Explore It After School!

Technology and Science for Students with Visual Impairments

By Linda Kekelis, Erica Rios and Marcia Vickroy

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Acknowledgments

The students at the California School for the Blind have taught us a great deal about making technology and science accessible to youth with visual impairments. We would like to thank all the students who helped us pilot the lesson plans presented in Explore It After School! They were enthusiastic participants in the process and their feedback helped us improve upon this guide. We hope that Techbridge has helped expand their options and look forward to seeing where the future takes them.

The administration at the California School for the Blind has been extremely supportive of Techbridge. Without their commitment to the program, we could not have taken on all the projects that contributed to Techbridge’s success. Superintendent Stuart Wittenstein was open to the opportunities that Techbridge could bring to his students and staff and enthusiastically supported every endeavor. In addition, we could not have imagined more helpful staff that supported our requests for help in the computer classroom, made materials available in large print and Braille, and supervised on field trips.

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While hands-on projects help spark an interest in technology and science, it is role models who are the key to inspiring students and showing them rewarding careers in technical and scientific fields. We would like to thank all of the role models who so generously gave of their time and shared their passion for their work with the students at the California School for the Blind.

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Foundation whose support helps Techbridge continue to operate at the California School for the Blind and at other participating schools.

Seeing the exciting results of Techbridge at the California School for the Blind, we hope that many more students can benefit from the lessons we learned along the way in developing this guide.

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Introduction

Unable to easily access the Internet or tinker with electronics, students with visual impairments may seem to be at a disadvantage in the fields of technology or science. However, the barriers these students encounter are more often due to limited experiences and training and the attitudes of others, rather than their visual impairments.

Chabot Space & Science Center and the California School for the Blind have introduced students with visual impairments to a wide range of opportunities in technology and science through Techbridge. Techbridge is an after-school program that provides hands-on activities designed to increase interest in science and technology, promote confidence, and build leadership skills. Projects encourage students to think and work independently and challenge stereotypes regarding academic and career options for persons with visual impairments.

History and Mission of Techbridge

With funding from the National Science Foundation, Techbridge was launched in 2000 to engage more girls in technology and science. Technical and scientific fields have lots of wonderful opportunities to offer girls, and girls have a great deal to offer science and technology. Unfortunately, most girls do not consider a career in these fields in which females are underrepresented.

The problem starts early. For example, girls are less inclined to enroll in a summer robotics camp or an advanced programming class than boys. But the problem isn't with girls. Take a look at computer games or course offerings and you'll find that most are designed for boys. Consider the early experiences of girls and you’ll find that most haven’t been encouraged to tinker with tools or build with blocks.

With girls in mind, Chabot Space & Science Center designed a technology program just for girls. We developed the Techbridge program to introduce girls to various applications of technology and to encourage them to consider careers in technical and scientific fields. We talked to girls to find out what kinds of technology projects appeal to them. Based on their input we developed activities like doing hands-on projects, working with tools, taking field trips, and meeting role models.

Techbridge comes at a critical time in girls’ development with middle school a key decision-making point. Research indicates that most students lack information and guidance to make informed academic and career choices. This is particularly true for girls, who are most likely to lose interest in math and science during the middle school years.

Techbridge fosters a peer network that supports achievement. As one teacher explained, "It's not cool to be a girl and smart in this school. But it is in Techbridge." The program also creates a solid foundation for students’ continued success by engaging teachers and families. Monthly
trainings provide teachers with a venue to learn new curriculum, exchange ideas, and share lessons learned. Family events encourage parents to help support their daughters’ interest in technology and science and help them make informed academic choices.

Techbridge Successes

Techbridge has impacted over 1,250 girls in primarily underserved and underrepresented communities in Oakland, California and surrounding communities and over 5,000 educators, role models, families, and partners since its inception in 2000. Year after year, Techbridge has consistently demonstrated success in improving girls’ technical skills, increasing interest in technology and science, and improving overall confidence, leadership, and teamwork skills. As a result of its successes, Techbridge was selected among thousands of National Science Foundation grants to represent the National Science Foundation in its reporting for the Government Performance and Results Act as a "model program in demonstrating significant achievement" in July 2005.

Techbridge at the California School for the Blind

In response to the success of the curriculum and career exploration activities, Chabot Space & Science Center introduced Techbridge to girls at the California School for the Blind in 2001. Techbridge and the California School for the Blind staff work closely together to adapt and develop curriculum to fit the needs and interests of students who are visually impaired. The resources and opportunities that came with Techbridge increased the girls’ technical skills, but did so much more. Confidence and leadership flourished. The program’s impact is captured in the following quote by one of the students: “If I was in my other school, I would never have gotten to be the editor of the newsletter. I would never have been able to use the computer in the ways that I have because they would not have thought I could do it.”

In recognition of the challenges similarly faced by boys with visual impairments, in 2003, Techbridge hosted its first coed program and invited boys at the California School for the Blind to participate. The program with its hands-on approach is proving to be equally successful for girls and boys. Students in the Techbridge program at the California School for the Blind have worked on a wide range of projects such as building circuits, learning about solar technology, and creating websites with HTML programming. They have taken field trips to worksites where they met role models and learned about career opportunities in technology and engineering. These experiences have helped expand their options for the future.

With the lessons learned from Techbridge at the California School for the Blind, we developed Explore It After School! The guide includes lesson plans for technology and science projects, career exploration activities, case studies of role model visits and field trips, and resources to broaden the academic and career options for students with visual impairments. We hope that many more students can benefit from our experiences and resources.

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The Techbridge Method

Techbridge programs meet once a week after school for 1½ to 2 hours. We have experimented with various formats and found that this schedule works best. As an after-school program, Techbridge can be fun and informal, which helps spark an interest in new subject areas. However, many of the projects are complex and require extended periods of time to set up and complete. Therefore, 1½ to 2 hours provides enough time to work on these projects as well as start with an icebreaker and wrap up with a short discussion of the day’s activity.

Since the projects often require several sessions to complete, Techbridge is not a drop-in program, and we ask students and families to make a yearlong commitment. Not only does this ensure the successful completion of projects, but experience has taught us that long-term participation leads to significant benefits for students.

As an after-school program, Techbridge needs to maintain students’ engagement. Keep it fun and hands-on, bolster confidence, and explore career options. These ingredients have been our recipe for success.

Keeping it Fun and Hands-on

Lessons are designed with the idea of making them fun. How many students can say that they put together their telephone? For many of the students, it’s the first time they assembled a kit and yet with teamwork, every one eventually had a working telephone that they got to keep. Upon completion of this project, students line up and call home to test their phones. The excitement they share is matched by the amazement of their parents when they are greeted with “Hello. I’m calling you on the phone I just made in Techbridge!”

We look for a mix of hands-on projects, which allows the students to master technical skills, express creativity, and have fun in the process. One month the students may be learning HTML and creating web pages, and the next month they are flying a kite and learning about aerodynamics.

Bolstering Confidence

Self-confidence grows out of working on projects that are challenging. Building a mechanical robot or designing a web page may seem daunting at first to a student who hasn’t had the chance to tinker with tools or program with HTML. When the technology doesn’t work right away, some students are overcome by frustration and want to give up. Confidence comes from working on projects that don’t come easy, but require problem solving and perseverance. But we have found that it is just these opportunities that help students believe in themselves.

Every attempt is made to modify existing Techbridge lesson plans as minimally as possible. There is an explicit understanding that we best serve students who are visually impaired when we give them the skills they will need to lead independent and fulfilling lives. Our expectations

This project was funded by the Mitsubishi Electric America Foundation.
are high, but we always offer students reasonable support. Often lesson plan modifications are limited to giving students additional time to complete a project.

Exploring Career Options

The hands-on projects that are a signature of Techbridge spark interest in new subject areas and increase confidence, but may not, on their own, lead to career ambitions. We have found that role models can be an important influence in shaping the academic and career paths of students. In classroom visits and field trips, they explain how their career is both professionally and personally rewarding. Enthusiasm and passion go a long way and can inspire a student to contemplate new career possibilities.

In preparation for their visits, our Techbridge staff offer role models personalized training to teach them how to present themselves in ways that will have the most successful impact on students. Although we can’t provide every role model this level of support, we hope that the ideas and suggestions in Explore It After School! will help you have a successful experience with role models.

Photo 1: Techbridge Student builds her own telephone.

*****

We wish we could invite you into a Techbridge after-school program so you could see the program in action. Since we can’t, we would like to invite you to check out our lessons that introduce students to technology, science, and engineering in a Techbridge kind of way.

We would like to hear from you. Tell us about your students and your program. What projects have you taken on? What have been your successes and challenges? We would especially appreciate your feedback on this resource guide. Please contact us at Chabot Space & Science Center.

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This project was funded by the Mitsubishi Electric America Foundation.
Building Confidence – Tallest Tower

Lesson’s Purpose

This activity encourages team work and creativity. The lesson provides an opportunity for students to utilize their problem-solving skills and learn about the engineering design process.

Time Required

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and Initial Steps</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Prototyping and Iteration</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Report Back</td>
<td>20 minutes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1 hour, 50 minutes</strong></td>
</tr>
</tbody>
</table>

Materials

- Spaghetti
- Skewers
- Masking tape
- Pipe cleaners
- Ping-pong balls
- Yard stick or measuring tape

Directions

Invite students to work in groups of 3. Each group is asked to meet the following challenge: Given a limited set of materials, build the tallest tower possible that is capable of holding a ping-pong ball at its top. For fun, create an imaginary scenario for the challenge. We told our students that the tower would serve as stand for a prize trophy, the winning ping-pong ball of a major tournament. Advise the students that the tower must be free-standing. Let them know that you will provide a set of questions to help them think about the challenge, but they will have to decide on their own how to build the tower.

Distribute the materials. Each group of students will receive a handful of spaghetti, 5 wooden skewers, 3 feet of masking tape, 5 pipe cleaners, and a ping-pong ball.

Begin by introducing students to the concept of the engineering design process. This is a process—a problem-solving strategy—used by engineers. The engineering design process is compromised of five steps: understanding the problem, inventoring materials, brainstorming, prototyping (also known as building), and iteration.

First, an engineer attempts to fully understand the problem he or she is asked to solve. Ask the class to describe the problem they have been invited to solve. Encourage them to ask questions to
be sure they understand the scope of the project. Although the challenge may appear straightforward there are points of clarification that should be made. For example, we have done this activity several times. In every instance at least one student asks if it is OK to tape the ping-pong ball to the top of the tower. This is a valid question and reflects that students are trying to understand exactly what strategies and resources are available to them. We sometimes allow students to tape the ball to the top of the tower; other times we prohibit it when we know the students are highly skilled. You can decide what is best for your students.

The second step an engineer often takes in the design process is taking inventory of the materials and resources he or she has been given to solve the problem. Ask each group to inventory the materials they have. You can give them a few questions to help them do this, “What materials have you been given? How much do you have of each? What do you know about each material?” In general, students have some difficulty working with the spaghetti and tape. They are given large amounts of spaghetti, but it is a brittle material that is difficult to keep standing upright. Tape is a useful tool, but many of our students found it very difficult to work with. Their discomfort in using tape impacted the way in which they designed and built their towers.

