principle ripple into our systems of formal education, which are designed around the idea of standardizing the learning of the average student (in part to produce a replaceable worker). This means that education is a mismatch for anyone in the difficult 20%. They are either excluded or relegated to special education. Anything "special" is most vulnerable to budget, time, and resource constraints or cuts. Similarly, our systems of employment filter out and are not designed for the 20%. At best, our

of crashes with these fighter jets that couldn't be attributed to mechanical failure or pilot error. When researchers went to study this they realized that not a single pilot fit all of the bodily dimensions that the flight deck was designed around. "In essence the USAF had designed a flight deck for everyone, and no one." (p.96-97)

> equity efforts set them up for failure by recruiting them into work situations that were not designed for them. (p. 106)

Inclusive design and designing for neurodiversity are still emerging topics in the world of design. Industry-leading organizations like the Interaction Design Foundation are just beginning to provide education on the topic. A webinar hosted by UX designer Katrin Suetterlin (2023), who identifies herself as a neurodivergent person, urges designers to remember that the experiences of no two neurodiverse individuals will ever be the exact same, **"If you have met a neurodiverse person, then you have met ONE neurodiverse person."**

# Research Methodology

In addition to the secondary research outlined above, I conducted ethnographic research with learning designers and instructors at Northwestern University and adults with ADHD who have attended institutions of higher education. My interviews with Northwestern faculty and staff helped me understand how institutions are currently approaching accommodations for students with ADHD and accessibility considerations in online learning environments. My research with ADHD adults took the form of in-person and virtual interviews. Additionally, I capture qualitative insights through an anonymous online survey to learn more about the experiences of ADHD adult students using online learning management systems in higher education.

## Interventions for Students with ADHD at Northwestern

In discussions with Christine Scherer, a Senior Instructional Learning & Accessibility Specialist at Northwestern's School of Professional Studies (SPS), she stated that when considering "accessibility," Northwestern University adheres to the requirements of the Web Content Accessibility Guidelines (WCAG 2.1). While following these guidelines can benefit neurodivergent students, they were not designed to meet the unique needs of these individuals. Heather Brown, a Learning Designer at Northwestern SPS, said that in her experience, "accessibility" has regrettably only been considered in terms of compliance, but in recent years, she has seen topics of neurodiversity enter the discussion in Diversity, Equity, and Inclusion (DEI) spaces. Brown has been instrumental in surfacing the topic of neurodiversity among her fellow learning designers and to the Northwestern community at large. In collaboration with David Noffs, a Northwestern learning designer and instructor in the Master's of Information Design and Strategy (IDS) program, and Michelle Bannerman, a student in the IDS program,

Brown presented the session “Leveraging AI for Equity: Neurodiverse Learners and the Online Classroom,” at the 2023 Northwestern School of Professional Studies Symposium.

I spoke with Noffs and another instructor from the IDS program, Jessica Ashley, to get their perspectives as instructors on the way neurodiversity, and specifically ADHD, is being addressed in their courses. Both mentioned that they’ve seen increased awareness about neurodiversity in their classes, with more students speaking openly about their diagnoses. However, their ability to provide unique accommodations for neurodiverse students relies on the students self-disclosing their diagnosis — which is not something all students feel comfortable doing. Even when they do disclose, teachers aren’t aware of all the accommodations that can be made available to them and are instructed to send the students to a specialized department for help.

AccessibleNU is a program at Northwestern that works with students with disabilities, including ADHD, and provides them with specific resources and assistive technologies to aid their learning experience. Jim Stachowiak, Accessible Technology Strategy and Operations Lead at AccessibleNU, says that peer coaching and mentoring have been an effective way for many students with ADHD to manage their course loads. He also says that currently, one of the most popular assistive technologies among students with ADHD at Northwestern is the note-taking program Glean.

These interviews with Northwestern faculty and staff affirmed my hypothesis that ADHD and neuroinclusive learning design are still emerging topics in higher education. These discussions highlighted how students need to self-report in order to receive accommodations — an option that is not available to students with undiagnosed ADHD. Scherer, Brown, Noffs, and Ashley all expressed interest in improving the learning experience for students with ADHD and

other neurodivergent students but highlighted that they don't have good guidelines to begin addressing the problem.

# Uncovering the Perspectives of Students with ADHD

## Interviews About ADHD and Higher Education

I interviewed three individuals in my personal network (who had previously disclosed their diagnosis to me) about their experience being a student with ADHD in higher education. For their privacy, pseudonyms are used in the following descriptions of their experiences.

Alison is 26 years old and was diagnosed with ADHD at 22 in the first year of her graduate program. During our conversation, she reminisced about the struggles she faced during her undergraduate program prior to being diagnosed:

> I thought I knew how to study when I left high school, but when I got to college, I realized I was just skating by on what I had learned during class discussions. When I actually had to study, it felt impossible to read all the science textbooks I was assigned. I did great in hands-on, lab-based classes, but repeatedly failed tests about the readings.

Like Alison, Shanelle, a 22-year-old recent college grad, was a high-achieving student in high school. She was a band and choir member, loved art classes, and represented her school in their district academic decathlon her senior year. She was always a hard-working student, but it wasn't until she started college that she began to wonder if she was trying *too* hard. Why did it take her twice as long to study as her peers? Shanelle recounted her experience to me with the following statement:

> I didn't know I had ADHD until after I graduated college. I always did "well" in school, but I was constantly stressed and anxious. I barely slept, trying to keep up with everything. Some nights I'd be up all night looking at the same page of text for hours.

Shanelle and Alison both describe a shift in their learning experience once they entered a collegiate environment. The structure and stimulation they were used to in their primary and secondary education were no longer present. With more self-guided coursework, they found themselves struggling to keep up.

Oliver's experience was similar to Alison and Shanelle's: being up late trying to get through a reading, struggling to start assignments that didn't interest him, and missing important due dates. But unlike Alison and Shanelle, Oliver knew why he was struggling. He had been diagnosed with ADHD when he was seven years old. As the poster child for ADHD in the early 2000s, he'd been prescribed Ritalin to help calm his hyperactive tendencies. However, his parents feared the potential side effects of being medicated long-term, so he was taken off medication in middle school. Throughout high school and college, he developed coping mechanisms to help mitigate the adverse effects of his untreated ADHD, but he still found that his biggest struggle was self-pacing. Without clear due dates, Oliver says his "time-blindness" made it difficult to appropriately manage his time:

> I would wait until the absolute last minute to get anything done. Online classes were the worst. Some professors would have some projects that didn't have a strict due date, so I'd suddenly be working on five random projects on top of studying for my final during the last week of classes.

In addition to struggling with coursework, all my interviewees described an arduous process to receive an ADHD diagnosis. It could take months to see a specialist, it is an expensive process if not covered by health insurance, and it requires a lot of follow-up and planning that can be incredibly difficult for someone with untreated ADHD. Even Oliver, who was diagnosed as a child, says that he's put off getting re-prescribed medication to help with his ADHD symptoms because of how tedious the process is and how expensive the medications can be.

Figure 7:
**Summary of Interview Findings**

**From these three interviews, the following common themes emerged:**

- Students with ADHD struggled with self-driven timelines (managing readings, pacing work without clear due dates, etc.)
- Dense readings were often a time-consuming and unproductive way to learn new material
- They expressed a preference for hands-on, project-based work
- These students often looked incredibly successful on the surface, but were battling depression and anxiety[4]
- It can be very difficult to get a diagnosis and a prescription, so in college they relied on non-medication treatments and habits to manage their ADHD symptoms[5]

[4] While none of the interview participants disclosed other "official" mental health diagnoses, it is important to note that more than two thirds of individuals with ADHD have at least one coexisting condition such as a mental health diagnosis (anxiety, biopolar disorder, depression, etc.) and/or other neurodivergent diagnosis (autism, dsycalculia, dyslexia, dyspraxia, etc.). (CHADD, 2023)

[5] Alison described her experience living with ADHD without medication as "white-knuckling it through life"

## ADHD and Learning Management Systems Survey

When considering how I wanted to address the needs of students with ADHD in the project, I knew that I wanted to develop recommendations that focused on supporting students with ADHD instead of giving them yet another list of tools to "self-manage" their symptoms. Providing instructors and learning designers with recommendations to improve course design is the first step, but it once again requires an individual to take ownership of change. The area where I saw the most promise to create *systemic* changes was through learning management systems (LMS). Students, instructors, and learning designers all have to work within the confines of a learning management system to share course expectations, access resources, submit assignments, and build a learning community. By investigating opportunities for improvement in LMS we can reach all parties in the learning experience.

To further support my findings from the interview process, I sent out a survey to gather more information about the experiences of students with ADHD using learning management systems. I wanted to understand what features they used, which were useful, which were challenging, and how they think the systems could be improved. The survey was live from October 20, 2023 to October 29, 2023, and captured insights from 25 qualified respondents.[6]

### *What LMS features were challenging to use?*

Many respondents cited a "clunky" user interface as their primary challenge with the learning management system their higher education institution used. This issue was further exacerbated by each instructor setting up their course differently, leading to inconsistent layouts and unpredictable navigation.

[6] Twenty-two respondents confirmed that they had been diagnosed with ADHD, and the remaining three respondents had not been diagnosed but expressed frequent difficulties managing their attention in school and/or work settings.

Prior to conducting this survey, I theorized that the key LMS features that would be challenging for students with ADHD would be discussion boards and testing interfaces. None of my respondents mentioned tests/quizzes as a challenging feature, but several mentioned discussion boards as an area for improvement. One respondent stated that discussion boards were hard to follow, and for them, it "felt overwhelming to participate in the discussion."

### *What LMS features did students with ADHD find useful?*

Individuals with ADHD often struggle with time management and task prioritization, so the majority of respondents, when asked the question, "What was the most useful feature in the LMS? What made it useful?" stated that the course calendar and dashboard of upcoming assignments were the most useful LMS features. Respondents who used an LMS that had a calendar integration (they could connect their upcoming assignment dates from the LMS to their personal Google/Outlook calendars) were particularly fond of this feature.

### *What would they change about the LMS if they could?*

Respondents who didn't have a calendar integration available in their LMS (or who weren't aware of the feature) described a desire to have this feature integrated. Additionally, respondents voiced a need to add a "reminder" feature within the LMS calendar to help them stay on top of upcoming projects. There were a number of impactful suggestions from respondents, but others felt a bit disheartened, with one respondent stating, "I don't know [what I'd change]. I'm so used to them, I feel like I have changed for them, not the other way around." And I believe this points to the larger issue at hand — **we are asking students to change for technology instead of making technology a tool for student advancement.**

Figure 8:
**Summary of Survey Findings**

- Learning management system (LMS) interfaces are “clunky” and difficult to navigate when each instructor sets their instance up differently
- Being able to see upcoming assignments and descriptions is the most valuable feature of the LMS
- Regular reminders and being able to integrate due dates with external calendars is a valuable tool for ADHD task management and executive dysfunction
- Discussion boards (and other text-heavy screens) can be overwhelming and difficult to engage with
- Students are changing to fit the technology instead of designers adapting the technology to fit student needs

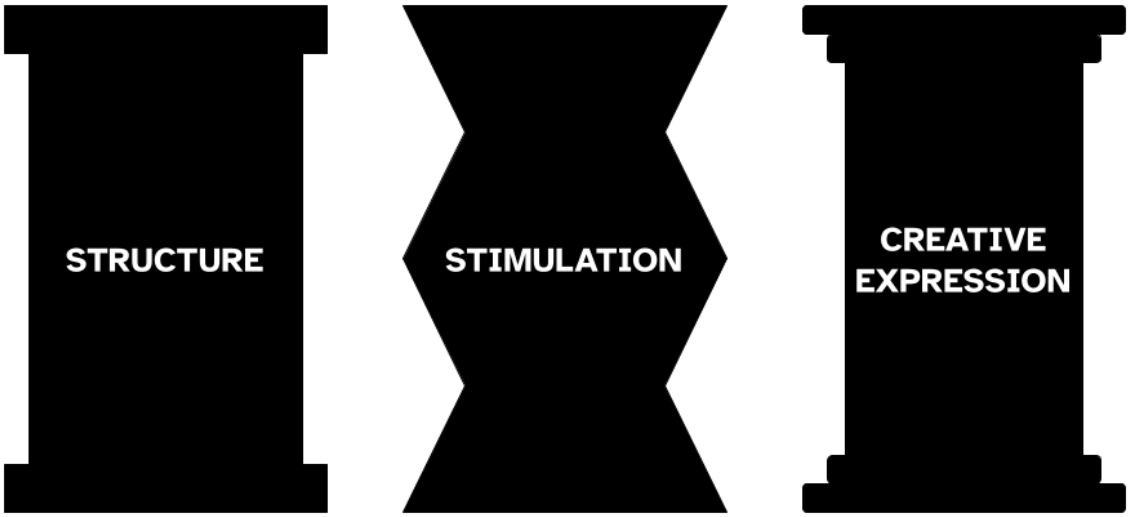
# Proposed Treatment

There is a clear need to improve the higher education experience for students with ADHD. While there is a desire within organizations like Northwestern to support neurodivergent students, instructors and learning designers don't have specific guidelines for creating neuroinclusive online courses. To address this challenge, I am proposing a framework for ADHD-friendly course design and recommendations to improve the user experience of learning management systems.

