Equal Access: Science and Students with Sensory Impairments

Ensuring the engagement of all students

by Sheryl Burgstahler, Ph.D.

Typical science presentations, curricula, and labs are not fully accessible to students with visual or hearing impairments. Instructors can ensure that these students have access to all of the content and experiences offered in science classes by

- proactive planning,
- incorporating principles of universal design, and
- providing accommodations to specific students.

Universal Design

Universal design has been defined 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" (*www.ncsu.edu/ncsu/design/cud/about_ud/about_ud.htm*). Universal design can be applied to

- Class climate,
- Interaction,
- Physical environments and products,
- Delivery methods,
- Information resources and technology,
- Feedback,
- Assessment, and
- Accommodation.

For more information about universal design of instruction, consult *Equal Access: Universal Design of Instruction* at *www.uw.edu/doit/Brochures/Academics/instruction.html*.

Accommodations

Academic accommodations can make learning opportunities accessible to students with disabilities. The best accommodations result when teachers, students, and support staff work together in a creative, resourceful, collaborative way. Examples of commonly used accommodations for students with sensory impairments follow (Burgstahler, 2006, p. 47).

Low Vision

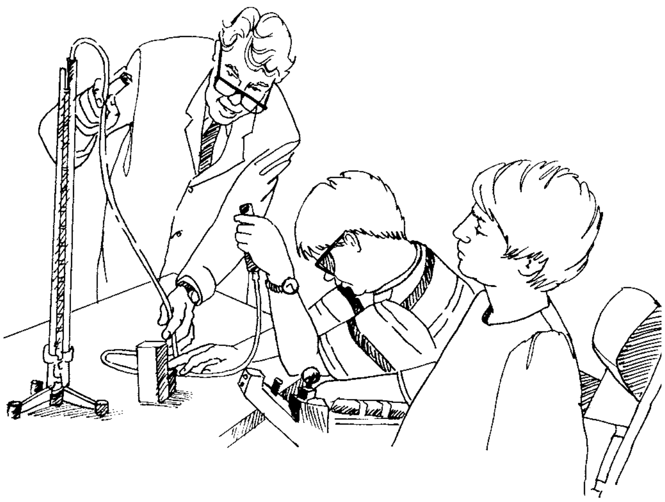
- Class assignments are available in electronic format.
- Computers are equipped to enlarge screen characters and images.
- Handouts, lab signs, and equipment labels are available in large print.
- Seating is available near the front of the class.
- TV monitor is connected to a microscope to enlarge images.

Blindness

- Adaptive lab equipment is available (e.g., talking thermometers and calculators, light probes, tactile timers).
- Computers are equipped with an optical character reader, voice output, and braille screen display and printer output.
- Lab signs and labels are posted in both large print and braille.
- Lecture notes, handouts, and texts are available in audio, braille, or electronic format.
- Raised-line drawings and tactile representations are available as an alternative to graphic images.
- Verbal descriptions of visual aids are provided.
- Warning signals are auditory as well as visual.

Hearing Impairments

- Assignments, lab instructions, and demonstration summaries are available in an electronic format.
- Email is used for class and private discussions.
- An FM system, interpreter, or real-time captioning is used for lectures.
- Warning signals are visual as well as auditory.
- Videos for class are open- or closed-captioned.



One Science Teacher's Experience

A high school science teacher who worked at a school for students with visual impairments drew on his experience to make the following recommendations to teachers who have a student who is blind in their science class (Burgstahler, 2006, p. 42; Burgstahler & Nourse (Eds.), 1998, pp. 63-64):

- The first question you should ask yourself is, "How do I provide this student with a quality educational program?" Although he will need some accommodations, your good teaching skills, with some modifications, will serve this student well.
- Your school district may have an itinerant teacher who works specifically with students who have visual impairments. These professionals can provide additional resources, three-dimensional models, and brailled materials.
- Regarding room logistics, ask the student where the best place is for him to sit. He will provide you with his insights on seating arrangements and other strategies that have worked in the past. Remember, he is, or should be becoming, an expert on his disability and accommodation needs.
- Some videos are available with an audio description option for visually impaired viewers. If you show other movies or videos, verbally describe the action.
- Modifications in the classroom should include tactile drawings or graphs, three-dimensional models, and a lot of hands-on learning. An example of an inexpensive solution is to buy fabric paint or get a glue gun to make raised drawings. Keep these drawings simple and free of clutter, or they will confuse rather than help. Try them yourself.
- A student who is blind may require brailled text. Work with the special services in your district to make arrangements to have materials brailled. A tape recorder can also be used to give information to a blind student.
- Always be sure that a student who is blind is included in all class discussions and hands-on experiences. Participation will give the student confidence and opportunities to work closely with his sighted classmates.