Engineers’ greatest resources are their knowledge and experience. They use them in the brainstorming step of the design process. For this activity there are no right or wrong answers. Give each group a set amount of time to brainstorm tower design ideas. Remind them that this activity is a cooperative learning experience. Everyone should put their ideas on the table for equal consideration.

Call time on the brainstorming session. Ask each group to decide on a general plan or starting point for building the tower. Engineers will call a plan a design strategy. Designs are often developed as the result of many engineers coming together and sharing their ideas on what is likely to work best in solving the problem they have been given.

The next step in the engineering design process is building. Not all engineers have the opportunity to build a prototype of their idea, but it is a required skill for entering the field. For example, NASA scientists will not build every version of a satellite they are designing. However, they must be able to use technical drawings and simulators to test their proposed strategies. Ask each group to build their design idea. Reassure them that it is reasonable and likely that they may have to modify their original design plan as they face challenges in building the prototype. It is also all right to go in a completely new direction.

Time is a constraint for each step of the process, particularly in the building step. Press each group to finish their tower in the time allotted. If you find not every group has finished in the allotted time, find a way for the completion of the towers before moving on. Even if they are not completely satisfied with the end result, we have found that students experience the rewards of perseverance if they have a standing tower at the end of this activity. As an instructor, you will be challenged to create that opportunity for them. It may be as simple as giving your students five more minutes to continue working, or you may have to offer suggestions or a helping hand in cutting tape. We encourage minimal help, but use your best judgment on what you believe the students need.

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If time permits, ask your students to go back to the drawing board and improve their design. An engineer will often reconsider a problem many times before he or she finally finds the solution that works best. The technical term for this process is *iteration*. Trial and error, as well as evaluation of possible better solutions, is part of the process. It is rare, if not impossible, to find a “perfect” solution on a first try.

Near the end of the lesson ask each group to describe its design. You should measure the height of each ping-pong ball atop its tower. The group with the tallest tower may be named the winner. Do this if your students are motivated by competition. If they are not, you may simply want to use the height as a demonstration of their success.

Close the activity by having students discuss their experience with the activity. Facilitate conversation by asking:

1. What do you like and dislike about your current design?
2. What was the biggest challenge you faced? How did you overcome it?
3. Describe your team’s dynamics. Did you select a team leader?
4. If you had an opportunity to redesign your tower, what would you change?
5. How did you personally feel while doing this activity? Did you ever want to give up?
6. How similar is your design to others in the room?
7. If you could add another material to the mix, what would it be and why?

**Lessons Learned**

We have done this activity with three groups of students who are visually impaired. We found that most of the students strongly preferred using pipe cleaners instead of tape, which they found difficult to work with. Although the pipe cleaners may have been easier to work with, they severely limited the types of designs the students could implement.

After observing each group of students, we realized many did not know how to manipulate the tape because they had little or no prior experience working with a large piece of tape. We had given them one large piece and expected that they would cut off smaller pieces to suit their needs. One student in particular struggled with the tape. He assumed instructors or students would cut the tape for him even though there was no physical reason he could not do it himself. When we pressed him to step up and learn the skill, he resisted.

We have found that some students have become accustomed to relying on adults and friends to do things for them even when they have the capacity to accomplish the tasks themselves. When we establish high expectations in this activity, we are asking students to give up on their learned helplessness. Frustration and fear are common experiences in the learning process. We use positive language to help students persevere. For example, a struggling student that asks an instructor to do something for them will be told, “I am sure you can do it. It looks like you’ve had a good try at it. What else can you do?” As an instructor, encourage students to search for their own alternative solutions. Only when a student has sufficiently struggled and it is apparent they need a strategy to overcome a problem will you want to coach them in a step-by-step
manner. It is only as a last resort when students do not have the physical or mental capacity to do a task that you should do it for them.

Comments on Modification

Sighted Techbridge students are given only a handful of spaghetti, a long strip of masking tape, and 20 minutes to complete the activity. We purposefully give our students who are visually impaired a greater variety of materials to make the activity manageable. We have varied this activity’s level of difficulty by substituting materials. To make the activity a bit easier we have sometimes used small craft Styrofoam balls instead of regular ping-pong balls. We also give students more wooden skewers and less spaghetti.

Career Exploration

This lesson is a good way to introduce careers in engineering, and civil engineering in particular. Discuss with your students what engineers do, how much money they make, and what type of education and experience are needed to pursue this career. If possible, invite an engineer who is visually impaired to your classroom to share the story of how he or she became an engineer and the rewards associated with the career.

Photo 2: A tower designed by a Techbridge team.

Photo 3: Two Techbridge students trying different approaches to their tower design.
Building Confidence – Kitchen Kapers
Adapted from Gibbs, J. TRIBES: A New Way of Learning and Being Together, CenterSource Systems, LLC, p. 290.

Lesson’s Purpose

Much like Building Confidence-Tallest Tower, this activity encourages students to express creativity in conquering a technical challenge. Students must overcome their frustrations and practical limitations as they utilize their problem-solving skills.

Time Required

| Step 1: Introduction                  | 40 minutes |
| Step 2: Building prototype kitchen utensil | 15 minutes |
| Step 3: Discussion                    | 25 minutes |
| **Total**                             | **1 hour 20 minutes** |

Materials

- Envelopes
- Toothpicks
- Straw
- Tape
- Paper clips
- Paper
- Craft scissors
- Pencil
- Small squares of foam
- Rubber bands
- Selection of kitchen utensils

Preparation

For the lesson’s introduction, collect a selection of kitchen utensils for your students to examine. For example, you could bring a variety of spoons, chopsticks, can openers, or straws.

For building the prototype, prepare an envelop for each team of student with the following items: three toothpicks, one straw, 4” of tape, two paper clips, a sheet of paper, craft scissors, a pencil, one small square piece of foam, and two rubber bands. Put all of the objects inside the envelope.

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**Directions**

Pass out the variety of kitchen utensils you collected for the brainstorming session. Invite students to compare and contrast the objects. What purpose do they serve? How are they similar? How are they different? Have them consider shape, size, texture, odor, flavor, or anything else they notice. Your goal is to help students get beyond general answers like, “Both spoons have handles.”

We introduced this lesson by showing a collection of different types of chopsticks. We asked students questions like, “What are they used for? How are they the same? How are they different? Who uses each type of chopstick? Are they well designed for use by persons who are blind or visually impaired?” Good answers may include, “Chopsticks are used for picking up food. Both sets of chopsticks are long. One chopstick is rectangular at one end and the other chopstick is rounded at one end. One chopstick style comes from China and the other from Japan.” If your students struggle with giving descriptions you may want to offer some general observations or facts and then ask them to build on what you have pointed out.

After your students have examined the objects, invite them to discuss how they could improve upon the utensils. This activity is brainstorming. Ask them, “How could you improve upon one of these utensils?” There are no right or wrong answers. Practical and outrageous suggestions are equally helpful in brainstorming. Even the silliest idea may trigger another person to think more practically.

After brainstorming, the students are ready to begin building. Pair students up. Instruct students that their goal is to invent and prototype a unique kitchen utensil. The utensil should be something novel that they would like to see sold at a store or that they would enjoy using in their own kitchen. Remind students that the most interesting utensils will be those that are not commercially available. Begin by asking your students if they know what a prototype is. If not, explain that a prototype is a model that someone builds to demonstrate an idea they have. Even better, bring in a prototype to show the group. For this activity, your students will be using ordinary materials to represent an actual object.

The utensil they prototype may be very similar to the ones they examined during the brainstorm. It may also be similar to a utensil they have used while cooking, or it may be an idea all their own. Do not allow your students to exactly model something they have just examined. This would defeat the creative purpose of this activity.

Give students a set amount of time to build their prototype. Also, ask them to come up with a name for their invention. When time is called ask each group to report back. Their utensil should be passed around the class so every student may examine it.

Facilitate discussion by asking students to address these questions: “What is your utensil called and how do you use it? What do you like and dislike about your current design? What was the biggest challenge you faced? How did you overcome it?”

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Notice if there was a skill that many students struggled with. For example, several of our students had difficulty twisting a rubber band. Take a few minutes to teach them how to accomplish the task. This will help them develop hands-on skills and reinforce the idea of being a problem solver.

Invite students to take home their new inventions and share them with friends or family. Or perhaps, put them on display for other students to enjoy.

**Lessons Learned**

It is very important to create context for students who are visually impaired. When we introduced this activity with a group of summer school students at the California School for the Blind it became apparent that they had not had as much exposure to common kitchen utensils as sighted Techbridge students. The students who were blind struggled with describing the forms and functions of tools like spatulas and ladles. Unprepared for this teaching challenge, we did not have examples of these tools available for students to examine. When we repeated this activity, we created context for students by presenting them with examples of existing kitchen utensils—spoons, forks, chopsticks, and straws. Students were asked to take time to examine the utensils and describe them to one another. As a result, the lesson dramatically improved. Students used their study of the kitchen utensils as the foundation for inventing a new utensil. They showed creativity and invented an interesting range of utensils that included a “kniospork” that was a combination knife, spoon, and fork and a “fisk” that was a combination fork and straw for use with solids and liquids.

This lesson also taught students how to deal with challenges. When asked to share what they had learned from *Kitchen Kapers*, students responded with “stay calm,” “stay focused,” and “when you feel you’re getting frustrated, take a couple of deep breaths or count to 10.”

![Photo 4: Techbridge team creating a novel kitchen utensil.](image-url)
An Exploration of Electricity and Pumps - Table Top Fountains

Lesson’s Purpose

We harness energy from many sources. This lesson provides a forum to discuss how common objects utilize electricity from wall outlets. Students also practice observation skills by examining and understanding how a water pump works.

Time Required: 2 hours

This activity can be completed in two hours. In this time, the students will gain a good understanding of how a water pump works and how it is powered by electricity. If time permits, it would be worthwhile to have students experiment with their water pumps before assembling the fountains. This will allow them to better understand the impact of various parts of the fountain like the water flow control tab and swivel arm.

Materials

- Small gardening pot – be sure the pot doesn’t have a drainage hole
- Immersible water pumps, available at craft or marine supply stores
- Gardening stones
- Soft tubing, sized to fit over the pump’s arm
- Wood or bamboo, sized to fit from the top of the gardening pot to the top of the pump
- Twist ties or gardening wire

Directions

Step 1: Taking Inventory

Scientists and engineers depend on their ability to carefully examine objects related to their area of study. Although many of them rely on their sight to make observations, sight is not the only sense that can be used for in-depth study of an object. Touch can often be equally valuable if it is done methodically. Give each student a complete set of materials: gardening pot, water pump, gardening stones, and a stick of wood or bamboo. A professional always knows what resources are available to him or her. Ask your students to inventory their materials.