## The Pillars of ADHD-Friendly Course Design

Students with ADHD require three key conditions from their learning experience: structure to help with executive functioning, stimulation to keep them engaged, and creative expression to demonstrate their unique strengths. These conditions or pillars, as seen in Figure 9, can all be addressed through the use of Universal Design for Learning. But, as outlined previously, designers can fall into the trap of designing for an "average" person and fail to consult historically excluded audiences in their design. In the following descriptions of the Pillars of ADHD-Friendly Course Design, I will outline specific examples related to the needs of adult students with ADHD.

Figure 9:
**The Pillars of ADHD-Friendly Course Design**




## Structure

The first pillar of ADHD-friendly course design is "structure." In this context, structure refers to the underlying way courses are built and the resources included in the learning environment design to support students. This pillar focuses on building solid frameworks for students with ADHD so they can successfully navigate and participate in a learning experience.

One of the primary challenges students with ADHD face is executive dysfunction.[7] Executive functions are skills related to self-management, including organization, planning, initiating and completing tasks on a timely basis, tracking and shifting tasks, self-monitoring, and self-inhibition (Barkley, 2015, p. 85). For individuals who struggle with executive dysfunction, it can look like being very distractible or having trouble focusing on just one thing (or becoming

[7] Executive dysfunction is not unique to individuals with ADHD and can be caused by other factors including dementia, depression, obsessive compulsive disorderd (OCD), traumatic brain injury, etc. (Cleveland Clinic, 2022)

hyper-fixated on just one thing). Individuals who struggle with executive dysfunction have difficulty motivating themselves to start a task that seems difficult or uninteresting. They can have trouble planning or carrying out a task because they can't visualize the finished product or goal and struggle to move from one task to another. (Cleveland Clinic, 2022)

By structuring courses to reduce cognitive load and set clear parameters for engagement, instructors and learning designers can support students with ADHD in managing executive dysfunction. Key suggestions for incorporating structure into learning environments can be found in Figure 10. (Some of these recommendations were drawn from UDL Guideline #6: "Provide options for Executive Function," linked in the appendix of this paper.)

Figure 10:
**How to incorporate "Structure" into learning environments**

| | |
|---|---|
| **Clearly define goals and expectations** | It is important to reduce any ambiguity that could hinder a student's participation in the learning experience. By clearly outlining requirements, assignment due dates, and expected conduct, instructors can support students with ADHD in overcoming the "planning" aspects of executive function. |
| **Maintain consistent formatting and navigation** | For a student with ADHD, being unable to locate the necessary information to complete a task can quickly turn into abandoning the task altogether. By making assignment descriptions, LMS navigation, and testing interfaces consistent, instructors can reduce cognitive load and simplify task initiation for students with ADHD. |
| **Set regular reminders of upcoming due dates** | Students with ADHD struggle with time tracking and task initiation/completion. The minds of ADHD students are constantly moving and easily distracted, making it very easy for them to miss deadlines. Providing regular reminders and suggested pacing for projects can help students with ADHD stay on top of their work. |

| | |
|---|---|
| **Provide relevant work examples when requiring specific deliverables** | This helps individuals with ADHD and executive dysfunction visualize the end result and removes a barrier to task initiation. |
| **“Chunk” large projects into smaller sub-tasks** | If a project is large and requires multiple steps, it can feel very overwhelming to a student with ADHD. Breaking it into key deliverables or tasks can reduce overwhelm and help students with ADHD stay on top of major deadlines. |

## Stimulation

The ADHD brain craves stimulation — if a topic doesn't interest them, they will not engage. While instructors cannot force students to be interested in a specific topic, they can encourage engagement by removing daunting barriers like the "wall of text" and providing stimulating educational materials.

The stimulation pillar supports structure by keeping students with ADHD engaged in the learning process. Stimulation isn’t just about making learning “fun” it also asks instructors to make sure that the key points of action in the learning journey are clear so students’ attention is not diverted away from their end goal. As previously stated, the needs of one neurodivergent student will differ from those of another neurodivergent student, so there is no one-size-fits-all for keeping students engaged. As part of the “stimulation” pillar, instructors should help students with ADHD identify the topics and materials they find most stimulating.

Figure 11:
**How to build "Stimulation" into learning environments**

| | |
|---|---|
| **Remove extraneous information and make action points prominent** | Students with ADHD struggle to regulate their attention and thus become easily distracted by stimuli. To ensure students stay on task and learn the appropriate materials, ensure key action points are prominent in your course materials and only include the most relevant information. |
| **Prioritize hands-on engagement** | When applicable, have students learn through hands-on and interactive experiences. In asynchronous virtual learning environments, this can look like a team collaboration through a tool like Miro or a virtual reality experience, as opposed to sharing a pre-recorded lecture or assigning a textbook reading. |
| **Use case studies and real-world applications** | Connecting the learning experience to real-world applications is beneficial to adults with ADHD because it can help them understand the purpose of what they are learning (visualizing the end result) and support principles of andragogy by connecting learning to students' life experiences. |
| **Encourage students to explore topics of personal interest** | Stimulation looks different for each student, so the most efficient way to keep students with ADHD engaged is by encouraging them to explore a course learning objective in the context of something that interests them. |
| **Select materials that offer multiple forms of stimulation** | Prioritize learning materials that offer multiple forms of stimulation (videos with interesting sounds and graphics, games, etc.). When multiple forms of stimulation are unavailable, follow UDL best practices and include different media types to support the course's learning agenda (readings, videos, podcasts, etc.). |
| **Explore gamified learning experiences** | Games are an incredible tool for stimulation and can go a long way to keep students with ADHD engaged in the learning experience. Read more about gamification in the appendix on pages 54-58 and pages 62-63. |

| | |
|---|---|
| **Introduce students to supportive tools and helpful integrations** | Numerous digital technologies exist to help students stay engaged in the learning process. Instructors should introduce these tools into their course materials and encourage their students to share resources they've found helpful. Read more about adaptive technologies that benefit ADHD students in the appendix, pages 58-64. |
| **Incorporate community building** | Creating community in an online learning environment can serve many functions to keep students with ADHD engaged. Community-based discussions allow students to ask questions and brainstorm new ideas. The presence of a fellow student or "body double" can help students with ADHD complete tasks and promotes accountability. Read more about body doubling in the appendix on pages 63-64. |

## Creative Expression

In alignment with Universal Design for Learning guidelines for multiple means of action, individuals with ADHD thrive in learning environments where they can express themselves and communicate their ideas in a variety of ways. It is important to once again consider how executive dysfunction can hinder an individual with ADHD's ability to communicate. Individuals with executive dysfunction can have trouble explaining their thought process clearly. While they understand it in their head, putting it into words for others can feel overwhelming. By providing different ways for a student to creatively communicate their ideas, instructors can help overcome this barrier between understanding and expression. Creative expression is a valuable tool for grounding learnings in exciting and practical applications while encouraging long-term retention of course materials.

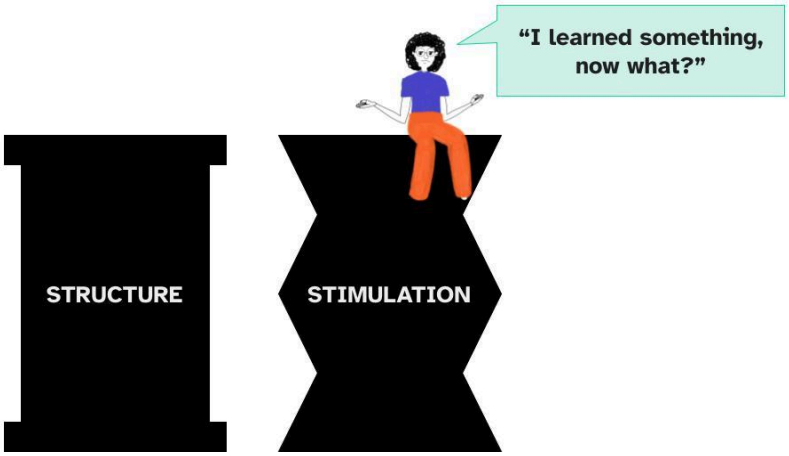
Figure 12:
**How to encourage "Creative Expression" in learning environments**

| | |
|---|---|
| **Encourage students to communicate in the format that works best for them** | In alignment with UDL's multiple means of action, ensure that assignments are structured in a way that allows students to communicate using the media that works best for them. While a learner with dyslexia may excel at story-telling in conversation, he may falter when telling that same story in writing. (CAST, 2018) |
| **Provide space for open-ended creativity** | Creativity is a key strength of students with ADHD, and while students with ADHD need structure, they can often feel restricted by it. Creating space in the learning environment for open-ended and playful expression can bring out the greatest strengths of an ADHD student. |
| **Introduce students to new tools and technologies** | In a rapidly changing digital landscape, it is important for instructors to share new tools for expression with students, such as augmented reality experiences or generative artificial intelligence tools like ChatGPT and DALL-E. The introduction of new tools can open up new avenues of expression for students with ADHD. The introduction of a new technology alongside a new topic could help increase long-term learning retention. |
| **Challenge students to explore new ideas, topics, and techniques** | By challenging students to explore new means of working, you can increase their capacity for creative expression and help students with ADHD develop skills to overcome barriers to effective communication. |

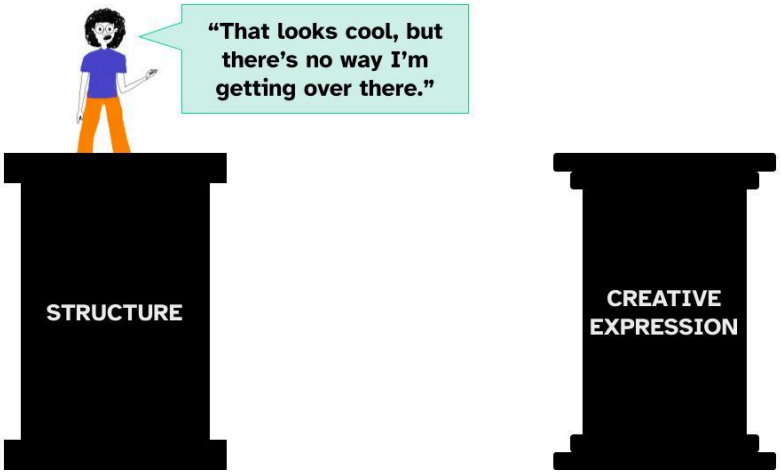
## How the Pillars Work Together

When designing ADHD-friendly courses, it is important to consider all of the pillars together. If you remove even one pillar, you run the risk of students not retaining the information, becoming disengaged, or struggling to stay on task.