Below are some specific examples of how you might accommodate students who are blind in a science classroom:

- Make a syringe tactile by cutting notches in the plunger at 5-ml increments.
- Make a triple beam balance tactile by filing deep notches for each gram increment. Add glue drops on either side of the balance line so that the student will know when the weights are balanced.
- Make graphs tactile by using glue guns or fabric paint.
- Add braille labels to lab equipment.
- Identify increments of temperature on a stove with fabric paint.
- Use different textures like sandpaper or yarn to identify drawers, cabinets, and equipment areas.
- Make models out of clay, plaster of paris, or papier-mâché.
- For geometric shapes, use 3-D triangles or spheres.
- For maximum hands-on experiences, use a pegboard with golf tees and rubber bands to draw shapes or develop spatial awareness.

- Use Styrofoam and toothpicks or molecular kits to show atoms and molecules.
- For a measurement tool, use staples on a meter stick to label centimeters.
- When measuring liquids, have glassware with specific measurements, or make a tactile graduated cylinder. Use a cork borer to make a Styrofoam circle. On a plastic strip stores use to identify plants, cut out notches at 5-ml increments. Put a notch in the Styrofoam circle, and glue the plastic strip in. When water is put in the cylinder, the Styrofoam will float upwards and your student can use touch to measure the liquid.

These examples demonstrate that inexpensive supplies used creatively plus a commitment to the full participation of all students can make the experiences of a student who is blind in your class a positive one.

Listen to the Experts

People with sensory impairments share with science teachers the following suggestions for working with students like themselves (Burgstahler, 2006, pp. 44-45; Burgstahler & Nourse, 1998, pp. i-ii).

- My name is Nhi. I attended high school in Washington. I am visually impaired and have limited vision in seeing details. One thing I would suggest is that the teacher describe in detail what is happening in a science lab. For instance, in a physics lab, have the student feel with their hand (if it is possible). An example would be, when we do an experiment on using the pulley and putting weight on it to make a cart on a table accelerate, it would be nice if the student like me can feel the process and have it described in detail to them. Or in biology, when it comes to dissecting a frog, have a student who is blind do the dissecting with guidance from a visual student on what and where to dissect.
- My name is Bridget. I attended high school in Washington and I'm currently a college student. I'm profoundly hearing impaired and my main problem is understanding speakers. When presenting a topic or giving instructions for an activity, visual aids, especially written comments or instructions, are very helpful. I also use a microphone system to hear the speaker, called an FM system. Be aware that students with hearing impairments may not hear random and quick comments you may make during an activity. Speakers need to have the attention of everybody, including the student with a hearing impairment, before saying anything important.
- My name is Frank. I have been blind since I was 16. I attended high school in Helena, Montana. I am currently an electrical engineer for Battelle Laboratories. Math and science can be difficult subjects for a student who is blind—not only because of the visual nature of graphs and much of the lab work but also because of the "rush rush" nature of most classroom labs. Be sensitive to the need for preparation time required by the student before the class commences to get textbooks recorded onto tape or put into braille. The many new adaptive technologies now available to help deal with the barriers imposed by blindness are wonderful, but nothing can replace the mentoring and support of the teacher who is aware, positive, and proactive. Working with a student who is blind is neither a burden nor a blessing, just another challenge. Your attitude and the choices you make can be pivotal. Most important, remember that you need to work closely with the student as a partner in this process, letting him or her participate in the development of the approaches and accommodations that you will incorporate into your lessons. Every person who is blind is an individual and is usually the most knowledgeable resource on what specific adaptations work best for them.

References

The content of this handout has been replicated in other DO-IT publications that include:

Burgstahler, S. (Ed.) (2006). *Making Math, Science, and Technology Instruction Accessible to Students with Disabilities*. Seattle: DO-IT, University of Washington. *www.uw.edu/doit/MathSci/*

Burgstahler, S., & Nourse, S. (Eds.) (1998). *Accommodating students with disabilities in math and science classes*. Seattle: DO-IT, University of Washington.

Additional Resources

An electronic copy of the most current version of this publication as well as additional useful DO-IT brochures can be found at *www.uw.edu/doit/Brochures/*.

A 10-minute video, *Equal Access: Science and Students with Sensory Impairments*, demonstrates key points summarized in this publication. It may be freely viewed at *www.uw.edu/doit/Video/ea_sci_sensory.html* or purchased in DVD format. Consult *www.uw.edu/doit/Video/* to view other videos that may be of interest.

For more information about applications of universal design consult *www.uw.edu/doit/Resources/udesign.html* or *The Center for Universal Design in Education* at *www.uw.edu/doit/CUDE/*. The book *Universal Design in Higher Education: From Principles to Practice, Second Edition* published by Harvard Education Press shares perspectives of UD leaders nationwide. Learn more or order online at *www.uw.edu/doit/universal-design-higher-education-principles-practice-1*.

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the successful participation of individuals with disabilities in challenging academic programs and careers, 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.

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