Step 2: Observation and Forming Hypotheses

Once they aware of the materials they are working with, ask your students to take a closer look at the water pump they have been given. Present them with the question, “How do you think it works?” The question will encourage them to be thoughtful about what they are observing. Encourage your students to tinker to explore their water pump and think about the following questions. “Do any pieces move?” “Can you name any parts of the pump?” “How do the parts work together?” If your students are reluctant to answer the questions, remind them that
conjecture (a.k.a., guessing) is a valid scientific strategy. There are no wrong answers for this part of the activity.

Your students will inevitably stumble onto one or more of the following questions, “How does a water pump work with electricity? Doesn’t water conduct electricity? What is it about a water pump’s design that keeps us from being electrocuted?” When the time is right use these questions to help you transition into a directed observation of the water pump.

Step 3: Understanding How and Why

As you describe how water is sucked into the pump and then pushed out, ask your students to identify its key parts. The pumps we used contained a filter, water flow control tab, swivel arm, motor, soft PVC tubing, on/off switch, and power supply. Your goal is to methodically explain how the pump works. Focus on how each part contributes to the larger process of pumping water and how electricity travels from a wall outlet to the sealed motor. Ideally, your students should be able to correctly explain the process to someone outside of the class like a parent or friend and be able to answer all of the questions posed above.

Step 4: Assembling Fountains

The real fun begins when your students assemble their table-top fountains. First, have them put the PVC tubing over the pump’s arm. The PVC tubing needs to fit snugly over the arm. This is a challenging thing to do, even for sighted students.

Second, ask students to tie their wooden or bamboo stick to the water pump’s PVC tubing with a twist tie or gardening wire. The stick should give the soft PVC tubing a backbone of sorts to keep it from spraying water about when it is finally placed inside the gardening pot. The stick and tubing wiggle around a lot. Encourage students to come up with a strategy to keep the pieces from moving. Of course, they can solicit help from one another.

Third, they will need to place the pump and stick into the bottom of the gardening pot. The electrical outlet should be placed outside of the pot. Everything else should remain inside with the PVC tubing.

Fourth, have students secure the pump and tubing with gardening stones. The stones should be evenly distributed around, and on top of, the water pump.

Finally, allow students to fill their gardening pot with water. To avoid a hazard, ask them to be careful not to splash water on the electrical outlet. Once the fountain is fully assembled, have them plug their fountain into an outlet so they can verify their pump is working and the tubing is not shooting water out of the gardening pot.

Before students leave your class with their water fountains, remind them of some key maintenance issues. 1) Stagnant water can become moldy. Students need to regularly take apart and clean their fountain and place fresh water in it. 2) Never let the fountain run dry. Some water
will naturally evaporate. They should check the water every week. If it runs low they should add more. Their pump can burn out if there is not enough water.

**Lessons Learned**

Our students enjoyed this activity. Each material was different in texture and purpose and our students were eager to investigate each piece of the fountain.

The activity also gave us a platform to have an important conversation. Sighted people often study things they cannot see with the naked eye, like electrons. There are no valid reasons why a person who is visually impaired cannot do the same. It was quite a breakthrough for our students to realize that topics they assume are beyond their reach may not, in fact, be so. It helped keep their focus on the importance of understanding how electricity and motors work, rather than the tangible challenges of putting the fountain together.

**Lesson Extension**

Assembling the water fountains is an exercise in following instructions. If you would like your students to practice reading directions, write up your own instructions on how to assemble the water fountain in Braille and large print. Using the instructions and materials you provide them, ask students to work together in pairs to put together their fountains.

This project was funded by the Mitsubishi Electric America Foundation.
Telephone Technologies

Have you ever wondered how you can chat with friends across town or connect with family on the other side of the world? The telephone, invented by Alexander Graham Bell in 1876, makes possible communication that is convenient and immediate.

With this lesson, students learn to follow step-by-step instructions and use tools as well as learn the inner workings of the telephone.

Icebreaker

Telephone

Invite students to sit in a circle. Whisper a long and complicated 1-sentence message in the ear of the neighbor to your right. That student whispers what he/she thinks they hear to the person to their right. Continue until the message reaches the last student. At this point, the message is shared with the group. By the time the message reaches the last student, it is likely to have changed considerably from the original message.

This game is a fun way to start a lesson on the technology of telephones. Invite students to discuss why telephones were developed and how people communicated before they had electronic devices. This icebreaker is adapted from Ready-to-Use Activities for Before and After School Programs by Marian Wirth, Patricia Stemmler, Rita Shotwell, and Verna Stassevitch.

Time Required

Building the telephone kits takes approximately 10 hours, with each group of students having an instructor or aide to help them.

Materials and Set Up

- A completed phone for students to check out for reference
- Telephone kits (one for each student)
- Phillips head screwdrivers
- 9-volt batteries (one for every two telephones)
- Wire strippers (one for every two telephones)
- Scissors
- Plastic boxes large enough to store one telephone kit. The box should also have a lid with an edge around it so that students can use it to put parts inside.
- Access to a phone line
- How Telephones Work handout
Directions

1. Set up workstations so students have enough space to spread out their kits. Students are less likely to drop pieces on the floor when they can work at flat-surfaced tables.
2. Pass out telephone kits and plastic boxes.
3. Invite students to open the telephone kit boxes and transfer the contents into their plastic boxes. Organization helps keep small pieces from getting lost.
4. Invite the students to place their lid on the table in front of them. This will be their working space so that screws and other small pieces do not get lost.
5. Ask the students to find their screwdriver and place it in a spot that is easy to get to (perhaps on their lid). This is also a good time to lead a discussion on how to use a screwdriver, as some of the students may not have ever had an opportunity to use one.
6. Begin by asking the students to get out the parts for the first step. You may need to describe what the parts feel like in order for the students to find the necessary pieces.
7. At each step, before the students are asked to find the necessary pieces, it is a good idea to explain the function of the part. You may want to use the How Telephones Work handout as a tool to explain the parts of the telephone.
9. When Step 6 is reached, where the buttons need to be installed, the students will need to have an explanation on how to take the buttons out of the plastic casing. The orientation should be such that the button with the nub sticking out (which is the number 5) should be in the second row from the top and the flat side of the numbers should be facing up. This will put the number 1 in the top left hand corner of this casing. This will help students take out the numbers, piece-by-piece and inserting them from right to left starting at the top of the telephone Push Button Panel.
10. Have students continue building until they reach Step 8, where they need to connect the wires from the PC Board to the Speaker. At this point, students may again need help determining the colors of the wire as well as using the wire strippers.
11. After the students have built their kits, allow them to test the telephone by connecting it to an outside telephone line and dialing a family member or friend.
12. Once everyone has been successful making a call on their telephone, bring the group together to discuss how telephones work.

Discussion Questions

1. Using the How Telephones Work handout, lead a discussion on how the telephone works and how the parts of the telephone work together.
2. Ask students if they know the history of the telephone’s invention. Lead a discussion on the progression of the telephone’s development by discussing when it was invented, how operators used to facilitate the process, and what the difference is between pulse dialing and tone dialing.

This project was funded by the Mitsubishi Electric America Foundation.
Lessons Learned

We have heard from students and their parents how important it is to spend time after projects to discuss how and why the kits work. Be sure to build in time at the end of lessons like this one for discussion and questions.

After working on these telephone kits with several groups, we have some helpful hints:

1. Put together a telephone before starting this lesson with students. A completed phone will be useful for students to use for reference while they complete their kit. It will also help you become familiar with the instructions.
2. Many of our students had never used a screwdriver before this activity, so it is important to start the lesson with tips on how to use one. From our experience with building kits, it is also important to teach students techniques for keeping track of small parts and for keeping screws in place. For this activity, we bought screwdrivers with magnets on the end, which helped the students work on the phone kits.
3. It is a good idea to have a spare telephone kit so that you can use it for reference while reading the directions. You can describe the pieces used in each step as well as give students a chance to handle the piece(s), so that it will be easier for them to find the piece in their kit. Also, sometimes kits are missing pieces or parts break, so an extra kit (or two) may come in handy for these situations.
4. Be sure that all students finish one step before moving on to the next step. Encourage students to help their neighbors if they finish a step faster than others.
5. Be sure to check that each student has the lever ABOVE the hook switch in Step 4. This was a common mistake with our students.
6. If possible, it is a good idea to have one aide to every two students. This allows the groups to move along at a faster rate and ensures that students’ work can be double-checked before the students move on.

Resources

http://electronics.howstuffworks.com/telephone.htm
2. Elenco sells the telephone kits. 
http://www.elenco.com/

Photo 5: Techbridge starts with Telephone icebreaker.

This project was funded by the Mitsubishi Electric America Foundation.
How Telephones Work

Label the parts of the telephone from the list of descriptions below:

![Figure 1: Telephone Anatomy](image)

**Hook Switch** - A switch to connect and disconnect the phone from the network

**Ringer** - a speaker and a circuit to generate a pleasant ringing tone when someone is calling

**Microphone** - a device that has a diaphragm that is vibrated by sound waves (your voice) and turns the sound waves into an electric signal

**Speaker** - a device that takes electric signals and turns them into sound waves

**Duplex Coil** – a device to block the sound of your own voice from reaching your ear so you don’t hear your own voice in the speaker when you talk

**Touchtone pad and frequency generator** - a key pad the produces different tones based on the key being pressed

Information from [http://electronics.howstuffworks.com/telephone1.htm](http://electronics.howstuffworks.com/telephone1.htm) and [http://electronics.howstuffworks.com/telephone2.htm](http://electronics.howstuffworks.com/telephone2.htm)

This project was funded by the Mitsubishi Electric America Foundation.
An Introduction to Air Flight and Kites

Lesson’s Purpose

Through a series of kite building and flying exercises, students are introduced to concepts in aerodynamics. In the process, they develop a working knowledge of a kite’s anatomy and exercise hands-on skills. These activities also walk students through the engineering design process as they build and test a model.

For this activity, you will build or purchase a large sample kite for every group of 2 to 4 students in your class. They will be used as examples for this activity. Building a sample kite is invaluable, and we advise you to build at least one if you plan on purchasing samples. The challenges you face will be the same ones faced by your students. Also, your students will enjoy seeing your kite and likely use it as a point of reference as they design their own. As an introduction activity, the students will also build a miniature kite.

Time Required

<table>
<thead>
<tr>
<th>Step</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>2 – 3 hours</td>
</tr>
<tr>
<td>Step 1: Understanding a Kite’s Anatomy</td>
<td>½ hour</td>
</tr>
<tr>
<td>Step 2: Building and Flying a Mini-Kite</td>
<td>1 hour</td>
</tr>
<tr>
<td>Step 3: How Kites Fly</td>
<td>2 hours</td>
</tr>
<tr>
<td>Step 4: Building Full-Size Kites</td>
<td>2 hours</td>
</tr>
<tr>
<td>Total</td>
<td>7 ½ hours  – 8 ½ hours</td>
</tr>
</tbody>
</table>

Note: Building a large sample kite is time consuming, but well worth the effort. You may reuse the kite for future classes.

Step 1: Understanding a Kite’s Anatomy

Many students who are visually impaired have never had an opportunity to build or fly a kite. Therefore, it is helpful to review the basic parts of a kite and their primary functions.