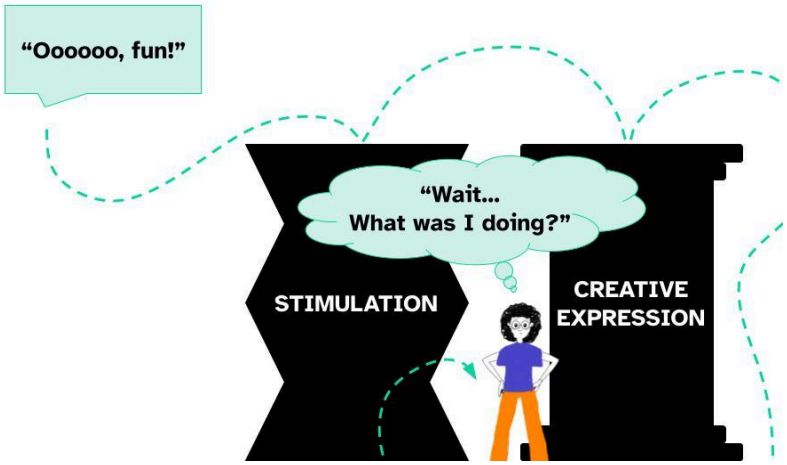
Figure 13:
**What happens when you remove one of the pillars?**




**Without an outlet for creative expression,** students don't know what to do with the information they've learned, and you run the risk of them not retaining the information in the long term.




**Without stimulation,** students with ADHD will not stay engaged in the learning process. Regardless of how much the final stage may excite them, getting there can feel impossible.




**Without structure,** a student with ADHD may be interested in the learning experience but can struggle to stay on task or face other barriers to productive participation.

Graphics created with character illustrations by Elba Sindoni

## Applying the Pillars to Learning Management Systems

Students with ADHD face a number of challenges in higher education, and many of these challenges are further exacerbated in an online learning environment. Improving the online learning experience requires systemic shifts that can impact all parties involved in the learning experience — learning designers, instructors, and students. We can begin this process by looking at the ways learning management systems are failing students with ADHD. I believe there are a number of ways that learning management systems can be redesigned to better address the needs of students with ADHD and create a better experience for all students working in online learning environments. Based on my research, I've identified the following as key areas for improvement:

- Facilitate consistent formatting and navigation
- Incorporate reminders and notifications for upcoming tests and assignment deadlines
- Ensure integration with external calendars to streamline task and project management
- Implement modular features so users can customize their experience
- Reduce barriers to participation, like the "wall-of-text," within key, interactive LMS features such as discussion boards

### Best Practices for Neuroinclusive Visual & Content Design

The design of learning management system interfaces is an important part of bringing structure and stimulation in a student's online learning experience. Several existing resources can be used to inform neurodiverse-friendly interface design; for this project, I focused on insights from the *Neurodiversity Design System* and the World Wide Web Consortium's *Cognitive Accessibility Guidelines*.

### *The Neurodiversity Design System*

The *Neurodiversity Design System* is a set of standards and visual design principles for learning management systems created by Will Soward, Lead User Experience and Media Designer at Open Polytechnic of New Zealand. Soward created this design system to support the principles of Universal Design for Learning (UDL) in alignment with the needs of various neurotypes, including ADHD. As of November 2023, the *Neurodiversity Design System* was still in "beta," but offered comprehensive visual design recommendations for neurodiverse-accessible digital interfaces. (Soward, n.d.)

Figure 14:
**The Neurodiversity Design System Key Takeaways**

| | |
|---|---|
| **Font & Typography** | The right font for learners will increase retention, reduce fatigue, and support good stress.<br>• **Use a sans serif type** with distinctive letterforms and defined characters to increase legibility for low-vision readers.<br>• **Font size should be easy to read at arm's length** on any device.<br>• **Ensure readability with high contrast between text and background colors** — these colors should meet WCAG's AAA (highest-level) standards for color contrast. |
| **Color** | Color is an influential tool to inform and direct and should be used to enhance a design — not dictate it.<br>• **Optimize contrast between background and foreground colors** in alignment with WCAG's AAA (highest-level) standards.<br>• **Use consistent color patterns to inform action types** — these should be consistent with relevant cultural meanings of color (i.e., green for "submit" and red for "delete" reflect Western color interpretations).<br>• **Provide the option to switch the visual appearance of an interface** to a specific hue and saturation from a wide selection of colors (i.e., dark and light mode settings as well as specific color overlays). This reduces eye strain and cognitive fatigue for various neurotypes. |

| | |
|---|---|
| **Interface Layout & Components** | The layout and navigation of interfaces should be consistent to support students' expectations for engagement. Providing an uncluttered, organized arrangement of elements reduces cognitive load and choice paralysis.<br>• **Place learning content first.** Supporting elements like navigation, fixed notices, branding, contact information, and decorative elements must not compete for the learner's attention but rather "dissolve" from view, become concealed, or be omitted completely.<br>• **Consider minimal layouts** to reduce overwhelm and cognitive load. Learners with ADHD tend to choose less complicated/stressful tasks when faced with multiple options, so utilize simplified layouts to streamline the student journey and decision-making process.<br>• **Interactive elements should be designed with "intention to action."** Buttons, links, and text areas should look "clickable" to reduce hesitation and ambiguity about their interactive properties. |

### *W3C Cognitive Accessibility Guidelines*

In 2021, the World Wide Web Consortium (W3C), the organization that develops the Web Content Accessibility Guidelines (WCAG), released a guidance titled "Making Content Usable for People with Cognitive and Learning Disabilities." In this guidance, "cognitive and learning disabilities" include but are not limited to neurodivergent diagnoses (like ADHD, autism, dyslexia, etc.), mild cognitive impairment, early-stage dementia, brain injury, and anxiety disorders. Also referred to as the *Cognitive Accessibility Guidelines*, this supplemental guide goes beyond the standard WCAG guidelines and outlines eight key objectives (Figure 15a).

Figure 15a:
**W3C Cognitive Accessibility Guidelines: Objectives**

| |
|---|
| **Objective 1:** Help users understand what things are and how to use them |
| **Objective 2:** Help users find what they need |
| **Objective 3:** Use clear and understandable content |

**Objective 4:** Help users avoid mistakes and know how to correct them

**Objective 5:** Help users focus

**Objective 6:** Ensure processes do not rely on memory

**Objective 7:** Provide help and support

**Objective 8:** Support adaptation and personalization

The guidance goes on to describe the design and content patterns that support these objectives. In Figure 15b, I have outlined the primary design patterns that are most relevant to creating ADHD-accessible learning management systems. (W3C, 2021)

Figure 15b:
**W3C Cognitive Accessibility Guidelines: Key Design and Content Patterns for ADHD-Friendly Course Design**

- **Make it easy to find the most important tasks and features of the site**
    - Make the purpose of your page clear
    - Make it easy to find the most important actions and information on the page
    - Make each step clear
    - Separate each instruction
    - Provide information so a user can complete and prepare for a task
    - Provide reminders
    - Clearly state the results and disadvantages of actions, options, and selections
- **Use a familiar hierarchy and design**
    - Make the site hierarchy easy to understand and navigate
    - Use a clear and understandable page structure
- **Use a consistent visual design**
    - Clearly identify controls and their use
    - Make the relationship clear between controls and the content they affect
    - Use clear visible labels

- Use icons that help the user

- **Support simplification**
  - Avoid too much content
  - Limit interruptions
  - Use white spacing
  - Make short critical paths
  - Provide summary of long documents and media
  - Provide alternative content for complex information and tasks

- **Support a personalized and familiar interface**
  - Let users control when the content moves or changes
  - Enable APIs and extensions

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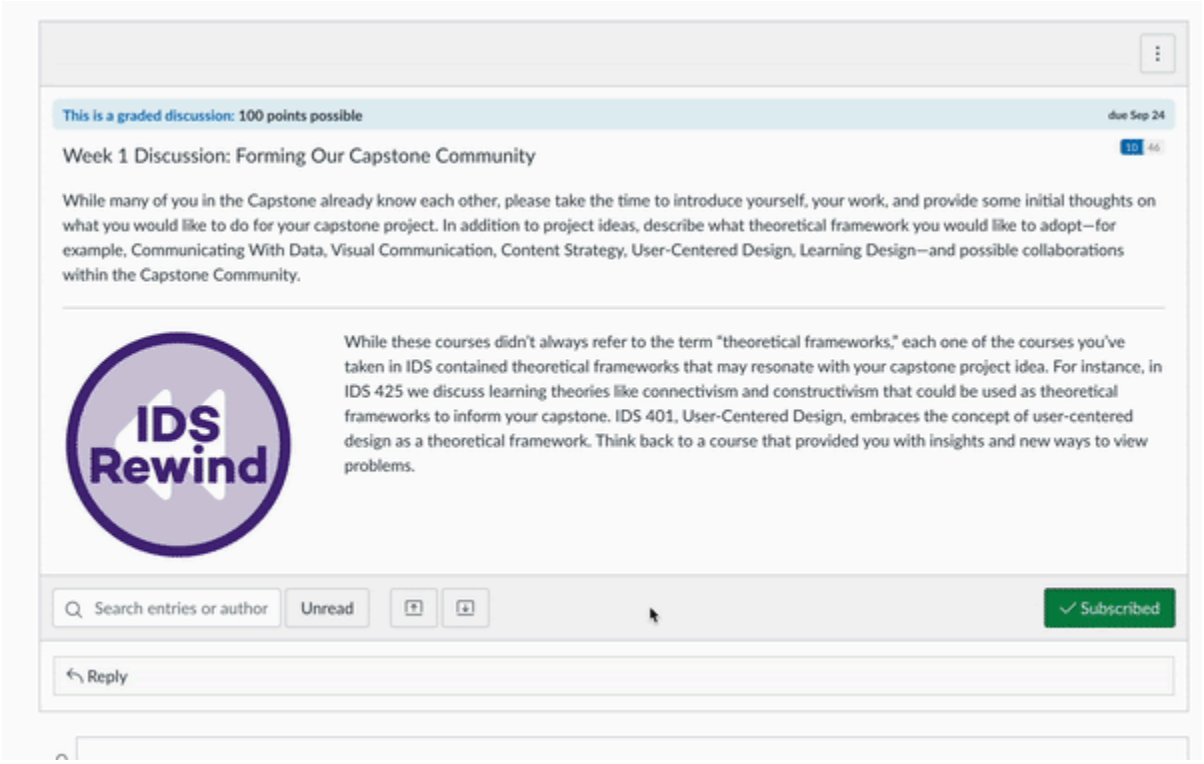
## Case Study: Redesigning Canvas Discussion Boards

To demonstrate how the Pillars of ADHD-Friendly Course Design and visual design best practices for neurodiverse audiences can be applied to a learning management system, I have developed the following case study based on Canvas discussion boards. (Canvas is a popular learning management system used by institutions of higher education, including Northwestern University.) This case study includes screenshots from a digital prototype I created using the design software Figma. This prototype was designed following the best practices for neuroinclusive design outlined above, and was created through an iterative design process starting with sketches, low- and high-fidelity mockups, culminating in a final interactive prototype.

Figure 16:
**Current Canvas Discussion Boards (GIF)**




At the time of this writing, Canvas discussion boards are hosted in an incredibly cumbersome interface (see Figure 16). Many instructors use discussion boards in the following way: they pose one or two questions to the class and ask each student to post their response to the questions and respond to two of their fellow students. This question-posing system and the existing interface lead to a text-heavy discussion board with minimal visual interest that requires a lot of scrolling and reading for students to engage with it. Additionally, the existing interface design makes it difficult to distinguish between original posts and replies. By applying the Pillars of ADHD-Friendly Course Design to Canvas discussion boards, we can eliminate some of the barriers to engagement faced by students with ADHD and improve usability for all students.

