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Overview

This chapter describes how teachers can provide enhanced safety and learning opportunities for students with disabilities in science/STEM education. The chapter begins with a discussion of the characteristics of adolescents with disabilities who typically participate in science/STEM laboratories. We then provide an analysis of the barriers they face during science/STEM learning. The Universal Design for Learning framework is presented to proactively address learner variability while increasing science/STEM laboratories outcomes for students with disabilities. The chapter concludes with practical suggestions teachers can use to meet the legal obligations associated with having students with disabilities in their laboratories.

Keywords: Science Laboratory, STEM Laboratory, secondary education, special education, executive function

Why Students With Disabilities are Needed in Science/STEM

Science/STEM Laboratories are exciting environments for students in any school. However, these environments often pose unique challenges for students with disabilities (Love et al., 2020). Individuals with disabilities have been underrepresented in the science, technology, engineering, and mathematics (STEM) workforce for more than two decades (National Science Foundation, 2019). However, individuals with disabilities such as Autism Spectrum Disorder (ASD) possess unique attributes which lend themselves to STEM careers including but not limited to: a) sustained, hypersensitive attention to detail; b) repetitive, systematic procedural knowledge and skills; c) the ability to conceptualize outcomes and solutions to complex problems; and d) the ability to disassociate themselves from emotional attachment when completing tasks (White & Mitchel, 2013). High-functioning individuals with disabilities clearly have the potential to flourish in science/STEM careers when provided with appropriate coaching and mentoring in the Laboratory (Marino et al., 2020; National Science & Technology Council, 2018). This chapter describes what teachers can do to ensure active and safe participation in a laboratory environment, while accurately assessing student learning.

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Characteristics of Adolescents With Disabilities in STEM Laboratories

Approximately 6.1 million students in the United States between the ages of 6 and 21 receive services under the Individuals with Disabilities Education Act (U.S. Department of Education, 2019). According to the U.S. Department of Education (2019), students with specific learning disabilities comprise the majority (2,135,000) of these students. Another 915,000 students are served under the speech and language impairment category and 915,000 additional students receive services under the other health impaired category, which includes students with Attention Deficit/Hyperactivity Disorder (AD/HD.) In addition, 600,000 students are identified with ASD. Most students with disabilities are served in inclusive science/STEM laboratories alongside their peers without disabilities. Definitions of the disabilities mentioned in this section are from IDEA (2004) unless otherwise noted. A specific learning disability is defined as:

> *A disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.* (IDEA, 2004, Sec 300.8 (c) (10))

Specific learning disabilities are followed in prevalence by speech or language impairment, which is defined as, "a communication disorder such as stuttering, impaired articulation, a language impairment, or a voice impairment that adversely affects a child's educational performance." These students also typically receive services in inclusive classrooms.

Other health impairment is the next largest category. This group includes individuals:

> *Having limited strength, vitality or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment that is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, Tourette's Syndrome, and sickle cell anemia; and adversely affects a child's educational performance.* [IDEA, 2004, Sec 300.8 (c) (9)]

While this definition includes a diverse range of disabilities, Attention-Deficit Disorder (ADD) and ADHD are the most common other health impairment categories served under IDEA.

Autism makes up the final group recognized as having high incidence disabilities. Autism has been defined as:

> *A set of neurodevelopmental disorders characterized by a lack of social interaction, verbal and nonverbal communication in the first 3 years of life. The distinctive social behaviors include an avoidance of eye contact, problems with emotional control or understanding the emotions of others, and a markedly restricted range of activities and interests.* (Park et al., 2016, p. 1)

This group of students can be especially challenging because of their limited social skills. However, it should be noted that some of the greatest scientific discoveries came from people with ASD. For example, while the term autism did not exist until 1943, many have speculated Nikola Tesla, Sir Isaac Newton, Albert Einstein, and Charles Darwin were afflicted with the disorder. In contemporary times, Bill Gates, Temple Grandin, and Steve Jobs have been identified with high functioning autism. It is clear individuals with ASD can make significant contributions to science/STEM and can do so while working with others in a safer environment. Creating a safe environment for students with disabilities to explore science/STEM laboratories and careers will provide a pathway for future scientists.

Many obstacles prevent students with disabilities from learning in traditional science/STEM laboratories. Obstacles include communication issues, sensory overstimulation, and inaccessible facilities. For example, students with Attention-Deficit/Hyperactivity Disorder who have significant executive function deficits may have difficulty planning and carrying out procedures during an experiment as a result of becoming easily distracted and having a hard time refocusing. Students with physical disabilities face a different set of challenges such as diminished mobility and dexterity, limited strength, the need for personal assistance services, and inaccessible laboratory spaces and equipment (Stumbo, 2011). Students with ASD may be overstimulated and lack the communication skills necessary to describe their difficulties (Goudreau & Knight, 2018). With proper planning and communication, it is possible for these students to have a highly successful and safe laboratory experience.