Hand out the sample kites you built or purchased. As you describe each part, invite students to locate it on a sample kite. Every kite shares common parts. Identify and describe the sail, wings, tail, bridle, and flying line on the large sample kites. You can refer to the Kite Anatomy handout at the end of this lesson plan.

Step 2: Building and Flying a Mini-Kite

Students see and feel the effects of lift and drag by building a miniature kite. Miniature kites are small and lightweight, so sufficient lift can be created by holding a mini-kite’s string and walking. When your students have a good understanding of the parts of the full-size kite, test...
their knowledge of kite anatomy by distributing one miniature kite to each student. Ask them to identify the sail, wings, tail, bridle and flying line on their mini-kite. Note: Miniature kites do not have a traditional bridle, but they have a bridle point. It is the point where the line attaches to the sail. Once students have successfully identified the kite parts, they’re ready to build one of their own.

Materials:

- Sail
- Thread (approximately 12”)
- Skewers
- Mylar strips for tails
- Tape
- Templates for sail
- Scissors
- Electric fans

Directions:

1. Take a sail and fold it in half lengthwise to put a crease on it. The sail should be in a “V” shape.
2. On the template, the bridle point is indicated. Trace this position onto the sail.
3. Tape a piece of thread onto the sail. Make sure that the edge of the tape makes the thread meet the sail right at the bridle point.
4. Tape the other end of the thread onto the skewer.
5. Tape the Mylar tail onto the bottom center of the sail.
6. Re-fold your kite along the crease you made in Step 1 so it keeps the “V” shape.
7. Fly your kite indoors at a slow walking speed.

Our group chose to purchase miniature kite kits from an Internet supplier (http://miniatures.kitingusa.com/mini_kits.htm). Techbridge is not affiliated with this website. Our students really liked the miniature kites they built from the kits. They were easy to make and fun to fly. The instructions were also easy to follow.

If you would prefer not to purchase kits for your students, there are several websites that provide instructions on how to build miniature kites with common craft and household materials. Here are a few:

- Tissue paper kite http://www.billybear4kids.com/graduation/summer/kite/make-it.html
- Paper napkin kite http://www.geocities.com/Colosseum/Track/8336/napkinkite.html
- Fabric “pig” kite http://miniatures.kitingusa.com/plan_pig.gif

Once they are ready, invite your students to place their miniature kites in front of a fan to experience and experiment with forces of lift and drag. After students have had the chance to do so, highlight the principles of aerodynamics. Ask them to describe what they experience as they make their kites fly. Where do they see the effects of lift? Where do they see the effects of drag?

This project was funded by the Mitsubishi Electric America Foundation.
If some students’ kites display odd flight patterns ask the group to help troubleshoot the cause of the problem. This will help them apply what they have learned.

**Step 3: How Kites Fly**

As part of the lesson on mini-kites, be sure to introduce your students to the basics of air flight. Two basic forces make air flight possible: lift and drag. You may use the diagram in the appendix to help you explain these concepts. Present this information to your students by posing and answering five questions.

*What is lift?*
Lift is the force generated that is perpendicular to the wind in an upward direction.

*What is drag?*
Drag is the force generated that is perpendicular to the lift.

*What do lift and drag have to do with air flight?*
Most objects, like a kite, are heavier than air. As wind blows across a mass (like water or land), lift is generated. If there is sufficient lift, the weight of the air becomes greater than that of the kite. Or, another way to state this concept is that the kite becomes lighter than the air. The upward force caused by the wind lifts the kite into the air. A kite will fly as long as it remains lighter than the air below it. Drag presses down on the kite and encourages it to return to the earth.

*Is lift stronger than drag? Or is it the other way around?*
Lift must be greater than drag for something to take flight. When a kite or airplane begins to return to earth it is because drag has become greater than lift. If the forces of lift and drag are equal, the object that is flying will simply stay in place. It will neither rise nor fall.

*Can we see lift and drag?*
Not directly. We can see the effects of lift and drag. They are much like wind. We cannot see wind, but we can see leaves shake off trees and blow away. In the same way, we cannot see lift and drag, but we can see a kite rise or fall.

To reinforce these concepts, invite students to walk with their mini-kites. They can experience lift as the air pressure above their kite lessens and the kite begins to fly. As they stop walking, they will experience the air pressure above the kite lessen and the kite will begin to drop. They are experiencing the result of drag.
Lift and Drag: Two basic forces make air flight possible

![Force Diagram](image)

**Figure 2: Force Diagram**

**Figure 3: Force Diagram**

### Step 4: Building Full-Size Kites

Now students are ready to build their own full-size kites. Begin by passing around the full-size kite you built to show your students what they’ll be working on.

### Materials:
- 1 sheet of Tyvek® cloth 60” x 40” for each kite*
- 2 wooden dowels 4 ¼” x 36” for each kite
- Fiber-reinforced tape or strapping tape
- Flagging tape for tails
- 1 reel of flying line per kite
- Scissors
- Yardsticks
- Markers
- Butcher paper for templates
- Hole punches
- 1 paper clip per kite
- Paint, markers, and stickers to decorate the kites

Kites can be built from many materials. We selected Tyvek® cloth because it is durable and lightweight. Tyvek® is also forgiving. If a student gently peels off tape while building the kite, the cloth is not affected. If Tyvek® is difficult to locate or beyond your budget, feel free to substitute other materials.

### Directions:
1. Decide on the dimensions for your diamond kite. The maximum for width and height should be 36 inches.

This project was funded by the Mitsubishi Electric America Foundation.
2. Cut out a template for the sail and keel from butcher paper according to the measurements you made for your design. Instructions on how to make these templates are provided. See “Making the Sail” and “Making the Keel” handouts.
3. Trace out your sail and keel from your template onto your Tyvek®.
4. Cut out your sail.
5. Cut out your keel.
6. Tape a dowel along the width of your sail. Only tape at the corners. WARNING: If you tape the whole width of your dowel onto your sail, it will not fly.
7. Tape the other dowel along the length of your sail. WARNING: If you tape the whole length of your dowel onto your sail, it will not fly.
8. On the other side of your sail (not the side where you taped your dowels), tape your keel lengthwise on the center. Make sure to tape both sides of your keel to the sail. You need to tape the entire length of your keel onto your sail.
9. Reinforce the bridle point of your keel with strapping tape.
10. Punch a hole on the bridle point with a hole punch.
11. Put a paper clip through the hole.
12. Tie your flying line onto the paper clip.
13. Tape a strip of flagging tape at the bottom center of your sail to act as a tail.
14. Allow students to decorate their kites with markers, paint, and/or stickers.

The Interactive Kite Modeler Tutorial program, which is available from the NASA website, can help you design a kite and analyze if your design will actually fly. This tutorial is available at [http://www.grc.nasa.gov/WWW/K-12/airplane/kiteprog.html](http://www.grc.nasa.gov/WWW/K-12/airplane/kiteprog.html). If you use this program, be sure to test it ahead of time to make sure it will work on the computers available to your students.

**Review**

Ask students to answer one-by-one, “What did you learn about kites today?” and “What did you learn about air flight today?” Encourage students to go into detail. For example, if a student states, “I learned about the bridle” ask clarifying questions such as, “What function or purpose does the bridle serve?” or “What’s the bridle’s job?”

Students will often get caught up in the activity. Remind them that there is an additional abstract concept they should take away with them. The take-away for this activity is “Even though you have a visual impairment there are other ways you can experience and study air flight. When someone says you can’t or you shouldn’t do something (like build and fly a kite), try to figure out a different way to accomplish the same thing.”

**Lessons Learned**

It is often assumed that persons who are visually impaired cannot learn concepts that are assumed to be dependent on visual observation. We can invite sighted students to observe and understand concepts like lift and drag by asking them to do something as common as flying a large kite outside. From a distance they can see a kite’s behavior as wind conditions change.

This project was funded by the Mitsubishi Electric America Foundation.
Because youth who are visually impaired cannot do an activity the same way as their sighted peers, they are often not given opportunities to observe abstract concepts like lift and drag. We have found that this lesson dispels that myth. We first created context by allowing students to examine the large kites. Next, we modeled aerodynamics using a small scale model—miniature kites. Finally, students were able to observe aerodynamics tactiley.

In our experience students develop a good understanding of aerodynamics with this lesson. When quizzed on wind direction and the weight of air pressing on a kite’s sail they correctly determined whether the kite would rise or fall. The lesson is empowering and fun.

Photo 6: Flying kites and learning about flight and drag.
Anatomy of a Kite

The Sail is the lifting part of the kite. A sail can be made of paper, plastic, or fabric, such as Tyvek.

The Wings should be symmetrical for the best possible flight.

The Tail prevents the kite from moving from side to side (called "yawing").

The Keel provides stability for the kite in flight.

The Bridle Point is the place where the kite line connects to the kite. Adjust the bridle point position for the wind, as necessary.

Figure 4: Anatomy of a Kite Diagram
How to Make a Mini Kite

Materials
- Tissue Paper
- Invisible tape
- 5” piece of mylar or plastic for the tail (Christmas tree icicles are ideal)
- 9-12” piece of thread
- Tweezers (optional)
- Wooden skewer or plastic drinking straw (optional)

Step 1: Create a Sail
- Cut the template out.
- Fold your tissue paper in half.
- Trace the template onto your tissue paper. Be sure to line the dotted line up with the folded edge of your tissue paper.
- Cut along the outline you’ve just drawn.
You now have a sail!

Step 2: Assemble Your Kite
- Cut small pieces of tape – approximately ¼” long and 1/8” wide.
- Using your tweezers or a steady hand, tape your tail to the end of the kite. Remember to use a very small piece of tape so you don’t weigh down your kite.
- Tape your thread to the bridle point as shown in the drawing. Because the kite is so small, if you do not tape it accurately your kite may not fly well.
- If you would like, tape the end of the kite line (thread) to a wooden skewer. You will see a more dramatic lift.

Step 3: Test
Be sure your kite’s sail still as a strong crease down the center. If it does not, you can refold it. Hold the end of the kite line (thread or skewer) and walk. See your mini kite fly!
Diamond Kite Design Worksheet
(to be used with NASA’s Kite Modeler Program)

Figure 7: Kite Modeler Screenshot

H1 = ___________ inches
(H1+H2 ≤ 36)
H2 = ___________ inches
W1 = ______________ inches (≤ 36)

The following dimensions will be calculated using the Kite Modeler

B-Bridle = ___________ inches
K-Knot = _____________ inches

Subtract K from B. You will need this measurement for your keel.

B – K = ______________ inches
T-Tail = ____________ inches
Angle = ____________ degrees

(should be between 25 to 35 degrees)
Making the Sail

1) First you need to make a template on butcher paper:
   a. Your sail is as long as $H_1 + H_2$. You should know this value from your
      Diamond Kite Design Worksheet. Measure this length on your template paper.
      Mark the length $H_1$.
   b. Your sail is as wide as $W$. You should know this value as well from your
      Diamond Kite Design Worksheet. From the mark $H_1$, measure out one half of
      $W$. Connect this mark to both ends of the length of your sail. Now, you have a
      template that is half the size of your sail.