Figure 17:
**Applying the Pillars of ADHD-Friendly Course Design to Canvas Discussion Boards**

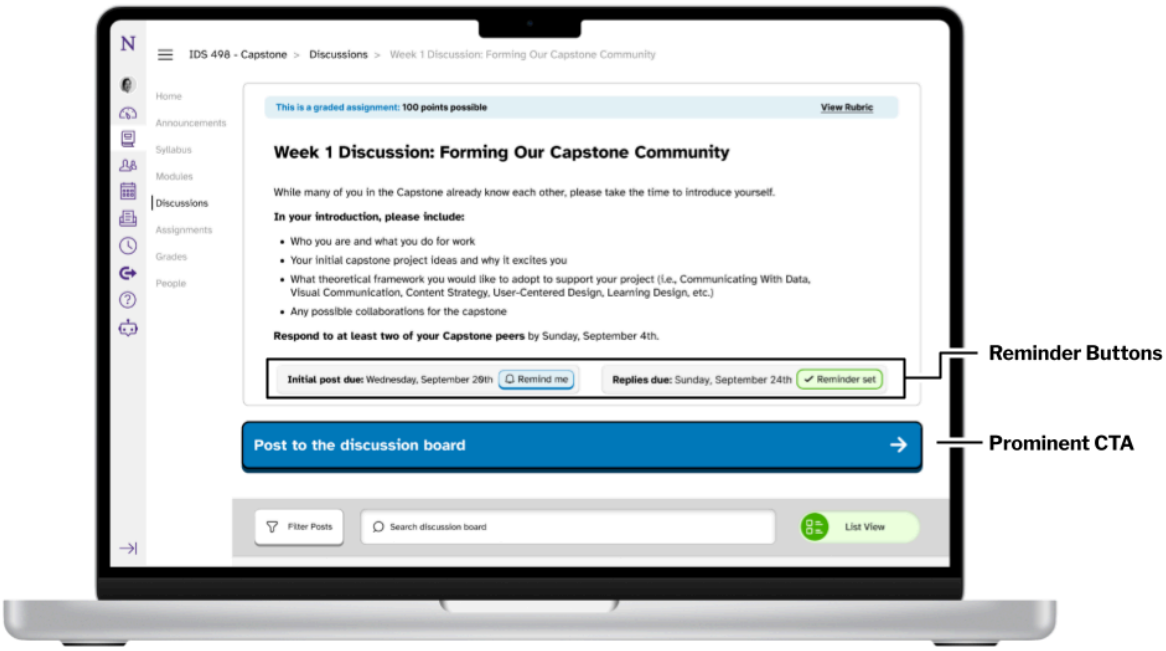
| | |
|---|---|
| **Structure** | • Clearly define expectations for participation<br>• Include due dates and reminders<br>• Improve the page hierarchy |
| **Stimulation** | • Make calls-to-action clear<br>• Add interactive and multimedia elements |
| **Creative Expression** | • Encourage students to communicate in the format that works best for them<br>• Connect the discussion to student's personal interests and passions |

### *Discussion Description*

In Canvas, discussion descriptions are generally text-based and lack prominent calls-to-action. If there are multiple due dates involved for posting and responding, the system is unable to denote these as different due dates. In Figure 18, you can see a prototype I developed that works to make the discussion assignment description clearer by bulleting out post requirements (this makes it easier for students with ADHD to identify what areas they need to pay attention to), displays a prominent button indicating how a student can initiate their post and includes built-in reminder buttons. These reminder buttons allow students to set up custom reminders for the unique due dates associated with the initial post and the response requirements. This feature could also prompt students if a deadline is approaching and they haven't posted yet. Additionally, instructors can make discussion descriptions more engaging by including

explanatory videos or by encouraging students to explore different ways to communicate in the discussion board beyond text-based responses.

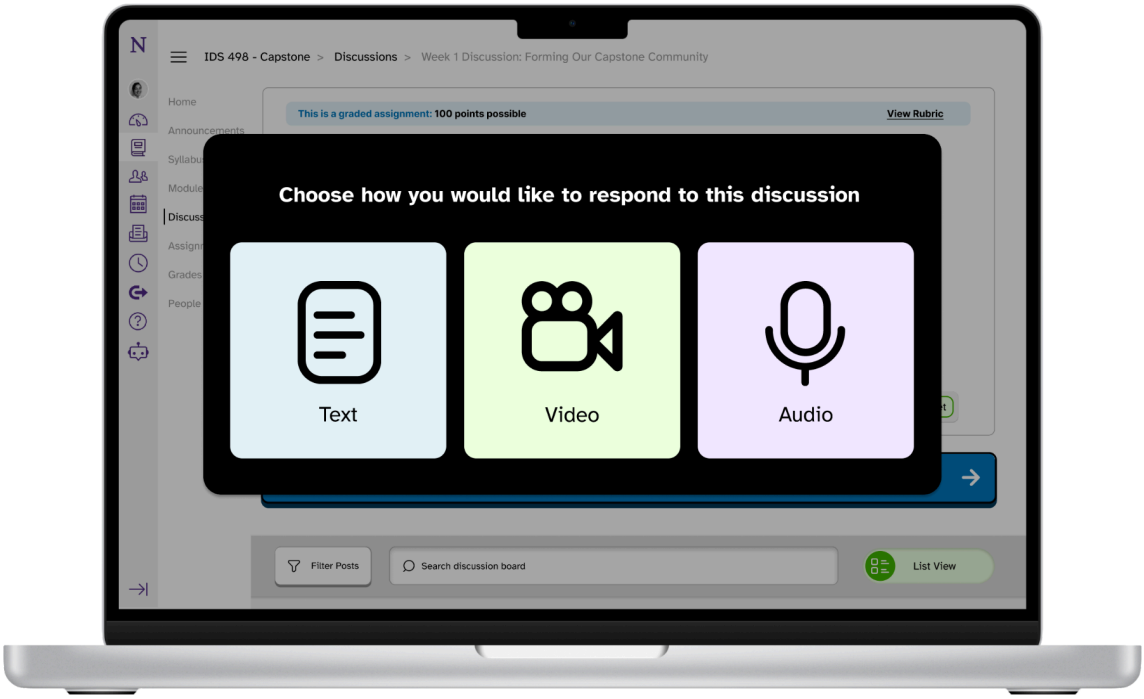
Figure 18:
**Highlighting calls-to-action and integrating reminders for discussion participation**




## *Posting to the Discussion Board*

Universal Design for Learning stresses the value of multiple means of expression, however, these "multiple means" are not intuitively built into learning management systems like Canvas. In the example of discussion boards, the expectation is that discussion boards will operate as a text-based forum. We can break out of this restrictive model by integrating the multiple means expression directly into the initiation of a discussion post, as seen in Figure 19. Currently, students can attach or embed video and audio files into a discussion post, but this requires a student to go searching for these options.

Figure 19:
**Multiple Means of Discussion**




## *Updating the Discussion Board Forum*

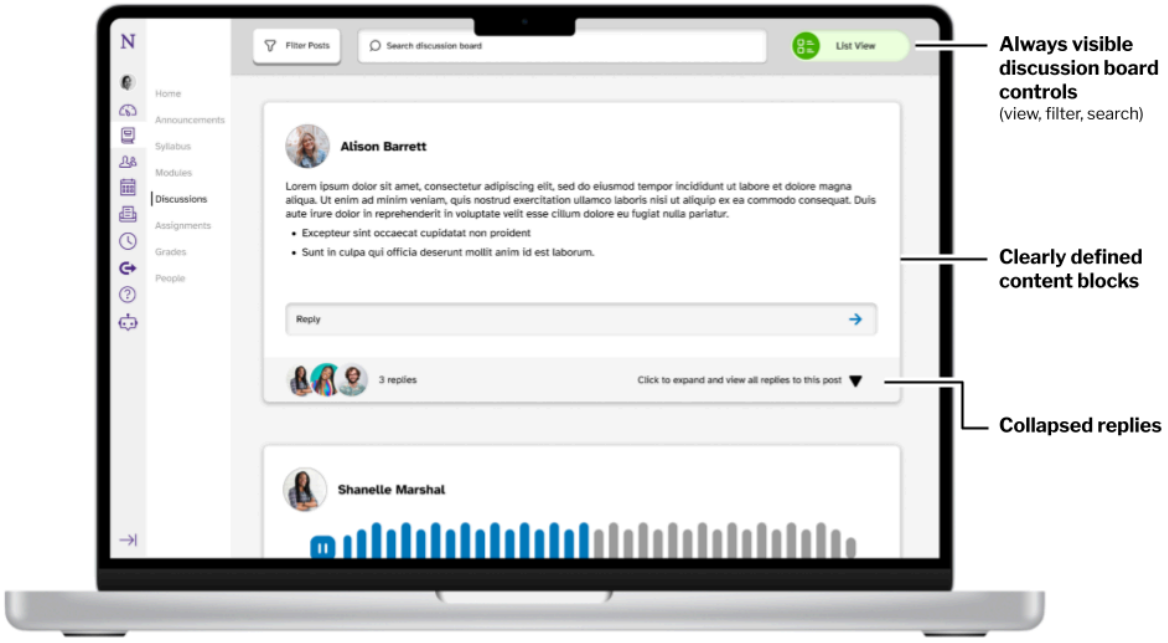
To tackle the wall-of-text that prevails throughout Canvas discussion boards my prototype works to better distinguish posts from one another through the use of white space, offers features to reduce overwhelm (collapsable replies, filters, search bars, etc.) and provides different discussion "views."

W3C's *Cognitive Accessibility Guidelines* state that whitespace should be put around objects, text, and content blocks to separate each section. As seen in Figure 20a, I used ample white space in this prototype to clearly distinguish posts from one another. Replies are initially collapsed in the default list view to reduce overwhelm. While the comments are collapsed, there

are still graphical and text elements that show a student how many replies are associated with the original post, and there is clear text and iconography indicating how to expand and collapse the replies.

Discussion board controls for filtering, searching, and changing the discussion view type are “sticky” to the top of the webpage, ensuring visibility regardless of where you are in the discussion thread. Finally, a CTA becomes visible after every five posts, prompting a student to “load more discussion posts.” This limits the endless scrolling of the existing platform and allows students to view the discussion board in chunks.

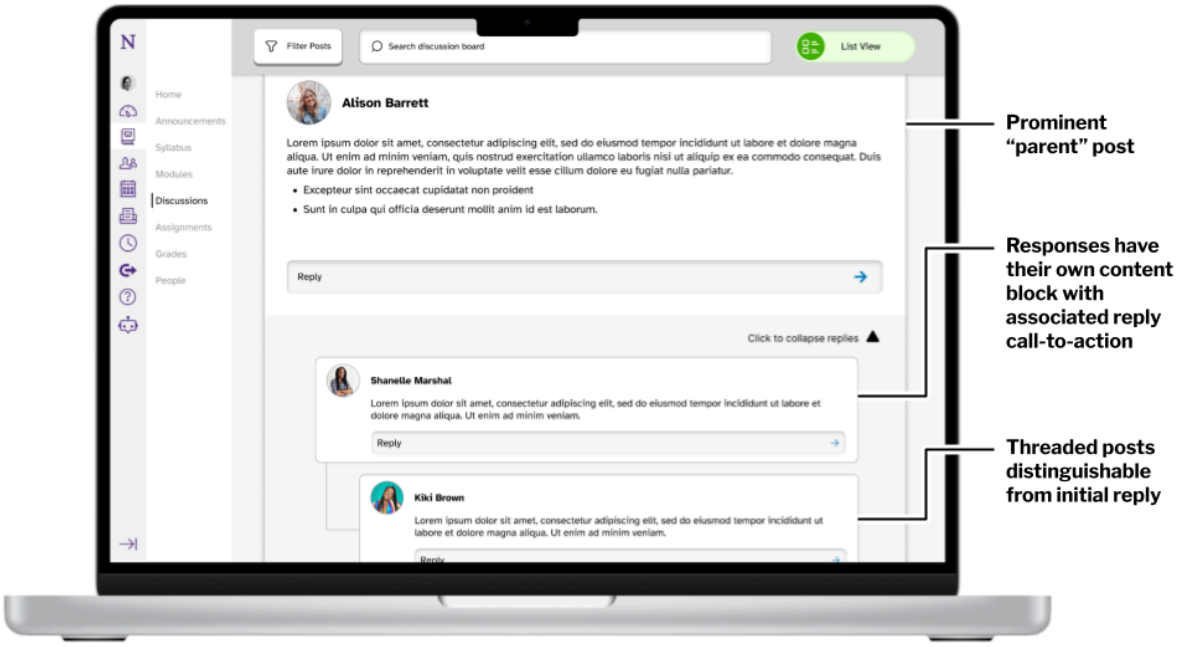
Figure 20a:
**Using whitespace to reduce overwhelm**




Once a student has expanded the post, replies are housed in clear content blocks, so it is easy to visually identify the original “parent” post from the replies (or “child” posts). Reply CTA’s are also clearly visible under each post within the discussion thread (as seen in Figure

20b). In alignment with Fitt's Law[8], the CTA stretches the expanse of the post so a student doesn't need to move their mouse far to engage with the point of action.

