Making Science Labs Accessible to Students with Disabilities

Application of universal design to a science lab

by Sheryl Burgstahler, Ph.D.

Students with disabilities face access challenges to typical science labs in precollege and postsecondary settings. Access barriers may prevent a student from:

- gaining knowledge,
- demonstrating knowledge, and
- fully participating in lab activities.

There are two approaches to making academic activities accessible to students with disabilities—accommodations and universal design (UD). Accommodations are alternate formats, assistive technology, and other adjustments for specific students once they are enrolled in a class. For examples of accommodations in science classes, consult the publications *Working Together: Science Teachers and Students with Disabilities*[1] and *The Winning Equation: Access + Attitude = Success in Math and Science.*[2]

Universal Design

The Center for Universal Design[3] defines universal design as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." Applications of UD in education take proactive steps to create aademic products and environments that are accessible to students with a wide range of characteristics, including disabilities, thereby minimizing the need for future accommodations. For example, if a science lab contains an adjustable-height workstation, an accommodation will not be needed for a future student who uses a wheelchair that is too high for standard-height workstations. This workstation may also be comfortable for a student who needs to remain seated because of a health impairment or someone who is very tall or short in stature. In a science lab, UD can be applied to:

- lab climate;
- physical access, usability, and safety;
- delivery methods;
- information resources;
- interaction;
- feedback;
- assessment; and
- plans for accommodations.

Making accommodations is reactive, whereas universal design is proactive.

Accommodations

Following are examples of accommodations that might benefit a student with a disability.

- Use wheelchair-accessible labs and field sites.
- Talk to a student about special learning needs and accommodation alternatives.
- Provide a lab partner.
- Use plastic instead of glass.
- Allow extra time for set up and completion of lab work.
- Address safety procedures for students with a variety of sensory and mobility abilities.
- Use institutional resources for students with disabilities.

Typical science lab accommodations for students with specific disabilities include those in the following lists.

Blindness

- verbal descriptions of demonstrations and visual aids
- Braille text and raised-line images
- Braille or tactile ruler, compass, angles, protractor
- Braille equipment labels, notches, staples, fabric paint, and Braille at regular increments on tactile ruler, glassware, syringe, beam balance, stove, other science equipment
- different textures (e.g., sand paper) to label areas on items

Low Vision

- verbal descriptions of demonstrations and visual aids
- preferential seating to assure visual access to demonstrations

- large print, high contrast instructions and illustrations
- raised-line drawings or tactile models for illustrations
- large print laboratory signs and equipment labels
- video camera, computer or TV monitor to enlarge microscope images
- hand-held magnifier, binoculars
- large print calculator

Mobility Impairments
- wheelchair-accessible field site
- uncluttered lab; clear, wide aisles
- preferential seating to avoid physical barriers and assure visual access to demonstrations
- mirrors above the instructor giving a demonstration
- an enlarged screen
- wheelchair-accessible, adjustable-height work surface
- non-slip mat
- utility and equipment controls within easy reach from seated position
- electric stirrer, container filler
- support stand, beaker and object clamp; test tube rack
- handles on beakers, objects, and equipment
- surgical gloves to handle wet or slippery items
- modified procedures to use larger weights and volumes
- extended eyepieces so students who use wheelchairs can use microscopes
- flexible connections to electrical, water, and gas lines
- single-action lever controls in place of knobs
- alternate lab storage methods (e.g.,"Lazy Susan," storage cabinet on casters)

Deaf and Hard of Hearing
- preferential seating to view demos and watch instructor captioning for video presentations
- written instructions prior to lab
- visual lab warning signals

Learning and Attention Disabilities
- combination of written, verbal, and pictorial instructions with scaffolding
- repeated demonstration of procedure and support practice
- frequent, brief breaks
- preferential seating to avoid distractions and minimize extraneous stimuli
- scanning and speaking "pen"

Health Impairments
- avoid chemical materials to which student is allergic or provide alternate assignment
- flexible schedule and time allocation

Universal Design Considerations

Some of the accommodation suggestions listed above could be implemented within a lab now, anticipating that at some point a student with a disability may need access to the lab and that some changes may benefit all students. Here are some strategies that could be implemented in a science lab as a part of universal design efforts:
- Provide both written and verbal instructions.
- Give verbal and visual descriptions of demonstrations and visual aids.
- Use plastic instead of glass.
- Allow extra time for set up and completion of lab work.
- Address safety procedures for students with a variety of sensory and mobility abilities, including the provision of visual lab warning signals.
- Make laboratory signs and equipment labels in large print, with high contrast.
- Ensure that field sites are wheelchair accessible.
- Maintain wide aisles and keep the lab uncluttered.
- Incorporate an adjustable-height work surface for at least one workstation.
- Install a mirror above the location where demonstrations are typically given.
- Use lever controls instead of knobs.
- Install flexible connections to water, gas, and electricity.
- Buy lab products that can be used by students with a variety of abilities (e.g., plastic lab products instead of glass, tactile models, large print diagrams, non-slip mats, support stands, beaker and object clamps, handles on beakers and equipment, surgical gloves to handle slippery items, video camera with computer or TV monitor to enlarge microscope image).

