Tips for High School Educators: Engaging Neurodivergent STEM Students

This publication offers guidance on working more effectively with neurodivergent students. This information was collected through classroom interactions, discussions with neurodivergent students and educators, literature reviews, and participation in conferences and workshops.

Neuroscience for Neurodiverse Learners (NNL) provides hands-on experiences in neuroscience disciplines, networking opportunities, and resources to high school and early postsecondary students identified as "neurodivergent" learners—those with academic challenges related to conditions such as dyspraxia, dyslexia, attention deficit hyperactivity disorder, dyscalculia, autism spectrum disorder, and Tourette syndrome—and disseminates findings to teachers of courses that are related to neuroscience and, more broadly, science, technology, engineering, and mathematics (STEM). The goal of NNL is to enhance student interest in and skills to successfully pursue STEM fields, as well as empower educators to serve these students more effectively.

Universal Design

Universal design is a proactive approach to making facilities, information resources, and instruction welcoming to, accessible to, and usable by everyone is called universal design (UD). This approach means that rather than designing something for the "average" user, it is designed for people with a broad range of characteristics. Many of the strategies shared in this publication can be viewed through a universal design lens. As such, they have the potential to benefit all students—not just those who identify as neurodivergent.

Accommodations

Accommodations are a reactive process to providing access for individuals with disabilities. When a student, parent, or educator identifies an access barrier, they go through the process set out by the school district for coordinating accommodations. While universal design reduces the need for accommodations, no class will be fully inclusive for every student. A sign language interpreter is a common example of an access need that is not always practical for universal design but comes up frequently as an accommodation.

Lessons Learned

The table below shares the advice learned through our experiences with NNL.

Lessons Learned
Share "What We're Doing and Why It's Important"
Focus on Student Strengths
Find Ways to Incorporate Humor
Be Genuine and Be Vulnerable at Times
Build and Share Social Narratives
Allow for Hands-On Learning
Encourage Student Teaching of Others
Offer Options to Students
Make Time for Student-Driven Content
Use Near-Peer Leaders
Be Aware of Assistive Technology
Explore How Classes Can Continue to Promote Executive Function Growth

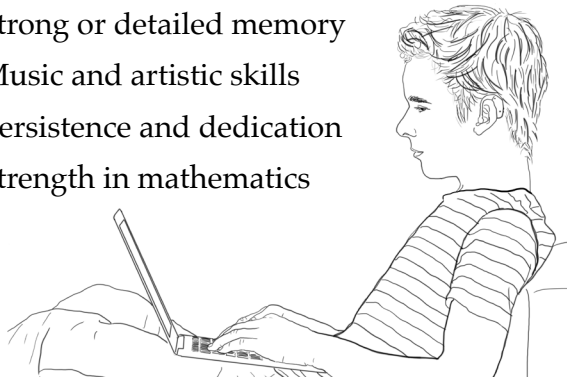
Share "What We're Doing and Why It's Important"

At the beginning of each classroom session, NNL instructors share the reasons they selected the content and the method of instruction, tying the content to broader goals of the program. NNL instructors also ended sessions with a summary of the class, as well as ways to engage with further resources. This practice was adopted from emerging concepts within the Transparency in Learning and Teaching (TILT) model of academic engagement. The TILT model employs a set of teaching strategies that focus on making transparent to students how and why they are learning content in particular ways.[1]

Focus on Student Strengths

Project staff asked students about their academic and social strengths and actively encouraged students to build on these strengths in the classroom. NNL students learn about "strengths-based" models of viewing disability, which entails focusing on what the person can do well because of their disability. Students are encouraged to recognize traits related to their disability that make them unique, helping them see that these traits can contribute positively to their identity. Common strengths reported by students included the following:

- Proficient in online learning
- Creative thinking and problem solving
- Spatial visualization and memory
- Honest and direct communication
- Empathy skills and kindness
- Strong or detailed memory
- Music and artistic skills
- Persistence and dedication
- Strength in mathematics



Students in the program also learned about historical models of disability, many of which depict disability as an individual deficit. Students were encouraged to consider how these historical models have impacted their experiences and identities.

Find Ways to Incorporate Humor

NNL staff observed that the use of humor is particularly engaging to students. Project staff observed that nearly all neurodivergent students in the program appreciated the use of humor in the classroom, even when such experiences were challenging to them. When staff asked students for advice about using humor, three themes emerged. First, students said it is helpful for an individual to explicitly state they are joking and explain the joke after telling it. Second, students said it helps to check in with them about the various humor being used; the most common concern heard from students was "sometimes I just want to know people aren't laughing at me." Third, it was observed by staff that using humor over email or other text-based platforms is more challenging as compared to in person.