Figure 20b:
**Distinguishing between original posts and replies**



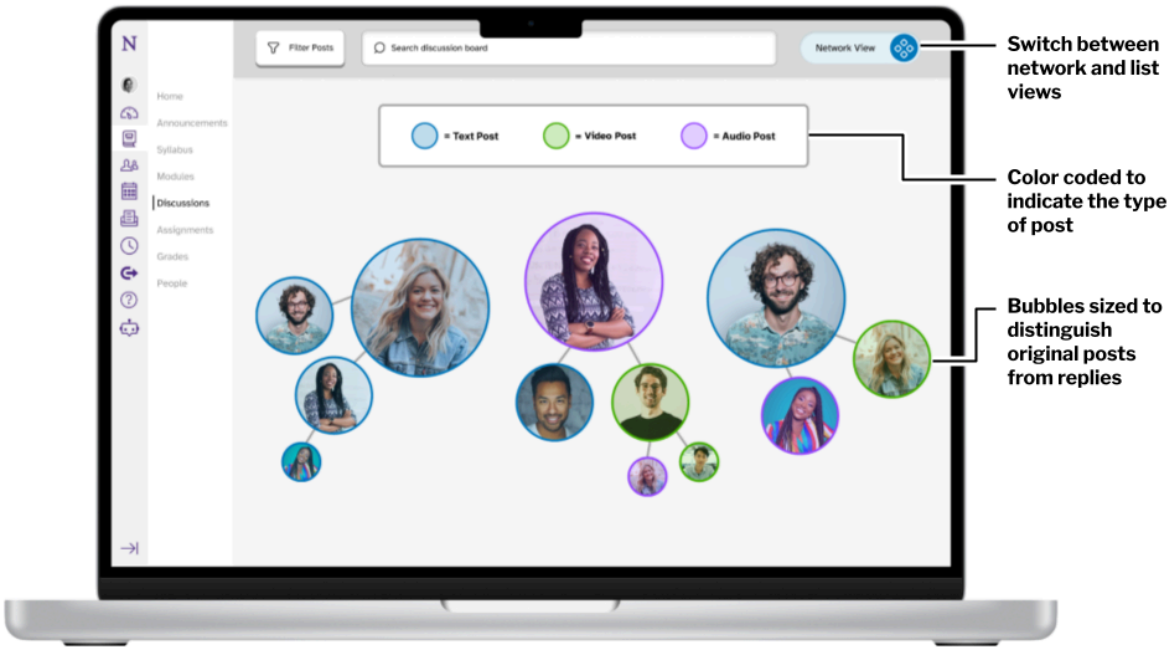

Finally, I designed additional flexibility and interactivity to the discussion board by adding a "network" view[9]. This network view offers a different way for students to engage with and visualize the discussion board. It gives students a birds-eye view of what is happening in the discussion board. Each post is represented by a bubble that features the profile picture of the student who posted it. Each bubble is color-coded to show the type of post (text, audio, or video)

[8] Fitts's Law describes the time it takes to click a target based on the size, distance, and position of the target. Interactive elements must be large enough for faster and easier clicks; the speed-accuracy trade-off for small targets results in higher error rates (Soward, n.d.).

[9] This "network view" was inspired by Discussion Hero, a gamified discussion tool created by learning designers at Northwestern University. I will discuss this tool in detail in the appendix (p. 54-58)

and sized to represent its hierarchy in the discussion board — the largest bubbles denote the primary post and smaller bubbles indicate subsequent threaded replies.

Figure 20c:
**Say goodbye to the overwhelming wall-of-text with the "network view"**




My redesigned Canvas discussion board strives to show how small changes to a design can make a big difference in increasing accessibility for students with ADHD and demonstrate how neuroinclusive design can make interfaces more usable for all students. This is still a prototype and would require additional testing to ensure optimal usability for students with ADHD. Tackling a complete learning management design is a tall order. While I believe it is a crucial step to making online learning experiences more ADHD-accessible, I have included additional ideas for improving the discussion board experience within the existing Canvas infrastructure in the appendix of this paper (p. 52-58).

## The Importance of "Modularity" in Learning Management Systems

As I continued to explore the ways learning management systems could be improved for students with ADHD, the more certain I was of the need for customization. Heather Brown, a learning designer at Northwestern University and my mentor for this project, described this as the need for a "modular" learning management system. As Kat Holmes (2023) explains, inclusive design — design that addresses the mismatches in experiences and integrates those excluded into the design process — may not result in a universal design or a single set of features that works for everyone (p.56). Where universal design came out of a movement in physical spaces, inclusive design is shaped by the emergence of digital technologies. It is much harder and more expensive to create multiple means of interacting with a physical space, but digital technologies are more flexible and able to accommodate multiple features for increased personalization.

In the case of visual interfaces, modularity can look like multiple visual overlays (dark or light mode), being able to change the default font, different views (list vs network), collapsible navigation, customized "drag and drop" dashboards, etc. Modularity can also be built into LMS by facilitating integrations with adaptive technologies. One of the key design patterns outlined in W3C's *Cognitive Accessibility Guidelines* is "supporting a personalized and familiar interface" by "enabling APIs and extensions." As artificial intelligence (AI) facilitates the emergence of new technologies, it will be more important than ever that LMS can work seamlessly with the tools that support the needs of neurodivergent learners. You can find a list of adaptive technologies used by adults with ADHD in the appendix of this paper (p. 58-64).

## Future Research Considerations

There are inherent limits to what could be accomplished in a 10-week Capstone project. The opportunities to expand this project beyond what is outlined in this paper are extensive, but I would like to highlight the following recommendations for future research within higher education and opportunities that lay outside the realms of higher education:

- **Developing this project into an interactive resource for learning designers:** The irony of this project is that the final deliverable (a 48-page paper, not including the appendix!) is an incredibly inaccessible resource for many individuals with ADHD. With more time, I would love to develop the key findings of this paper into an online resource that could be easily accessed by learning designers. This would likely take the form of a website similar to Will Soward's *Neurodiversity Design System.*

- **Learning management system usability testing and interface redesigns:** The discussion board redesigns shared in this paper are just a drop in the bucket of possibilities to make learning management systems more accessible to students with ADHD and improve usability for all students. Given the time constraints of this project, the interface mockups I developed are based on best practices and my research findings but require additional testing to ensure optimal usability. If I am able to take this project to the next stage, I would conduct thorough usability testing of the existing Canvas system with students with ADHD to identify additional areas for improvement. The next step would be to develop accessible prototypes for testing and generate buy-in from learning management systems to develop these alternative interfaces.

- **Implementing ongoing feedback from students with ADHD:** Regardless of learning management system constraints, all institutions and instructors can gather feedback from students to improve the learning experience. Students with ADHD may struggle to remember to submit their end-of-course evaluations, so instructors should provide multiple reminders and set up a dedicated time for their students to provide feedback. Additionally, institutions should consider other ways to gather feedback from students outside of a survey-based evaluation.

- **Consider systemic interventions beyond course design:** Through my interviews and survey, I heard from multiple students how they wished they had known their ADHD diagnosis upon starting college (many didn't know until well after they had graduated). While the recommendations outlined in this paper can help remove barriers for adult students with ADHD, they cannot tackle all of the challenges that arise from this diagnosis. Giving students the tools they need to recognize their diagnosis and seek appropriate treatment should be a priority for academic institutions. A survey respondent recommended instituting ADHD testing as part of the student onboarding process. Strengths-based assessments, as outlined by Fung (2023), can also be a valuable tool to help students understand the unique strengths that may come from their neurodivergent diagnosis. Instructors can also build free, self-guided strengths-based evaluations like HIGH5 into their course introductions to help students ground their coursework in their core strengths.

- **Conduct research with individuals with ADHD who did not attend college:** Research for this project was conducted with students who find the design of higher education "difficult to use." (These are students that would fall into the second ring of the starburst

chart, pictured in Figure 5.) While it is incredibly valuable to understand the experiences of people who struggle to use the design, it is crucial to reexamine how the design of online learning in higher education is a barrier to those who can't use the design at all (those in the outermost circle of Figure 5). To do this will require additional research with adult ADHD populations that did not attend college to understand their barriers to entry. This is not to say that higher education is for everyone, but there are opportunities to expand this project beyond the bounds of higher education.

- **Explore implications for online learning in professional settings:** Higher education may not be the right fit for all individuals, but it is likely that most adults with ADHD will have to learn new skills and technologies in our information-driven economy. Many professionals will be asked to learn through online training and certifications. Expanding the Pillars of ADHD-Friendly Course Design to online job training could have an incredible impact on adults in the workforce.

# Conclusion

I approached this project with the belief that everyone deserves an accessible education. An education where students can be prepared for the future, understand their unique strengths and learn how to share those strengths with the world. But, sadly, this is not the world we live in.

Institutions of higher education need to ask themselves, *Are we excluding people because they don't have the capacity to learn the material? Or are we excluding people because they do not learn it in the same manner we do?* As I mentioned in the introduction to this piece, I've seen several intelligent, creative, and charismatic people in my life struggle through their higher education experience. It was not for a lack of skill or intelligence — it was because the ways they were asked to learn did not suit the ways they actually learned. They are all capable of amazing things but have been kept from engaging productively by antiquated systems. Higher education isn't for everyone, but living in the information age requires us to be constantly learning new skills and technologies. Our ever-changing economy and the emerging power of artificial intelligence are going to require all of us to think more creatively. Institutions of higher education offer a space to learn these skills and strengthen our critical thinking. But if we continue to build our learning environments as we have, we will continue to exclude neurodiverse students — students with the creativity and skills humanity will need to meet the demands of tomorrow.

I believe in the promise of online learning in higher education and have experienced its value first-hand. Completing my master's degree online offered me the flexibility to work full-time while in school and has allowed me to connect with people across the country as part of my program. After years of wanting to go to college, my mother was able to graduate with her bachelor's degree just before her 50th birthday, thanks to an online program. While online

learning has been a blessing for some, it has been a burden for others. In the decade that I have been using learning management systems in my education, from middle school through my master's degree, I have not seen them change. However, I truly believe that online learning can be reshaped to include neurodiverse students, and in designing with the needs of these students in mind, we can create a better online learning experience for all students.

By building our online learning environments to include ADHD-friendly structure that supports executive function, stimulation to keep students engaged, and creative expression so students can share their unique strengths, we can improve the learning experience for countless students. We can improve the learning experience of the working parent who has kids screaming in the background. We can improve the learning experience of people like my mom, who are trying to learn new concepts in their second language. We can improve the experience of the freshman student with undiagnosed ADHD who is excited to start college.