- Ensure that utility and equipment controls are within easy reach from a standing or seated position.
- Provide surgical gloves for handling wet or slippery items.

Additional Resources

DO-IT has created a collection of videos and publications that help teachers make math and science teachers coursework accessible to students with disabilities. They include:

- *Working Together: Science Teachers and Students with Disabilities*
- *The Winning Equation: Access + Attitude = Success in Math and Science*
- *Equal Access: Science and Students with Sensory Impairments*

These titles may be freely accessed online.[4] DVDs can also be purchased from DO-IT. Permission is granted to reproduce DO-IT videos and publications for educational, noncommercial purposes, provided the source is acknowledged.

For more information about universal design in academic settings, read *Equal Access: Universal Design of Instruction*[5] and *Universal Design in Education: Principles, Practices, and Applications.*[6] For a comprehensive set of resources, consult *The Center for Universal Design in Education.*[7] The book *Universal Design in Higher Education: From Principles to Practice* published by Harvard Education Press shares perspectives of UD leaders nationwide. To receive a 20% discount, visit the DO-IT website.[8]

Cited Web Resources

1. *www.uw.edu/doit/Brochures/Academics/working.teachers.html*
2. *www.uw.edu/doit/Brochures/Academics/winmathsci.html*
3. *www.ncsu.edu/project/design-projects/udi/*
4. *www.uw.edu/doit/Video/*
5. *www.uw.edu/doit/Brochures/Academics/equal_access_udi.html*
6. *www.uw.edu/doit/Brochures/Academics/ud_edu.html*
7. *www.uw.edu/doit/CUDE/*
8. *www.uw.edu/doit/UDHE/coupon.html*

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the successful participation of individuals with disabilities in challenging academic programs such as those in science, engineering, mathematics, and technology. Primary funding for DO-IT is provided by the National Science Foundation, the State of Washington, and the U.S. Department of Education.

For further information, to be placed on the DO-IT mailing list, request materials in an alternate format, or to make comments or suggestions about DO-IT publications or web pages, contact:

DO-IT
University of Washington
Box 354842
Seattle, WA 98195-4842
doit@uw.edu
www.uw.edu/doit/
206-685-DOIT (3648) (voice/TTY)
888-972-DOIT (3648) (toll free voice/TTY)
509-328-9331 (voice/TTY) Spokane
206-221-4171 (fax)
Founder and Director: Sheryl Burgstahler, Ph.D.

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Communication Hints

Treat people with disabilities with the same respect and consideration with which you treat others. There are no strict rules when it comes to relating to people with disabilities. However, here are some helpful hints.

General

- Ask a person with a disability if he or she needs help before providing assistance.
- Talk directly to the person with a disability, not through the person's companion or interpreter.
- Refer to a person's disability only if it is relevant to the conversation. If so, mention the person first and then the disability. "A man who is blind" is better than "a blind man" because it puts the person first.
- Avoid negative descriptions of a person's disability. For example, "a person who uses a wheelchair" is more appropriate than "a person *confined* to a wheelchair." A wheelchair is not confining—it's liberating!
- Do not interact with a person's guide dog or service dog unless you have received permission to do so.

Blind or Low Vision

- Be descriptive. Say, "The computer is about three feet to your left," rather than "The computer is over there."
- Speak all of the content presented with overhead projections and other visuals.
- When guiding people with visual impairments, offer them your arm rather than grabbing or pushing them.

Learning Disabilities

- Offer directions or instructions both orally and in writing. If asked, read instructions to individuals who have specific learning disabilities.

Mobility Impairments

- Sit or otherwise position yourself at the approximate height of people sitting in wheelchairs when you interact.

Speech Impairments

- Listen carefully. Repeat what you think you understand and then ask the person with a speech impairment to clarify or repeat the portion that you did not understand.

Deaf or Hard of Hearing

- Face people with hearing impairments so they can see your lips. Avoid talking while chewing gum or eating.
- Speak clearly at a normal volume. Speak louder only if requested.
- Use paper and pencil if the person who is deaf does not read lips or if more accurate communication is needed.
- In groups raise hands to be recognized so the person who is deaf knows who is speaking. Repeat questions from audience members.
- When using an interpreter, speak directly to the person who is deaf; when an interpreter voices what a person who is deaf signs, look at the person who is deaf, not the interpreter.

Psychiatric Impairments

- Provide information in clear, calm, respectful tones.
- Allow opportunities for addressing specific questions.