2) You will use this template to know how to cut your Tyvek®:
   a. Fold your Tyvek® making sure that it is at least as long as the long side of
      your template and as wide. Match the long end of your template along the
      fold.
   b. Trace out the template onto the Tyvek®.
   c. Cut out the Tyvek® and unfold it: you now have your sail.

Figure 8: Sail Measurements

This project was funded by the Mitsubishi Electric America Foundation.
Making the Keel

Figure 9: Keel Measurements

1) First you need to make a template:
   a. The keel is as long as H1+H2. You should know this value from your Diamond Kite Design Worksheet. Mark this on your template paper.
   b. The long side is K. You should know this value as well from your Diamond Kite Design Worksheet. Mark this on your template paper.
   c. The short side is B minus K. You should know this value as well from your Diamond Kite Design Worksheet. Mark this on your template paper.
   d. Now, you have the length of all sides of your keel. By using rulers to measure the other sides, the vertex of the keel can be marked on the template.
   e. Cut out your template.

2) To make your keel, trace the template onto your Tyvek®. Cut your Tyvek®.
See What I Hear: A Lesson in Photography

Lesson’s Purpose

Taking pictures of family, friends, and special places is a rewarding activity for most students. However, it is often assumed that students who are blind and visually impaired do not have the ability to take quality photos or would not find the activity equally rewarding as their sighted peers. This lesson teaches students who are blind and visually impaired how to use cameras and present their work in PowerPoint presentations.

Time Required

This project takes several two-hour sessions, indoors and outdoors. One session may be devoted to learning how to use the cameras. Another may be dedicated to the walking tour and picture taking. Depending on your students’ knowledge of PowerPoint, you may need a full session to teach them how to use this program. One or two sessions may be needed to view, select, and insert photos into a presentation. In a follow-up session, give students the opportunity to practice and deliver their presentations.

Materials

Each student will need a disposable or digital camera. They will need Microsoft PowerPoint and a screen reader like JAWS or ZoomText installed on their computers. Each student will also need a removable storage device such as a floppy disk, CD-ROM, or flash drive to save their work.

Directions

Step 1: Preparation

Label the students’ cameras with their names in Braille or large print. Also, if you are not particularly familiar with PowerPoint or would like advice on how to teach it to your students, take time to work through the PowerPoint program. Be sure you practice using the shortcut keys your students will be using.

Step 2: Practice Focusing

Set up chairs around your classroom in locations that are different from where students ordinarily sit. Ask your students to find a chair. Once everyone is seated, assign each student a partner who is not in close proximity. Progressing one group at a time, ask students to give their partner auditory cues to their location. Using their hands, students should point towards where they would aim their cameras, if they wanted to photograph their partners. This is a fun way to begin the See What I Hear project. It gives students

This project was funded by the Mitsubishi Electric America Foundation.
the opportunity to start thinking about where to “point” the camera when taking a picture of their subject.

**Step 3: How to Use Your Camera**

Give your students a lesson on how to use the disposable or digital cameras you have provided them. Be sure you cover the basics: pointing, shooting, using flash, judging the proximity of one’s subject (not too close, not too far), and knowing when you’ve run out of film or filled a memory card.

**Step 4: Take a Trip**

This activity lends itself well to taking a field trip outdoors. Being outside allows students to listen for sounds they do not normally hear at school. However, if you do not have easy access to an area off campus, your school grounds can also be used for this activity.

Once you arrive at your destination, distribute cameras to students and orient them to their surroundings. If possible, arrange a tour, stopping along the way so students can take pictures of what they hear. During the excursion, you may want to highlight points of interest that students might not be able to hear, but rather smell or touch. Remind them of what they learned about using a camera such as orientation, proximity of a subject, and using flash.

Collect your students’ cameras at the end of the trip.

**Step 4: Processing Prints**

If you have provided students with disposable cameras, we recommend processing the film for prints and CD-ROMs. You students will have an easier time incorporating their photos into PowerPoint if they are already in an electronic format. If you are unable to get them on disc you will need to use a scanner to put their prints into a format they can use with PowerPoint. Tip: Write each student’s name on the processing envelope that belongs to his or her camera. This will save you a lot of guess work when you get the orders back.

If you use digital cameras, download the images into separate folders. It is helpful to name each folder with the student’s name. Your students will need access to the files to do their PowerPoints. Save the folders to your server, burn them onto a CD-ROM, or use a flash disk.

**Step 5: Selecting Favorite Pictures**

When the pictures have been developed or downloaded, give your students their respective photos on CD-ROMs or flash disk. Alternatively, tell them where they can be accessed on your server. Students who are visually impaired may view their pictures on
the computer using appropriate software to enlarge the images. Students who are blind will need someone to describe each photo they have taken.

Ask students to select their five favorite photographs. They will use them to create their PowerPoint presentation.

Step 6: Microsoft PowerPoint

We found that most of our students had little or no experience with PowerPoint. If the same is true for your students, you will need to teach them how to use this program. You may develop a ‘How to use PowerPoint’ lesson or can use the Microsoft PowerPoint tutorial found at http://www.actden.com/pp/.

At minimum you will need to teach your students how to add photos and text to each slide of their presentation. We found that it is best to ask students to follow directions step-by-step as a group. It is a slow process, but ensures that no students get left behind. Encourage students to help their neighbors if they finish first. If possible, it is a good idea to have one instructor available to assist two students. This allows the group to move along and ensures that students’ work can be reviewed in a timely manner.

After students have learned how to use PowerPoint, invite them to put their knowledge to work by creating a story using their five favorite photographs. Support their creativity by allowing them to use narrative or poetry to describe their experiences with this project.

When students have finished their projects, encourage them to share their presentations with a partner and get input. Next, review the presentations and give students constructive feedback. With the feedback they have been given, students should edit their presentations. Let them know the importance of review and revision for all projects.

Step 7: Presenting Their Work

Begin by reviewing the Presentation Guidelines handout at the end of this lesson plan. Ask student to introduce their projects and present their PowerPoint. For example, “I selected five photos of different leaves I found. Each leaf had a unique shape, texture, and smell. My favorite was the large one that was smooth to the touch. It reminded me of a trip I took to Yosemite last fall.”

Step 8: Discussion and Follow-Up

After each student has had an opportunity to present his or her work, invite the group to reflect on the activity. We offer you some questions to facilitate a discussion:

1. Was this the first time you used a camera? If so, how did it feel to take pictures? If not, was there anything different about this experience from your previous experiences with the camera?
2. What part of the project did you find most interesting?

This project was funded by the Mitsubishi Electric America Foundation.
3. What part of the project did you find most challenging?
4. People often use PowerPoint to present their work in school and at work. Do you feel comfortable using this program?

Students love to take projects home to share with their family and friends. Give each student a copy of his or her final presentation on disk and on photo paper.

Lessons Learned

Our group took a field trip to a wildlife refuge, which gave them an opportunity to take photographs and also practice their orientation and mobility skills on a hiking trail. Along the way, the group stopped at observation points to snap photos of the running creek, flora and fauna, and each other. It is helpful to assist students when they take their first photograph by guiding them (if needed) while they are aiming at their subject. This will help them orient their camera toward their subject matter in the future. Once back on campus, the students worked with PowerPoint, adding text to their images and creating photo displays for others to enjoy. For students who had been told they couldn’t take photographs because of their visual impairment, the lesson proved empowering.

Additional Resources

To Photograph is to See offers a portrait of renowned photographer, George Covington, who is legally blind.
http://www.kodak.com/takePictures/covington/introduction.shtml

Shooting Blind: Photographs by the Visually Impaired is a project by the Seeing with Photography Collective in New York City. Photographs and interviews with the artists explain why individuals who are blind or visually impaired might be interested in photography: “to develop pride in succeeding at a seemingly impossible task.”

Vision Quest Photography by Carrell Grigsby at the Texas School for the Blind and Visually Impaired. This curriculum helps students with low vision discover how much they can see when they learn to optimize their vision. Both visually impaired and sighted individuals can improve observational skills through the study of photography.
http://www.tsbvi.edu/Education/photog.htm

Presentation Guidelines for Students

Just as valuable as learning digital photography and PowerPoint is learning to make successful presentations. In our experience, most students are afraid to speak before a group. Frightened or not, all our students have benefited from learning strategies to present their work before a group. Here are tips to help your students:

1. Introduce yourself. Provide your name and additional information (school, grade, and relevant information appropriate for your audience).
2. Remember to speak loudly and clearly.
3. Be calm, stand up straight, and remember not to fidget.
4. Don't rush. Take a breath and pause between your important ideas.
5. Be natural and try to use gestures.
6. Add some creativity to your presentation. Bring props to help explain your topic.
7. If they help, make note cards to help you remember your key points, but do not read from your notes.
8. Know your time limit and stick to it.
9. At the end of your presentation, try to summarize the main point in one sentence.
10. Invite questions from your audience.
11. Most importantly, enjoy yourself! The audience will be on your side and want to hear what you have to say.
12. Thank the audience when you’re finished.
13. Practice, practice, practice. The more practice you have giving a presentation, the better it will be.

Photo 7: A lesson in photography on a field trip.

This project was funded by the Mitsubishi Electric America Foundation.
Electronic Fun: A Holiday Greeting

Lesson’s Purpose

This activity allows students to blend their interests in technology with the fun of building a craft. Students build a sleeve that holds a small electronic device that records and plays back a message. The project can be used as a greeting card or wall or door decoration for any holiday.

Time Required

<table>
<thead>
<tr>
<th>Step</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>2+ hours</td>
</tr>
<tr>
<td>Step 1: The Voice Recorder</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Step 2: Assembly</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Step 3: Decoration</td>
<td>1½ hours</td>
</tr>
<tr>
<td>Total</td>
<td>2+ hours</td>
</tr>
</tbody>
</table>

Materials

- Craft foam – several sheets
- Pre-cut foam decorations
- Craft glue
- Yarn
- Single-hole punch
- Invisible or masking tape
- Scissors – one per student
- Voice-recording module – one per student
- 9-volt battery – one per student

Note: We used a voice-recording module available at Radio Shack and on its website. We advise testing these modules before you use them since we found that they had a high rate of failure. See Step 2 in the “Directions” section of this lesson plan for more information. You may also wish to check out the Recordable VoiceOver module that is available from Talking Presents at http://www.talkingpresents.com/line9/tek9.asp?pg=products&specific=jnpqork8

Preparation

First, prepare the card template, which is located in the appendix of this lesson plan. Cut the template along the solid lines. Then use a hole punch to make holes where circles appear along the outside edge.
Next, create the cards. Cut the craft foam into 4” x 7 ½” rectangles using the template you just prepared. Make 2 rectangles for each student.

Next, you need to punch holes in each of the foam rectangles you just created. Put the template over a foam rectangle and mark the foam rectangle with the location of each circle. Punch a hole in the foam where you just marked the circles. Repeat this process until each foam sheet has been punched.