# References


Barkley, R. A. (Ed.). (2015). *Attention-Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment*. Guilford Publications. https://www-r2library-com.turing.library.northwestern.edu/Resource/Title/1462517722

CAST. (2018). *Universal Design for Learning Guidelines version 2.2.* https://udlguidelines.cast.org/

CHADD. (2023). *ADHD and Coexisting Conditions*. https://d393uh8gb46l22.cloudfront.net/wp-content/uploads/2020/06/ADHD_and_Coexisting_Conditions.pdf

Cleveland Clinic. (2022, June 5). *Executive Dysfunction: What It Is, Symptoms & Treatment*. Cleveland Clinic. Retrieved from https://my.clevelandclinic.org/health/symptoms/23224-executive-dysfunction

Diaz, K., Duran, A., Friel, C., Serafini, M., Ensari, I., & Cheung, Y. K. (2023). Breaking Up Prolonged Sitting to Improve Cardiometabolic Risk: Dose–Response Analysis of Randomized Crossover Trial. *Medicine & Science in Sports & Exercise*, (May 2023), 847-855. DOI: 10.1249/MSS.0000000000003109

Dodson, W. (2020, February 28). *How ADHD Ignites Rejection Sensitive Dysphoria*. ADDitude. Retrieved from https://www.additudemag.com/rejection-sensitive-dysphoria-and-adhd/

Ducharme, J. (2023, April 12). *What's Driving the Demand for ADHD Drugs Like Adderall*. Time. Retrieved from https://time.com/6271049/adhd-diagnoses-rising/

EndeavorRx. (2022). EndeavorRx® - ADHD Video Game Treatment for Kids | FDA-authorized. Retrieved from https://www.endeavorrx.com/

FDA. (2020, June 15). *FDA Permits Marketing of First Game-Based Digital Therapeutic to Improve Attention Function in Children with ADHD*. FDA. Retrieved from https://www.fda.gov/news-events/press-announcements/fda-permits-marketing-first-game-based-digital-therapeutic-improve-attention-function-children-adhd

Fung, L. K., Doyle, N., & Treviranus, J. (2021). *Neurodiversity: From Phenomenology to Neurobiology and Enhancing Technologies*. American Psychiatric Association Publishing. https://www-r2library-com.turing.library.northwestern.edu/Resource/Title/1615373020

Hallowell, E. (2023). *ADHD Explained: Your Tool Kit to Understanding and Thriving*. Dorling Kindersley Publishing, Incorporated.

Holmes, K. (2020). *Mismatch: How Inclusion Shapes Design*. MIT Press.

Miller, M. D. (2016). *Minds Online: Teaching Effectively with Technology*. Harvard University Press.

National Institute of Mental Health. (2021). Attention-Deficit/ Hyperactivity Disorder in Adults: What You Need to Know. (NIH Publication No. 21-MH-3572). https://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd

National Institute of Mental Health. (2023, September). *NIMH » Attention-Deficit/Hyperactivity Disorder*. NIMH. Retrieved October 1, 2023, from https://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd

Noffs, D. S., & Wilson, K. (2021). How adult education can inform optimal online learning. In *pedagogy: Practical teaching strategies to overcome distance, disruption, and distraction* (pp. 54-76). Utah State University. https://doi.org/10.26079/ a516-fb24

Russell, J., Franklin, B., Allen, S., & Barkley, E. (2023, March 30). *Number of ADHD Patients Rising, Especially Among Women*. Epic Research. Retrieved October 1, 2023, from https://epicresearch.org/articles/number-of-adhd-patients-rising-especially-among-women

Scroggs, L. (n.d.). *The Pomodoro Technique — Why It Works & How To Do It*. Todoist. Retrieved December 2, 2023, from https://todoist.com/productivity-methods/pomodoro-technique

Shew, A. (2023). *Against Technoableism: Rethinking Who Needs Improvement*. W. W. Norton, Incorporated.

Soward, W. (n.d.). Neurodiversity Design System. Retrieved October 1, 2023, from https://www.neurodiversity.design/

Suetterlin, K. (2023). *How to Design for Neurodiversity: Inclusive Content and UX*. The Interaction Design Foundation. Retrieved October 1, 2023, from https://www.interaction-design.org/master-classes/how-to-design-for-neurodiversity-inclusive-content-and-ux

W3C. (2021, April 29). *Making Content Usable for People with Cognitive and Learning Disabilities*. W3C. https://www.w3.org/TR/coga-usable/

W3C. (2023, September 21). *Web Content Accessibility Guidelines (WCAG) 2.1*. W3C. Retrieved October 15, 2023, from https://www.w3.org/TR/WCAG21

York, C. (2022, October 24). *The Body Double: A Unique Tool for Getting Things Done - ADDA*. Attention Deficit Disorder Association. Retrieved December 1, 2023, from https://add.org/the-body-double/

# Appendix

## Case Study: Hacking the Existing Canvas Format to Improve the Discussion Experience

Tackling a complete learning management system redesign is a tall order. While I believe it is a crucial step to making online learning experiences more ADHD-accessible, I would like to offer some additional ideas for improving the discussion board experience within the existing Canvas infrastructure.

In my conversations with students with ADHD, Lindsey (a friend who has ADHD and extensive academic experience who helped me in the end stages of this project but was not a part of my formal interviews) noted that these online discussion boards fail to replicate the organic flow of an in-person discussion. As mentioned previously, most courses approach discussion boards with the following formula: instructors pose one or two questions to the class and ask each student to post their response to the questions and respond to two of their fellow students. This format leads to students posting very similar content and responses become dry statements of agreement (with the occasional devil's advocate). As Lindsey describes it, this type of discussion can be very challenging for students with ADHD (and many others) who excel at divergent thinking and love to explore tangential topics. During our conversation, we brainstormed ways instructors could reformat their discussion prompts within an existing LMS interface, to encourage a more organic conversation.

Lindsey described her favorite discussions as being ones where instructors embraced controversial topics. For her, these types of conversations were the most memorable because they required debate and collaboration from the class. And I shared with her some unique online

discussion prompt frameworks I've come across in Northwestern's M.S. Information Design and Strategy (IDS) program:

- **Splitting the class into question posers and question answerers:** Instructor Kelly Cutler used this method in her section of IDS-413 Visual Communication. This structure helped limit the number of original posts in the discussion thread and encouraged more back-and-forth within a single topic area.

- **Having one student start the discussion for the rest of the class to build off of:** This was an approach taken by Kevin Budelmann in IDS-407 Information and Content Strategy. This discussion format does a better job of reflecting the in-person discussion experience where the class builds off each other's answers in sequential order (as opposed to going around in a circle answering the same question).

- **Framing questions around personal experiences:** In my interview with Jessica Ashley, an instructor in the IDS program who teaches IDS-403 Effective Communication, she described how she tends to see more dynamic conversations coming out of discussions where the prompt asks the student to connect the course learnings to their personal experiences. As outlined in the Pillars of ADHD-Friendly Course Design, connecting the learning experience to areas of personal interest is important for stimulating student interest and facilitating creative expression. This also serves to keep discussions from becoming too monotonous because no two students have the same experience.

- **Using discussion boards as a forum to share progress on a project:** This discussion board approach was prominently used in IDS courses that center around a single project that runs the length of the course (IDS-405 User Research, IDS-411 Information Design

and Architecture, and IDS-498 Capstone). Similar to framing questions around personal experience, using discussion boards as a forum to share project progress ensures no two posts are the same and creates a more dynamic environment for students to ask for help and give advice.

The examples outlined above help create a more engaging discussion experience for students, but in large classes, the forum can still feel text-heavy and overwhelming. Teachers can encourage students to include multimedia components to break up the text (post video or image content to support their point of view). In Canvas, instructors can also break the class up into "groups." These groups are hosted in separate Canvas pages where each group can have a dedicated discussion board. IDS professor Jessica Ashley also expressed to me that her smaller classes seem the most willing to engage authentically with each other.

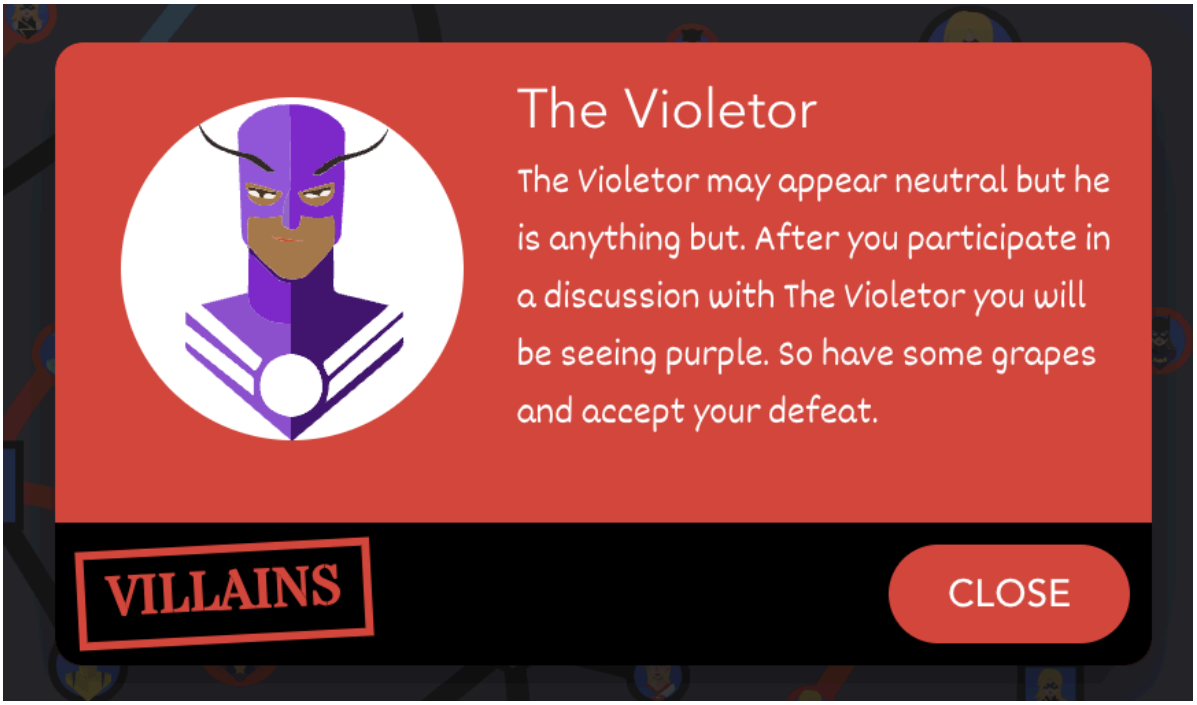
## Gamified Discussions with Discussion Hero

Another tool to diversify the discussion experience that is available to Northwestern University instructors is Discussion Hero. This alternative discussion board tool was created by learning designers Jacob Guerra-Martinez and David Noffs. I was first introduced to this platform in a course taught by David Noffs, IDS-425 Learning Environment Design. The aim of Discussion Hero is to "gamify" the discussion experience by providing an alternative framework where students play as heroes and villains in an anonymized discussion board.

To participate in the discussion, students have to choose a specific character or "avatar." Each character, hero or villain, comes with a description of how they interact in a discussion (see an example character in Figure 21a). The goal is for the student to embody the characteristics of this avatar in their discussion posts. In interviews with Noffs and Guerra-Martinez, both

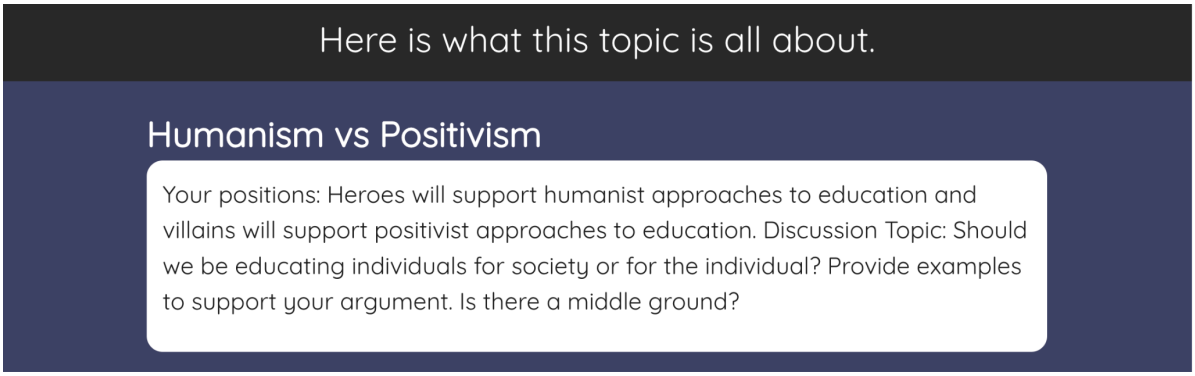
described how this anonymized role-playing helps students engage in more dynamic and meaningful discussions.

Figure 21a:
**Discussion Hero - Your Character**




To support the hero versus villain framework, questions are posed in a pro/con format with each group taking a specific stance (see an example question in Figure 21b). Framing the discussion in a pro/con manner supports an energetic discussion and critical thinking. (As Lindsey described, a level of "controversy" enhances the discussion experience.)