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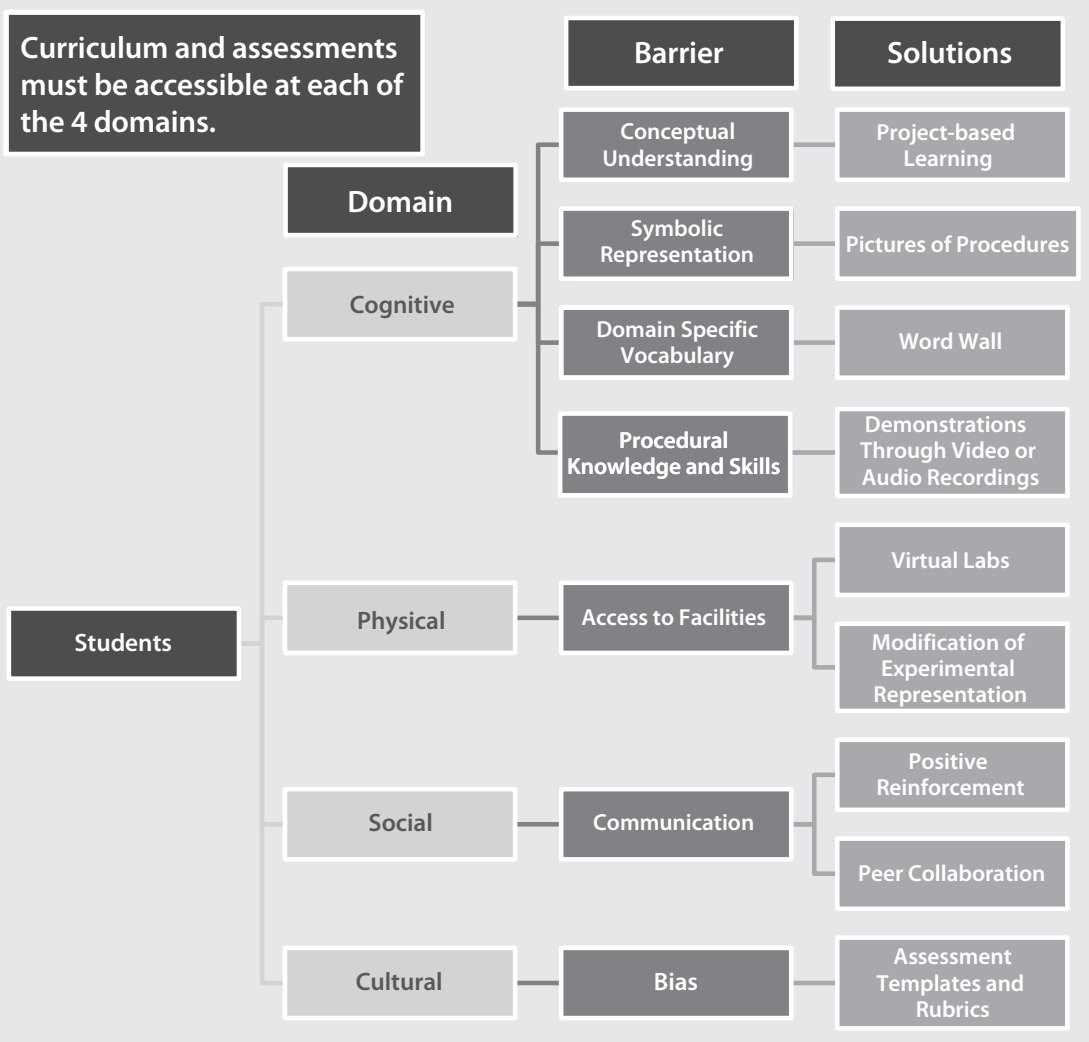
Identifying Barriers for Students With Disabilities in Science/STEM Laboratories

Examples of barriers based on the four domains of cognitive, physical, social, and cultural learning are included in Figure 11.1. This example is a starting point to determine possible barriers to student learning and assessment. These will likely be included in the student's IEP. In many schools, teachers only receive a list of accommodations. However, all teachers have the right to review the IEP. In most states, teachers must review the entire IEP and sign that they understand the contents in the document. Meeting with the students' case manager provides an opportunity for the teacher to discover other possible issues not explicitly stated in an IEP. Planning lessons that incorporate special education students' needs will allow instructors to remove barriers that may not be initially evident and will support other students who do not have an IEP.

Figure 11.1. illustrates a process teachers can follow to proactively address learner variability in their laboratories. The process begins by considering the four domains where learning barriers occur (i.e., cognitive, physical, social/emotional, and cultural). Each of these domains should be deconstructed to identify barriers students may encounter during the laboratory. For example, students with AD/HD may need step-by-step procedures presented in multiple formats such as in written form, in pictures, and an audible explanation from the teacher or a laboratory partner. Potential solutions are presented in the final column of the figure.

Figure 11.1.
EXAMPLE OF BARRIER IDENTIFICATION AND DECONSTRUCTION



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