Mark each back panel using the template as a guide. Be sure to mark the microphone speaker, play, and record buttons on each back panel. With scissors, cut a small X for the buttons to come through. You can determine the exact size of the slit you will need by noting the size of the buttons on the voice-recording module.

Note: Only mark half of the foam rectangles. For example, if you produced 20, mark only 10.

Finally, make a slit in the top right side of each back panel using the dashed line on the template as a guide. The recording module’s microphone speaker will eventually be placed here.

At the start of the activity give each student two foam rectangles. Be sure they get one front and one back, one yard of yarn, glue, craft foam decorations, scissors, a piece of tape (1 inch should be enough), and a voice-recording module.

Directions

Step 1: The Voice Recorder

Radio Shack sells 20-second voice-recording modules (product number 276-1323). They are relatively affordable and simple to use. The module contains a microphone speaker, record and play buttons, and a place to connect a 9-volt battery.

Invite students to examine and experiment with the voice recorder. If you are doing this activity as part of a larger module on electronics, programming, or circuits this simple device can be used to demonstrate concepts you taught in other lessons.

If you want to know more basics about electronics or circuits, check out the How Stuff Works website at http://www.howstuffworks.com/.
Step 2: Assembly

After students have had a chance to examine all of their materials they are ready to assemble and decorate their hanging sleeve. Have students begin by weaving the two foam pieces together with yarn. Attaching the end of yarn around a skewer with tape will make it easier for students to weave the yarn through the holes. They can begin at the upper left hand corner and work their way down, around, and up to the right hand corner. They should not weave the top shut. It is recommended that students tie knots at the beginning and end of the weave. The yarn that has been woven in should be fairly taut. If it is not, the weight of the 9-volt battery will cause the foam pieces to come apart and the recording module will fall through the bottom or sides of the sleeve.

Step 3: Decoration

After they have properly constructed their sleeves, invite students to decorate the front of the sleeves they created. You can purchase pre-cut letters and foam shapes appropriate for the occasion. Alternatively, students can create their own shapes and creations with pieces of scrap foam. Our students made greeting cards for Christmas and Chinese New Year. You could make cards to celebrate other special occasions.

The glue we used took a full day to dry. Be sure to take this into account when scheduling your activity. The decorations students glue onto their sleeves will fall off if they attempt to put their voice-recording modules into a sleeve when the glue is still wet.

When the glue has dried, ask your students to place the voice-recording module and 9-volt battery into the sleeve. The battery should rest gently and evenly at the bottom. The circuit board that holds the record button should be put through the small vertical slit on the right. The play button on the larger circuit board should be placed through the center of the X that was cut in the foam. If the X was made sufficiently small the foam will mold around the circular button. The microphone speaker’s wire should be pushed down through the slit at the top of the sleeve. The back of the microphone speaker should be left flush with the foam.

To protect the voice-recording module, students should weave a small piece of yarn through the top of the sleeve to seal the recorder in. They may want to tie bows rather than knots at the top of their sleeves. It will make it easier to change the battery at a later time. If these are to be used as door or wall decorations, a piece of yarn should be attached at the upper right and upper left hand corners.

Last and best, students may record the 20-second message they wish to share.

This activity can be incorporated into a larger module on electronics, programming, or circuits. It can also stand alone as a fun activity for students to enjoy before a holiday break.

This project was funded by the Mitsubishi Electric America Foundation.
Comments on Modifications

Much of the prep work involved in this project can be done by the students. As instructors, we made a conscious decision to do it for a single purpose – to allow students to focus more time and attention on how the digital-recording device worked instead of spending classroom time on doing prep work. You may prefer for your students to do the prep work if you find that they would benefit from practicing the hands-on skills it brings. This activity requires patience, precision, and dexterity – skills that are needed in Techbridge building activities.

![Techbridge student decorating electronic greeting sleeve.](image)

Photo 8: Techbridge student decorating electronic greeting sleeve.
This project was funded by the Mitsubishi Electric America Foundation.
Peanut Butter and Jelly Robot  
(Adapted from Educator’s Cheapbook, Museum of Science, Boston)

Lesson’s Purpose

This lesson introduces students to the concept of programming, focusing on the 
importance of clear and concise instructions. It is also a fun way to have your students 
make their own snacks! We suggest using this activity as an ice breaker for An 
Introduction to HTML Programming lesson.

Time Required

<table>
<thead>
<tr>
<th>Set-up</th>
<th>5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Clean-up</td>
<td>5 minutes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30 minutes</strong></td>
</tr>
</tbody>
</table>

Materials

- Peanut Butter
- Jelly
- Bread
- Knives
- Spoons
- Plates
- Napkins

Directions

Distribute one paper plate, a napkin, two slices of bread, one knife, and spoon to each 
student. Each student will also need one to two tablespoons of peanut butter and jelly on 
his or her plate. Ask students to not touch their materials until they are instructed by the 
programmer. We found it helpful to set materials out like you would for a place setting 
for a meal. It will help you encourage your student robots to be more concise with their 
programming instructions.

Set up the activity by explaining that computers are not intelligent. They are merely 
machines that compute numbers and help us communicate with one another. A computer 
can only do what it has been programmed to do. People program computers. 
Programming is also known as coding. Coding is the process of writing instructions a 
computer can understand so it can do a specific task.
Select a student to be the first programmer. Ask him or her to give step-by-step instructions on how to make a peanut butter and jelly sandwich. Write down what the student says as precisely as you can.

Read back the instructions that you wrote down step-by-step. Invite all of your students (including the person who acts as the first programmer) to become robots. They must do exactly what you say. For example, if the first instruction was, “Spread jelly on the bread,” stop students who begin to use a knife to spread jelly on a slice of bread. There was no mention of a knife in the instruction given. A robot is not a thinking being and would not know a knife existed.

Ask students to modify the instructions as they go along. What would be a clearer, more concise way of saying, “spread jelly on the bread” that a robot would understand? Remind students that robots do not have assumptions about what resources are available. Continue to ask students to reprogram the instructions until they have made a peanut butter and jelly sandwich correctly.

A good conclusion from this activity would be having students collectively come up with instructions like, “There is a plate with a scoop of peanut butter in the upper left hand side of the plate. There is also a scoop of jelly in the upper right hand side of the plate. Take the knife that sits to the right of the plate and use it to scoop a spoonful of jelly onto a slice of bread. The bread is sitting in the center of plate.”

A critical point in making this activity successful is stopping and prompting your students to improve their instructions. A tip is to constantly ask, “Are the students assuming something?”

Lessons Learned

This activity is a classic success at our Techbridge sites. Techbridge students at the California School for the Blind also enjoyed it. They imitated robotic voices and caught on quickly. We were impressed by how thorough their instructions eventually became. Things that sighted students assume, like the location of a knife, were not assumed by our students that were visually impaired. They are accustomed to being more explicit with instructions in this way. This lesson laid a strong foundation for introducing student to HTML programming.

This project was funded by the Mitsubishi Electric America Foundation.
An Introduction to HTML Programming

Lesson’s Purpose

Interacting with computers can often be more frustrating than fun. This activity was developed to help students who are visually impaired get excited about computing by writing their own web pages in HTML. It is a fun way to introduce them to basic concepts and careers in computer programming. With this lesson, students gain an understanding of HTML grammar and syntax. This activity assumes your students already have the ability to navigate through a text document and browse a web page using JAWS, ZoomText, or similar adaptive software programs.

Time Required

<table>
<thead>
<tr>
<th>Step</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Peanut Butter and Jelly Robot Ice Breaker</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Step 2: HTML Basics</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Step 3: Time in the Lab</td>
<td>10 hours</td>
</tr>
<tr>
<td>Step 4: Uploading Files</td>
<td>15 minutes – 1 hour</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>up to 12 hours</strong></td>
</tr>
</tbody>
</table>

Materials

- Computers for each students with adaptive software and hardware
- Text editor (e.g., Microsoft Notepad or Word)
- Web browser (e.g., Internet Explorer, Netscape, or Firefox)
- *How to Write a Web Page* handout – large print or Braille version
- *personalPg.htm l* – large print or Braille version

If you decide that your students should use Word, be sure you open the document as a text (.txt) file. This step varies depending on which version of Microsoft Word you are using. Some versions will automatically open it as an HTML file and you will not be able to edit the HTML source. In that case, Notepad is your best option.

A note on web browsers: It is likely that your computer already has a web browser installed. If it does not, you can download one for free:

- Internet Explorer (http://www.microsoft.com/windows/ie/downloads/default.mspx)
- Firefox (http://www.mozilla.org/products/firefox/)

Test the text editor and web browser ahead of time. Be sure to test your adaptive software with these programs. Not all web browsers are compatible with all adaptive software.

This project was funded by the Mitsubishi Electric America Foundation.
Directions

Step 1: Peanut Butter and Jelly Robot Ice Breaker

Computers are not intelligent. Human programmers have to write instructions (also known as code) to tell the computer exactly what to do and how to do it. The process a person goes through to do this is called programming. Your students will develop a better understanding of programming by participating in the Peanut Butter and Jelly Robot icebreaker. This fun activity helps students understand that computers are literal and not intelligent. It gives them a feel for what it means to be a computer programmer.

Step 2: HTML Basics

Computers do not understand English, Spanish, French, or any other verbal language humans use to communicate. Instead they understand written languages such as HTML, Java, or C++. These are special written languages that a computer knows how to process.

As an instructor, if you are new to HTML you should take the time to write your own web page. Review this lesson’s handouts and visit http://www.webmonkey.com. Webmonkey has an excellent set of tutorials on HTML. Practice with these tutorials will help you feel more confident presenting this lesson.

Give students the How to Write a Web Page handout and personalPg.html template in large print or Braille. Review each section of the How to Write a Web Page handout. Refer to personalPg.html to demonstrate the concept being described. Your goal is to help students feel comfortable reading the template and understanding how the HTML tags work.

Step 3: Time in the Lab

The only way to learn computer programming is to do it. Give each of your students an electronic copy of personalPg.html. You may want to make it available to your students by placing it on a network server, a floppy disk, or CD-ROM. Have them locate the file, open it, and save it under a different name – for example, firstname.html where firstname is the student’s first name before making any changes to the text.

personalPg.html follows a simple protocol (a.k.a. rule) to help students identify what text they should modify. Text surrounded by asterisks (*) need to be removed and replaced with appropriate content. The asterisks are not part of the HTML language. They should be removed as well.

This activity will encourage your students to exercise their knowledge of adaptive technologies. Students will get frustrated during this lesson. That is OK! You should give them a lot of lab time over several days or weeks so they can make mistakes and go back and fix them. Professional programmers make lots of mistakes and then have to go back and fix them over and over again. Programmers refer to the process as “iteration.”
Iteration is different from failure. It is a methodical process of trial and error, and problem solving. Good engineers do not give up easily. Making mistakes and learning from them is part of their jobs.