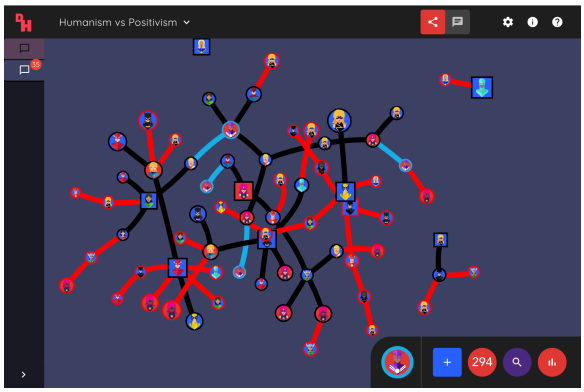
Figure 21b:
**Discussion Hero - Discussion Prompt Example**



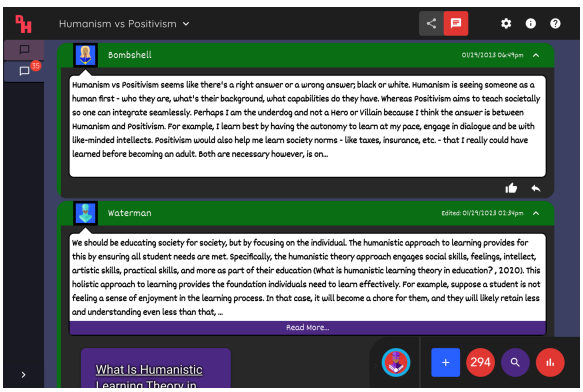

Discussion Hero continues the gamified experience through interesting visuals and interactive elements. In Figure 21c, you can see how students are able to toggle between the network and standard views. In the network view, students can hover their mouse over a specific bubble to see the associated text post. (This interactive network design inspired my discussion interface designs, seen in Figure 20c.)

Figure 21c:
**Discussion Hero - Network and List Views**

Network View




Traditional View




While Noffs describes positive feedback from students using Discussion Hero in his classes, Guerra-Martinez shared with me that they have had difficulty getting instructors at

Northwestern to buy into the value of gamification. Guerra-Martinez believes that part of the problem is that many instructors view Discussion Hero as a "toy" and see games as "childish." In his opinion, this is a very reductionist view of how gamification can improve the learning experience, and many instructors fail to see how their online learning environments are already gamified. (For example, stratifying learning by locking modules that can only be unlocked once the previous content has been learned is a form of gamification.)

Gamification offers an amazing framework to support the needs of neurodivergent students. In 2020, the FDA approved marketing of the first game-based digital therapeutic device designed to improve attention function in children with ADHD, ages 8–12 (FDA, 2020). This gamified therapeutic, EndeavorRx®, states that 73% of children who use their game reported an improvement in their attention, and 68% of parents reported improvement in ADHD-related impairments after two months of treatment (EndeavorRx, 2022).

But as stated previously, games aren't just for children. In *Against Technoabelism,* Ashley Shew (2023) describes a conversation from a panel on autism tech at Virginia Tech's November 2020 public engagement series "Choices and Challenges – Technology & Disability: Counternarratives." This panel featured four autistic scholars and one non-autistic researcher. In this conversation, panelists identified games like Dungeons & Dragons (D&D) and Pokémon as "autistic technologies." These games provide a valuable way for autistic people to "socialize, connect, and empathize" (p. 107). While this example is not ADHD-specific, there is a significant overlap between these neurodivergent conditions. It is estimated that 1 out of 4 individuals with ADHD also have autism (CHADD, 2023). I've observed a unique love for gaming from individuals with ADHD in my life and those I interviewed during this project —

many play games like D&D, Minecraft, World of Warcraft, Animal Crossing, and Stardew Valley (just to name a few).

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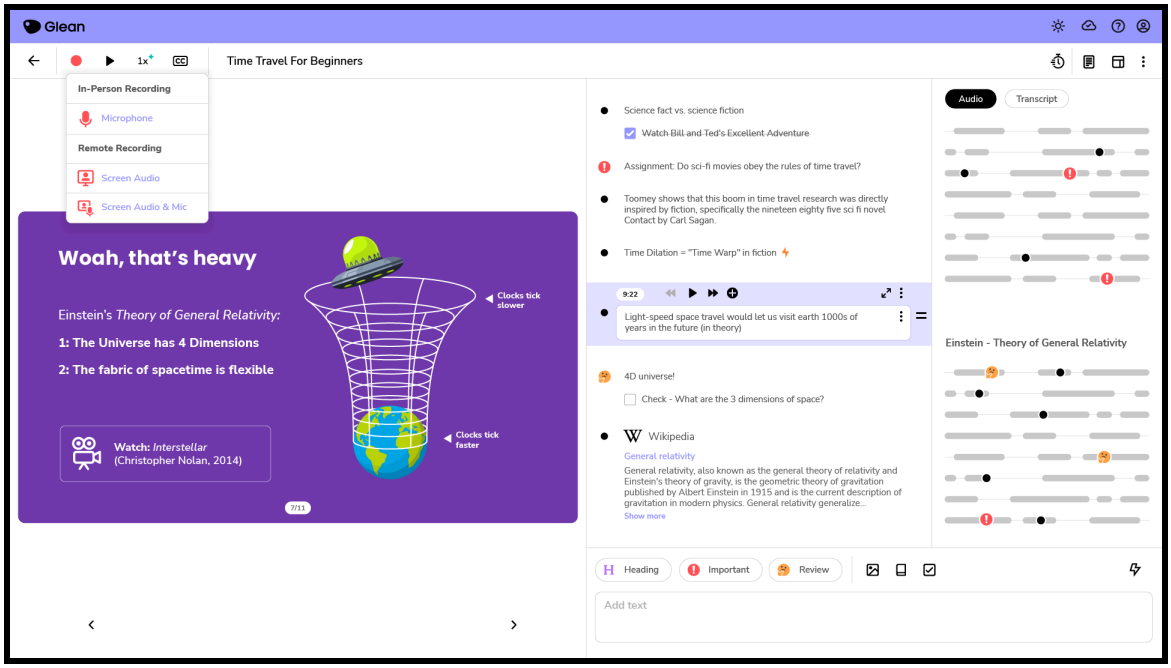
## Adaptive Technologies Used by Adults with ADHD

Discussion Hero is just one example of how instructors and learning designers can integrate custom APIs into learning management systems to diversify the online learning experience. Through my research, I've been introduced to a number of digital programs that individuals with ADHD are using to facilitate their learning experiences, task management, and habit tracking. Being able to integrate these tools with learning management systems or creating similar features within LMS can go a long way in improving the learning experience of a student with ADHD. In this section, I will discuss the following tools: Glean, Speechify, Tiimo, Habitica, and Focusmate.

**Glean** is an adaptive technology used at over 700 academic institutions globally and available to students at Northwestern through NUAccessible. This personal study tool allows students to record lectures, import related presentation materials, and take notes in real time, so the notes are aligned with the specific section of a lecture/presentation. It includes easy commands for students to flag sections where they had questions or highlight important areas so they can easily reference back to these areas when it comes time to study. Additionally, Glean can convert recorded audio into text with its transcription feature, allowing students to reference lectures in both audio and text.

Figure 22:
**Glean Interface**



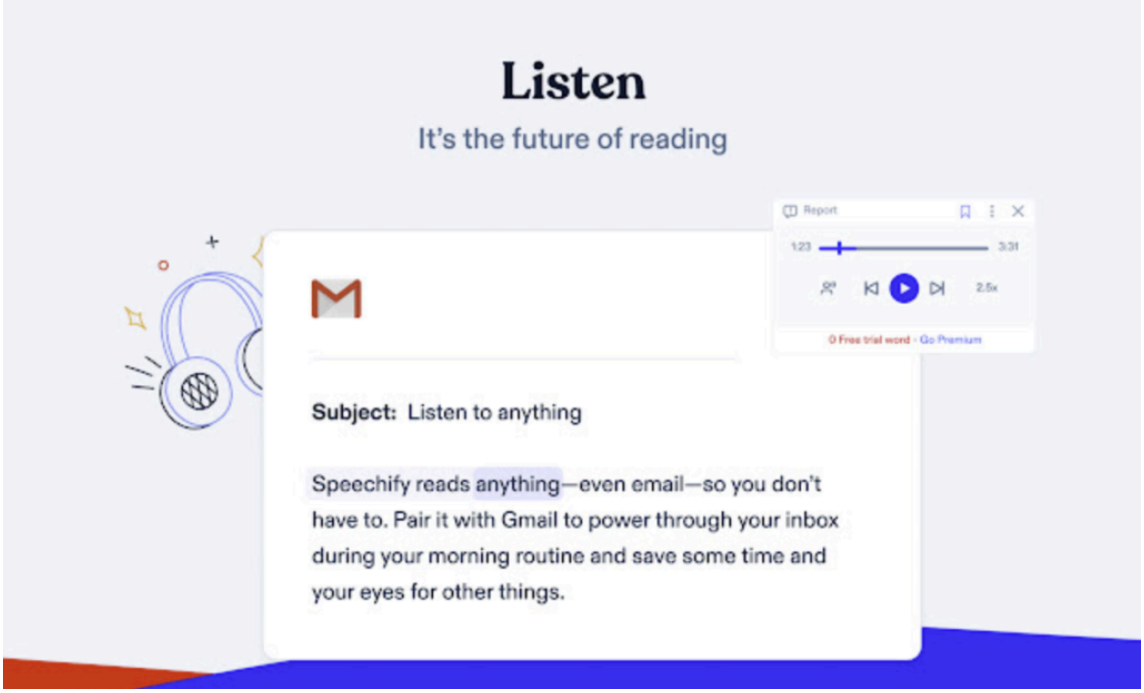

Source: [Glean Website]

**Speechify** is a text-to-audio tool that stands out for its natural sounding, human quality voice overs created with artificial intelligence (AI). Speechify was created by Cliff Weitzman as a way to overcome the challenges of his dyslexia (like ADHD, dyslexia is considered a neurodivergent diagnosis). This product works on desktop and mobile devices and works with PDFs, emails, Google and Word docs, or any website — including learning management systems like Canvas. Speechify offers a lot of customizability, allowing you to choose from a large selection of AI-generated voices and playback speeds.

I was first introduced to Speechify as a tool to help students with ADHD by Michelle Bannerman, a fellow student in the IDS program. Bannerman spoke about Speechify in her presentation "Leveraging AI for Equity: Neurodiverse Learners and the Online Classroom," at the 2023 Northwestern School of Professional Studies Symposium alongside David Noffs and

Heather Brown. Bannerman describes how Speechify benefited her teenage daughter, who has ADHD, by helping her overcome the “wall of text,” a barrier to engagement for a lot of students with ADHD. Speechify not only converts text to audio but also includes visual overlays that highlight words as it reads them — allowing users to listen and read at the same time. The combination of both an audio and visual queue can be very beneficial to individuals who struggle with visual and auditory information processing. Respondents to my survey also described how audio media (or being able to convert text to audio) is a valuable tool because it allows them to consume educational content while doing other tasks like exercising, cooking, painting, etc. This allows students to pair a boring task with one they enjoy. Or makes two tasks that may feel tedious or understimulating for a person with ADHD more stimulating by combining them together.