Be Genuine and Be Vulnerable at Times

Project staff observed that neurodivergent students in the program appreciate it when instructors and staff share their authentic selves and show vulnerability. On the first day of class, for example, one instructor shared "I am much older than you, and it's still a challenge for me to meet new people and make new friends. I've learned some strategies along the way, but it's still hard for me." When one student talked about outside noises making it hard for them to learn, a mentor in the program shared, "Yes! Me too. There is so much distraction outside today, and I'm having a hard time staying focused. I think I understand what you're saying."

[1] Winkelmes, M. A. (2023). *TILT Higher Ed Examples and Resources.* tilthighered.com/resources

Build and Share Social Narratives

A social narrative is a written story that explains a social situation, emphasizing where resources are, how others may interact, what expectations are generally set, and what changes a person may want to prepare for. At NNL, project staff provide an online orientation to the campus and classroom activities, including the types of activities to be engaged in, images of buildings and spaces to be visited, and anticipated sensory experiences (e.g., the odor in the brain dissection lab, specific noises that may occur, and things you can see the main classroom).

Allow for Interactive or Hands-On Learning

NNL project staff observed that students were especially engaged during interactive learning activities, such as the dissection of a sheep brain, the construction of a brain model "brain hat," neuroscience demonstrations with college students, the creation of sound-makers from everyday objects, and creating neuron models. Hands-on learning engages more areas of the brain as compared to lectures and other forms of instruction, which can lead to more effective retention of course material.

Encourage Student Teaching of Others

Offering opportunities for students to teach enhances student learning. This strategy is often referred to as a "flipped classroom." Providing scaffolding and clear expectations can make this more successful for most students. Through the development and teaching of a lesson called "The Neuroscience of Facial Recognition," the student gained confidence in their speaking skills, reinforced their own learning, and acted as a peer mentor to others. Observations from project staff included increased attention from the student group, lively questions, and excitement for the hands-on portion of the class, where students explored the campus in search of items that looked like human faces.

Offer Options to Students

Throughout the NNL program, students were offered different options to engage content. For example, prior to the sheep brain dissection activity, students were given the option of a small group learning session outside of the lab to learn about brain structure on a laptop instead of dissecting a real brain. Students were offered options on where they wanted to sit in the room, how they might want to respond to questions, and how they might want to control their setting. Students reported that having such options decreased anxiety and allowed more opportunities to fully engage in the program.

Make Time for Student-Driven Content

Throughout the NNL program, students were offered the opportunity to suggest topics of interest. Staff intentionally left time in the course to build new content based on student suggestions (e.g., how meditation impacts the brain, how experiences with music can impact the brain). The most popular class, suggested by students, was the exploration of how neuroscience is portrayed in movies, with an analysis of a movie's accuracy and plausibility. The highest-rated elements of the NNL programming were the topics that students identified as areas for further exploration.

Build Up Near-Peer Leaders

The NNL program has "near-peer" mentors, defined as mentors who are slightly older than mentees. After completion of a summer session, NNL students can apply to return as mentors. Undergraduate students who identify as neurodiverse also participate in the program to engage with high school students on college-preparation activities, lab work, and various skill building activities.

Be Aware of Assistive Technology

Educators are encouraged to explore assistive technology commonly used by neurodivergent learners, especially in the areas of note taking, organizing ideas, reading, writing, calendaring, and calculating. This may include specific recording devices, sound amplification, text-to-voice, a screen enlarger, physical support aids, or a wide variety of other technology.

Explore How Classes Can Continue to Promote Executive Function Growth

Educators can support the development of executive functioning skills by including use of these skills within lessons.[2] Executive functioning skills typically develop throughout adolescence and youth, but growth and support of these skills continue throughout most of our lives. Executive functioning skills include paying attention; organizing, planning, and prioritizing; starting and completing tasks; understanding different points of view; regulating emotions; time management, being flexible, and self-monitoring (keeping track of what you're doing), among others.

Academic coaches or trained therapists may be hired to help students build these skills, but all educators can support executive functioning growth within their curriculum. Providing outlines of class topics, offering commonly used workflows or time management techniques, encouraging short breaks to then re-engage—these are just a few examples of ways an instructor can help in this area.

About NNL

The University of Washington's DO-IT (Disabilities, Opportunities, Internetworking and Technology) Center and the Center for Neurotechnology at the University of Washington lead the NNL project for the purpose of increasing the participation of people with disabilities in neuroscience, and more broadly, careers in science, technology, engineering, and math (STEM).

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[2] Bellman, S., Burgstahler, S., & Hinke, P. (2015) Academic coaching outcomes for students with disabilities pursuing science, technology, engineering, and mathematics (STEM). *Journal of Postsecondary Education and Disability,* 28(1), 101-106.

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