Every time you return to the computer lab review core concepts in HTML programming. Specifically:

1. What does HTML stand for?
2. What is a tag? How do tags work?
3. Ask what a specific tag does. For example, what does \texttt{<br>} or \texttt{<a href>} do?
4. How do you test your web page?

Reviewing these questions will refresh their memory and help your students better understand what they are reading and modifying.

**Step 4: Uploading Files**

Your students have successfully made \textit{personalPg.html} their own. Their pages are now ready for the web. Work with your school or organization’s web master or Information Technology (IT) person to find out how to put your students’ web pages up on your organization’s website. If your school or organization does not have the ability to do this, there are a variety of free web-hosting solutions. The downside to this solution is that these types of sites will embed advertising on your pages. The upside is that they are free and you can quickly and easily put them up (or take them off) the web. A popular free web-hosting solution is Geocities (\url{http://geocities.yahoo.com/}). If you are feeling adventurous, you can purchase a web address and ftp your files to a site. Many web hosts will provide you with phone or e-mail support to help you correctly ftp and display your pages. You can visit Webmonkey.com for more basics on what this means.

**Follow-Up**

If your students get the programming bug you can allow them to update their web pages regularly. They will gain programming experience as they record their adventures and interests throughout the school year.

**Lessons Learned**

Learning HTML and coding their own web pages was one of the most difficult and rewarding activities accomplished by our Techbridge students at the California School for the Blind. The lesson was carried out over a 5-week period. Every student had anxiety about having to use JAWS and/or the Braille keyboard even though they had the skills they needed from a formal class they had taken.

During the first three weeks of the activity we had to persuade them to, “Try it. See what happens.” Many students would hover their fingers above the keyboard and worry they were about to do something very wrong. There was a lot of step-by-step coaching.

This project was funded by the Mitsubishi Electric America Foundation.
involved – something atypical for most other Techbridge sessions. There were a lot of questions asked.

Truthfully, most students knew the answers to their own questions. They were merely fearful of making a mistake. By the fourth week we found most students had overcome their fears and could work independently. More questions were directed at understanding how the HTML worked and less on the logistics of navigating the computer.

While many of the students did not characterize the process of writing the page “fun,” they did find that the outcome was rewarding. They enjoyed viewing their pages and asked for the opportunity to keep their web pages updated. Two students even stated it was their favorite activity of the year.

Photo 9: Student working on her web page.

This project was funded by the Mitsubishi Electric America Foundation.
How to Write a Web Page

What is HTML?

HTML stands for “Hyper Text Mark-up Language.” Any computer that has a web browser like Internet Explorer, Netscape, or Firefox can read this language. Many web pages are written in HTML. Some web pages are written in other languages like PHP or JavaScript.

Is learning HTML like learning a foreign language such as Spanish or French?

Learning any computer language is a little like learning a foreign language. You have to learn a new vocabulary and grammar. However, if you are fluent in English, HTML is easier to learn than a foreign language because it uses some plain English.

Some HTML Basics

There are a few things you need to know before you get started. First, you need to understand what a file extension is. A file extension is the set of letters after the dot in a file name. For example, in “index.html” “.html” is the file extension. Web browsers look at file extensions to determine what language they are reading. If the page is written in PHP, but it thinks it is written in HTML it will translate the information incorrectly. In a similar example, let’s say you know how to read Portuguese and Spanish. They are very similar languages. If you were asked to read a story and were told it was written in Spanish, but it was in fact written in Portuguese, your first attempt at translation would be wrong. You need to tell your computer in what language you are talking to it. Your file needs to end in “.html” so your web browser will know how to read the page correctly.

The second thing you need to know is all HTML pages are made up of two pieces: a head and a body. A book’s cover gives you information about the book’s title, author, and often a summary of its contents. A HTML page’s head functions the same way. It tells you a page’s name and some details about what the web page contains. The body of a HTML page is like the pages of a book. It contains words, photos, and tells you where to find other pages with related information. Here is an example of a basic HTML page.

<html>
<head>My Webpage</head>
<body>Welcome to my webpage.</body>
</html>

Thirdly, you need to understand what a tag is and how to use it. All HTML pages begin with <html> and end with </html> tags. You will recognize a tag because it begins with <command> and ends with </command>. The first part of the tag (for example,
“opens” the tag. The second part (for example, </command>) “closes” the tag. When a tag is opened it contains only a less than and greater than symbol around a command. A tag is closed when the command has a slash mark just after the less than symbol. In the example above the head tag is opened with <head> and closed with </head>. You might want to memorize some of these commonly used tags:

<h1></h1> is the **Heading 1** tag. It makes text bigger and bolder than any other text on a HTML page. It is like giving your page a chapter heading.

<h2></h2> is the **Heading 2** tag. The h2 tag makes the text bigger and bolder than all of the other text on a page except text marked with h1 tags. It is like giving your HTML page a chapter sub-heading.

<br> is called a **Break** tag. It is different than other tags. It does not have to be closed. You may wonder why, but the truth is there is not good reason! When you insert this tag your next line of text will begin on the next line of the document. It is like putting a hard return on a typewriter or computer.

The <hr> **Horizontal Rule** tag breaks the rule like the <br> tag. It does not have to be closed. It creates a horizontal line that divides a page. Often it helps sighted people recognize that the text above the line is on a different subject than that below it.

One of the most useful and interesting tags you can use is a **Hyper Reference a.ka. a Link**, for example <a href="http://www.awebpage.com"></a>. It allows you to go to another web page. It is like using an index in a book to jump around from one topic to another.

Sometimes we want text to appear on a web page in specific columns and rows. It makes it easier for some users to quickly see more content on a single screen without having to scroll down or across a page. Three steps are required to accomplish this task. People who program in HTML often create tables to accomplish this. There are three steps involved in creating tables. First you declare you are making a table by using the **Table** tag <table></table>. Second, you put a row in the table by using a row tag <tr></tr>. Each row must contain one or more columns, so the third thing you do is use a column tag <td></td>. Row tags are nested under a table tag and column tags are nested under a row tag. Look at this example.

```html
<html>
<head>My Webpage</head>
<body>
<h1>Welcome to my webpage!</h1>
<br>
<table>
<tr>
<td>This is row 1, column 1</td>
<td>This is row 1, column 2</td>
</tr>
</table>
</body>
</html>
```

This project was funded by the Mitsubishi Electric America Foundation.
Nesting is an important concept in HTML. Basically it means you put one tag inside the other. In the grammar section of this document you will find a more detailed explanation and another example.

People love to share pictures over the Internet. You can share your pictures by using an Image Source a.k.a. insert an image `<img src="file/location/here">` tag. Like the break tag `<br>`, this tag does not have to be closed. When you use this tag you will need to be sure the image you want to share is saved in a location your web browser can find. Your teacher can help you with this.

**Grammar**

There are many rules you must follow when using tags. These are the two most important ones.

1) With few exceptions, tags must be opened and closed. You open the tag before the text you want to “mark-up” and the close tag goes after it.

   `<h1>I enjoy programming.</h1>`

2) If you nest a tag – put one tag inside another tag – you must open and close the nested tag before you close the outer tag. For example, if you want a piece of text to appear larger than any other text on the page and you want it emphasized with bold or italics you would put this in the body of your web page page:

   `<h1><em>Welcome to my webpage!</em></h1>`

   You see that the emphasis tag `<em></em>` is nested inside the header 1 tag `<h1></h1>`. We had to open and close the emphasis tag before we closed the header tag. To make this clear let’s look at the wrong way of doing this:

   `<h1><em>Welcome to my webpage</h1></em>`

   The emphasis tag was opened after the header 1 tag. This is correct. The problem is that the emphasis tag is not closed before the header 1 tag. An easy way to remember how this rule works is to tell yourself, “Last opened, first closed.”
Writing Web Pages for People with Visual Impairments

For many years web designers did not give much consideration to the fact that people with visual impairments might visit their web pages. Therefore, they did not design the pages to be easily read and searched in ways that are not visual. We will be sure to make our web pages accessible to the visually impaired by following a few simple rules:

1) Keep the design simple.
2) Be sure all links are clearly named.
3) Always give images an alternative name.
4) Use headers appropriately.

You will see these rules in action as you build your own web page.

If you would like to know more about designing web pages that are accessible to people with visual impairments and other disabilities you may want to visit the World Wide Web Consortium more commonly known as W3C. This nonprofit organization establishes standards by which web pages should be designed and implemented. They even have guides about designing pages that are accessible to people with visual impairments. You can find the latest technical guidelines at http://www.w3.org/TR/WCAG10-HTML-TECHS/. If you find that the page gives you too much detail do a simple Google search on “writing web pages for visually impaired.” You will find hundreds of sites with suggestions on how to do it.

Testing Your Web Page

You’ve written some HTML code. You think you have done it right. How do you know for sure? You test it, of course! A few easy steps:

1. Save and close your HTML document.
2. Open Internet Explorer or whatever web browser you prefer to use.
3. Open your HTML file by going to File (Alt-F), then Open (O). You will have to browse to find the HTML file you just saved.
4. Using JAWS or your BrailleNote read your page. Are there any errors or omissions? Does the page read the way you would expect it to?

When you think your page is done ask a friend or instructor to browse your page. They might catch mistakes you did not find.
This project was funded by the Mitsubishi Electric America Foundation.
Financial Freedom Through Quicken

With the widespread use of the Internet, it is now possible to track and pay bills as well as monitor investments through the use of software programs such as Quicken. While most of your students may not have bank accounts and credit cards, it is important for them to learn how to manage these tools to prepare for financial independence. In this lesson, students will be given a budget and taught how to manage their budget with the personal finance management software, Quicken.

Time Required

<table>
<thead>
<tr>
<th>Step 1: Quicken Set up</th>
<th>1 hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2: Learning the Basics of Quicken</td>
<td>1-2 hours</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2-3 hours</strong></td>
</tr>
</tbody>
</table>

After students have learned how to use the basic Quicken program, you can follow up by allowing them to work on their own each week, to update bills and manage their accounts.

Materials and Set Up

- Computer (one for every student)
- Quicken Basic (one license for every computer)
- JAWS (or another screen reader) or ZoomText
- Quicken Setup Directions handout in large print and Braille
- Quicken Introductory Lesson in large print and Braille

Quicken should be installed on each computer. Be sure to prepare and test computers ahead of time.