Figure 23:
**Speechify: How it works**



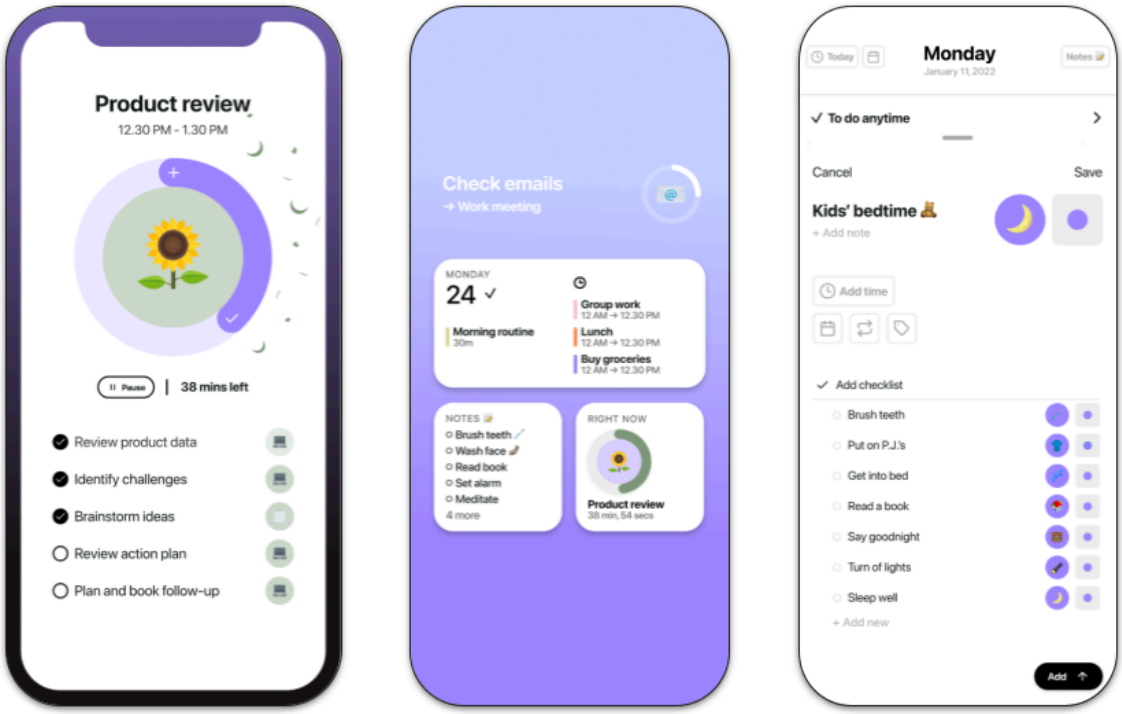

Source: Speechify Website

**Tiimo** is a visual planning app that, like Speechify, has AI-enabled features and was designed by and for neurodiverse people. Tiimo co-founders Helene and Melissa (diagnosed with ADHD and dyslexia) approached this product with the goal of building a "neuroinclusive world," following a research project they did looking into ways technology could support the needs of neurodivergent adolescents. Tiimo states, "Our experience is in designing for neurodivergent brains, but our approach benefits everybody." Tiimo is designed to aid neurodivergent individuals with time agnosia (or time blindness) and help them transition between activities. Tiimo includes AI-powered checklists that help break down, or "chunk," big tasks into smaller more manageable activities.

I was initially introduced to Tiimo through Katrin Suetterlin's webinar *How to Design for Neurodiversity* (2023). Tiimo is just one example of a digital tool for task management. Through my survey, adults with ADHD told me about other tools like Wrike and ClickUp that help them with task management in the workplace. Several respondents also described using Pomodoro timers to help them break up tasks and maintain momentum. The Pomodoro Technique is a productivity method that encourages people to break their days up into frequent, focused work sessions of about 25 minutes followed by five-minute breaks[10]. (Scroggs, n.d.)

[10] New research from Columbia University Medical Center shows that if your job involves sitting at a desk all day, breaking up our work days in this fashion and incorporating movement into our five-minute breaks can have significant benefits for our mental and physical health. (Diaz et al., 2023)

Figure 24:
**Tiimo Interface Screens**

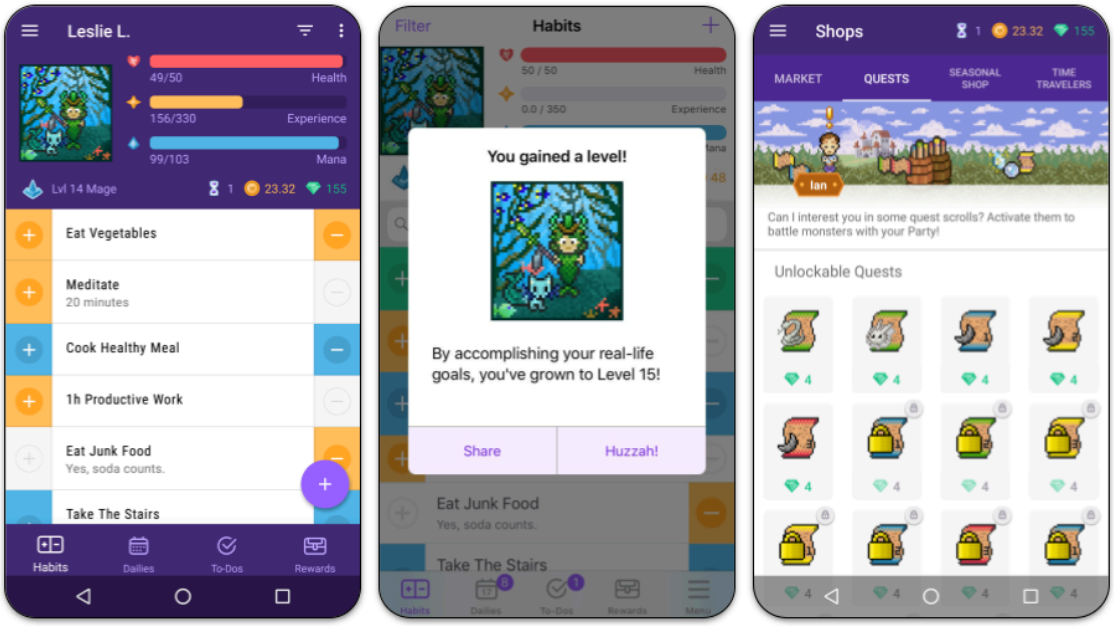



Source: Tiimo Website

Similar to Tiimo, **Habitica** is an app focused on task tracking and planning. Lindsey, one of the adults with ADHD that I consulted while working on this project, introduced me to this application. Unlike other task trackers, Habitica takes a gamified approach to help its users stay motivated to achieve their goals. Habitica gamifies your life by turning all your tasks (habits, to-dos, assignments, etc.) into little monsters that you have to conquer. The better you are "killing" your monsters, the farther you progress in the game. Lindsey describes how Habitica's gamification helps her stay motivated by rewarding her with currency for achieving her goals that can be used to "buy" new equipment and featuring unique "bosses" that she has to beat every week. Lindsey enjoys that Habitica keeps her accountable to her goals without exploiting an all-or-nothing mindset. If a person is unable to complete a set task, it can dock their "health"

in the game. But it is a minor hit that can encourage the user to complete the task in the future and doesn't create a dramatic punishment like "failure" that can demotivate a neurodivergent person entirely[11]. Habitica can be played solo or in collaboration with friends to increase social accountability.

Figure 25:
**Habitica Interface Screens**



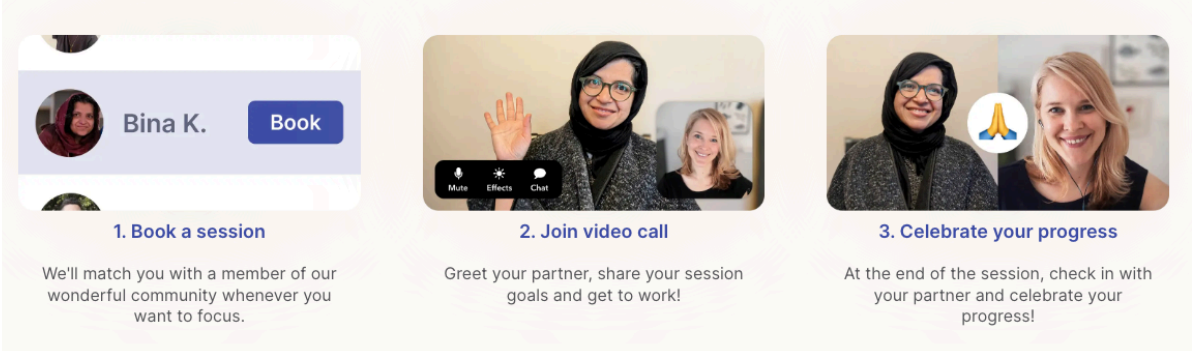

Source: Habitica Website

**Focusmate** is another tool that leans into the idea of accountability as a support for individuals with ADHD. In my survey, I asked adults with ADHD about digital tools they enjoy using or that help them manage academic or work-related tasks; one respondent described using Focusmate during the pandemic year of their graduate program. They said, "It re-introduced schedule and accountability partners, which are both things I benefit from." Focusmate serves as

[11] Many neurodivergent people, including those with ADHD, struggle with rejection sensitivity dysphoria (RSD) which is an extreme emotional sensitivity and pain triggered by the perception that a person has been rejected or criticized. (Dodson, 2020)

a tool for “body doubling.” Body doubling is the practice of having another person present to help you stay on task. This productivity strategy is popular among individuals with ADHD by encouraging them to stay focused, complete tasks and remain accountable to their goals. (York, 2022)

Figure 26:
**Focusmates: How it works**




Source: Focusmate Website

These are just a handful of the digital tools that can facilitate learning for students with ADHD. They are also amazing examples of how neurodivergent designers and those designing for neurodiverse needs can create extraordinary products that bring value to all neurotypes.

# Additional Resources

## Project Research & Design Links

- **LMS Survey:** Qualtrics Online Survey Preview
- **Interactive Figma Prototype:** Discussion Board Redesign

## Suggested Readings

Below are additional resources that were not cited (or only mentioned briefly) in this paper, but I believe are valuable additions to the topic of online learning design for adult students with ADHD:

- **TKI Inclusive Education Initiative:** Guide to ADHD and Learning
- **CAST Universal Design for Learning:** Guideline #6 –"Provide options for executive function"
- **Sententia Gamification:** The Gamification Report Blog
- **Body Electric:** An NPR podcast series investigating the relationship between our technology and our bodies

If you want to learn more about inclusive design, I highly recommend reading the following books that I cited in this paper:

- **Against Technoabelism: Rethinking Who Needs Improvement**
  by Ashley Shew
- **Mismatch: How Inclusion Shapes Design**
  by Kat Holmes

## ADHD Content Creators

A lot of the conversations around ADHD and neurodiversity are happening online on social platforms like TikTok or through podcasts and community forums. Below I have linked a few content creators that I've enjoyed learning from and that I believe provide valuable insight into the lives of adults with ADHD:

- **@drhallowell on TikTok:** Dr. Hallowell has been considered an expert in the field of ADHD having published 20 books on the subject. (I cited his book *ADHD Explained* in this paper.) He shares his insights on ADHD in the TikTok series #NedTalks.
- **@adhd_love on TikTok:** Rich and Rox are a couple that post digital content under the name ADHD love. Rox has ADHD and shares her experiences living with the diagnosis. Her partner, Rich, offers the alternative view by talking about what it's like to be a neurotypical person living with and loving someone with ADHD. They are also the creators of the body-doubling app Dubbii and the book *Dirty Laundry*.
- **@strugglecare on Instagram:** KC Davis is a digital content creator with ADHD who focuses on creating a "morally neutral" space to discuss home care and organization in a neuroinclusive manner. She hosts the podcast "Struggle Care" and wrote the book *How to Keep House While Drowning,* which outlines a "gentler approach to cleaning and organization."
- **@danidonovan on TikTok:** Dani is a mental health comic writer and video content creator. On TikTok she posts honest and humorous stories about her life living with ADHD. You can find her collection of ADHD comics, infographics, and illustrations about ADHD on her website.
- **@mostlyadhd on Instagram:** The comic artist who goes by Mostly ADHD Comics shares cute but blunt comic strips about life with ADHD.
- **r/ADHD:** This subreddit is described as an "inclusive, disability-oriented peer support group for people with ADHD with an emphasis on science-backed information." It is a place for people with ADHD to share their stories, struggles, and non-medication strategies. Nearly a million and a half users say they "feel at home" and "finally found a place where people understand them."
- **"The ADHD Skills Lab" Podcast:** This podcast is hosted by Skye Rapson, founder of the ADHD support service Unconventional Organisation. Each week, she chats with expert guests and dives into the latest ADHD research to provide listeners with practical support for life with ADHD.

**Please note:** Not all the content posted by these creators has been scientifically proven or fact-checked. Many are sharing only their personal experiences.