Directions

1. Invite students to choose a computer and start JAWS or ZoomText. Once one of these assistive technologies is up and running, students can begin the lesson.
2. Hand out the Quicken Setup Directions handout and work slowly through the directions, step-by-step, until each student has his or her own account set up.
3. Lead your group through the Quicken Introductory Lesson. Note the directions are for Quicken 2003 Basic, which is the software we had used with our students. During this lesson, students will learn how to use the program, add and delete bills, pay bills online, and manage their money.
Step 1: Quicken Setup Directions

1. Open the Start Menu by pressing the Ctrl & Esc keys. Scroll up to where it says Programs. Scroll over and then down or up until the computer says Quicken. Then scroll over and down until the computer says Quicken 2003 Basic, at which point you can press Enter.
2. Before entering information, you will be asked to save your account somewhere. You should save it as your name Quicken (i.e., Sally Quicken) on the Desktop of your computer.
3. Now you will be welcomed to Quicken Guided Setup. At this point you should press Enter.
4. Next you will be asked to enter some information about yourself. You can use the Tab key to move between cells.
5. The next step is to set your goals. In this section you will need to tell Quicken what you want to use it for. You can use the Tab key to scroll through the list. When you decide which goals are right for you, you should press the Space Bar key to check the box next to your goal. You can press the Space Bar key again to uncheck your selection as well. For this activity, you should make sure that both Cash Flow and Bills are selected.
6. Now you are ready to add your accounts to be tracked. In the first section you should track your cash flow. For this lesson, you should enter both Checking Account and Cash information.
7. When you select the Add Account box for Checking, you will be asked to add an Account Name. Type in your name Checks (i.e., Sally Checks). Then press the Tab key and scroll down to 1st Choice Bank. Press the Tab key twice and you will be able to select the Next key. You will now need to enter the statement ending date and balance of your checking account. You should use today’s date and $150 as the balance in your checking account. Lastly, you will need to select Done by pressing the Tab key until you reach that button and then selecting the Enter key.
8. Now set up a Cash Account by selecting that button. Type in the name of your account as your name Cash (i.e., Sally Cash). Then press the Tab key twice and select Next by clicking on the Enter button. Just as with your checking account, you will now need to enter the statement ending date and balance of your cash account. You should use today’s date and $0 as the balance in your cash account. Lastly, you will need to select Done by pressing the Tab key until you reach that button and then selecting the Enter key.
9. When you return to the main menu, you will want to select the Shift & Tab keys at the same time to go back up the menu and reach the Next Step button.
10. You will be brought to the Add Bills section of the setup menu. Here you will need to add any recurring bills that you may have, such as a cell phone bill, rent, or garbage. Scroll through the list, using the Tab key, until you reach the item that is for Rent. Check this box using the Space Bar key and then Tab to the next box where you will need to enter how many times you pay this bill per month. You should type in the number 1. Then scroll down to Telephone and click that button using the Space Bar. These will be your monthly bills, so now you can Tab all the way through until you reach the Next button, where you can press Enter. You can add more bills later.
11. Now you need to edit your Bill information. The cursor should begin on your first recurring bill—your rent. In the first column, type in your school name. When you Tab over, the next column tells Quicken which account to take the money from. Make sure Checking is typed in here. Tab over again and you have your category, which should be Rent. In the next cell, you need to type in how much money you pay in rent every month. Say, this amount is ¼ of your monthly earnings, so that would equal $150 * 25%, which equals $37.50. Type that amount into the cell for Amount. Tab over again and you can change the frequency; however, you will want to leave this as Monthly. The next cell will tell Quicken when that bill needs to be paid, which should automatically be set to today’s date. You should leave it there.

12. Now go through this list and do the same thing for your Telephone Bill. However, you will want to put in $10 for the monthly amount. Use the Tab key to scroll through the list until you reach the Done button. Select it using the Enter key.

13. In the main menu for the Bills section, scroll through until you reach the button that says Next Step. Select this button using the Enter key.

14. You will now be brought to the screen where you can Review Your Data. Alt-F4 will exit you out of this dialogue box.

Congratulations! You have successfully completed your account setup for Quicken. Now it is time to learn how to use the software.

Step 2: Quicken Introductory Lesson

1. Open the Start Menu by selecting Ctrl- Esc. Scroll up Programs. Scroll over and then down or up to Quicken. Scroll over and down to Quicken 2003 Basic, at which point you can press Enter.

2. You should be welcomed to your Quicken Home Page. There are several panes to be aware of on the screen. The pane in the left hand column is a list of all the areas where you can spend and save money (i.e., Cash Flow Center, Investing Center, and Property & Debt). In the right hand column are Notes & Reminders, Current Bills, Next Steps to Meet Your Financial Goals, and Online Updates. We will go through each one of these areas to learn how to use it and navigate through it.

Bills & Scheduled Transactions:

1. Select Alt-C (Cash Flow Center), then Ctrl-J (Scheduled Transaction List). You are now in the Scheduled Transaction List dialogue box.

2. Add scheduled transactions: Alt-W (Create New), then P (Payment). The Create Scheduled Transaction dialogue box will open.

3. The type of transaction should be Payment. Tab to the next box and select the name of your account (i.e., Sally Checking)

Opening Your Checking Account:

4. Select Alt-C (Cash Flow Center), then Shift-A (Cash Flow Accounts), then Ctrl-A (Account List). We are now in the Account List dialogue box.
5. Use the Arrow Up and Down keys to scroll through the accounts until you find your own. Then select Enter.

Cash Flow Center:

6. Once in the Cash Flow Center Menu, scroll down to where it says Go To Cash Flow Center. This will open a section called My Data.
7. Within the My Data section, you can change your Spending and Savings Accounts, review and pay your Bills and Scheduled Transactions, and review and pay your Credit Card Accounts.
8. You will first need to take a look at your Bills and Scheduled Transactions area to determine what bills need to be paid and when. In order to get to that area, you need to select the Alt key and then use the left arrow keys to scroll over until you reach the Cash Flow Menu. At this point, you need to use the arrow down key until you reach Scheduled Transaction List. Then select Enter.
9. A new screen will appear that allows you to add, edit, and change your cash flow. Within the cells here, you should be able to use the arrow down key to read the transactions that you entered during the setup of Quicken—your opening balance, rent, and telephone bill.

Discussion Questions

Once students have completed this introductory lesson on Quicken, spend time discussing the importance of setting financial goals and managing money. Here are some questions that can help guide your discussion with students:

1. What are your financial goals for the future?
2. What does your 10-year timeline look like?
3. Why is it important to be able to manage your money?
4. How can Quicken help you accomplish your financial goals?

Lesson Extensions

An important follow-up to the Quicken lesson is to encourage students to begin to plan for personally rewarding and financially independent lives. Explore with them the statistics on the unemployment and underemployment of persons with visual impairments. Help them make concrete plans so that they aren’t part of these statistics when they grow up. Here are some activities you may wish to use with your students:

1. Ask students to complete a 10-year timeline to explore their career and financial goals. It is never too early for students to begin to think about their future and come up with ways to explore career interests. We encourage our students to look for volunteer work and internships to gain valuable experience and to look for mentors to help them explore fields of interest.

This project was funded by the Mitsubishi Electric America Foundation.
2. Invite students to complete a budget that outlines the cost of living for their ideal lifestyle. We have heard from students how valuable these exercises are, especially since finances are seldom discussed in their families. If your students are like ours, they will be very surprised to learn just how much it costs to cover the basic expenses.

3. Once students begin to understand what it takes to support an independent lifestyle, you can invite them to do research on career they are interested in. As part of this lesson, encourage students to research the pay range along with the benefits (like medical coverage, vacation time, sabbaticals, and flexible work schedules) that are associated with various jobs. As part of this activity, we highlight the benefits of scientific and technical careers.

4. Check out the Girls Inc. Economic Literacy program, which teaches basic financial concepts, including money management and investment. With this lesson girls (and boys) can learn to make smart decisions about saving, sharing, and making money.  http://www.girlsinc.org/ic/page.php?id=1.2.8

5. Independent Means offers resources to help promote financially stable, savvy, and empowered children ages 5-18.  
http://www.independentmeans.com/imi/ffk/index.php?PHPSESSID=a891801f1a008430935d90e45b1672a

This project was funded by the Mitsubishi Electric America Foundation.
I Spy: An Observation Game

Lesson’s Purpose

Observation is an important skill in science. This activity encourages students to examine objects in greater detail. It also aims to improve students’ ability to accurately describe what they observe.

Materials

Collect five to ten objects that have similar characteristics. For example, a wooden match and a paper clip are both small. They fit in the palm of your hand. Another example – a 12-inch piece of yarn and a pipe cleaner are both long. A list of items we used for the activity can be found at the end of this lesson plan.

Time Required

Step 1: Preparation 1 hour
Step 2: I Spy! 20 minutes to 1 hour
Total 1 hour 20 minutes to 2 hours

Directions

This activity is a modification of the road-travel game “I Spy.” In the road-travel version, one player, the spy, gives clues about an object he or she observes. The other player(s) attempt to guess what he or she spies. For example, the spy looks out a car window and sees a cow for example. She reports, “I spy something with four legs.” Other players try to guess what object the “I Spy” clue describes. She continues to give clues until a player correctly guesses what she has spied.

In this version of “I Spy,” the instructor is the spy and the students try to guess what the instructor is observing. The instructor may only spy objects that have been pre-selected and distributed to students.

Step 1: Preparation

Select five to ten objects that have similar characteristics. Compare and contrast the objects you have selected. Develop three to five “I Spy” clues for each item. Write them down. Your clues should help students deduce what object you are spying. For example, if three of the objects you have selected are a penny, a paper clip, and a screw you could give the following clues: “I spy something small. I spy something metal. I spy something circular. I spy something that does not have a pointy end.” By the time you have given the fourth clue, your students should guess the penny.

This project was funded by the Mitsubishi Electric America Foundation.
If your students cannot correctly determine what objects you are spying, your objects may be too similar or your clues may be too vague. If this happens, choose different objects to spy or modify your set of clues.

After you have finalized your clues, collect one of each object for every student. For example, if you have 10 students and you are spying a penny, paper clip and a screw, you will need to have 10 pennies, 10 paper clips, and 10 screws available for your students to examine.

**Step 2: I Spy!**

Introduce the game to students by explaining you are a spy. The object of the game is for them to guess what object you are spying based on the clues you provide. Following verbal instructions in this game is very important. Ask your students to listen carefully.

Do not allow students to speak to one another as you hand out the objects. Silently, they should note each item’s size, shape, texture, smell, weight, and anything else they find unique about the object. Encourage them to look for detail in the objects.

After each student has had an opportunity to examine every object, begin giving clues for the first item you spy. Read the clues slowly. Briefly pause between clues so your students have time to think about which objects satisfy the clue. After you have given the last clue for an object, ask students to hold up the object they think you have spied.

If students get it right, applaud and celebrate. If they get it wrong, identify which clue did not fit the object they selected. You may want to call on students to describe the object that was just identified. If they have problems accurately describing it you may want to ask them leading questions such as “How big is the object?” or “How heavy is it?” The goal is to have the students provide concise, accurate descriptions of the objects.

You may want to keep a tally so the student with the most correct responses is the winner. Or, you may just play the game for fun. You know your class best. Select the reward system that will best motivate them.

Our Techbridge students really enjoyed this activity. After completing a full round of the game, they asked for the opportunity to be the spy and have other students guess what was being spied.

**An Example of Clues for I Spy!**

The following is an example of a full set of clues developed for an I Spy game we played at the California School for the Blind. You may use this example as a model for setting up your own game and creating your own clues.

Object 1: Pipe Cleaner
I spy something long.
I spy something that can be tied around something else.
I spy something that keeps its shape when it has been bent.
I spy something fuzzy.

Object 2: Marker
I spy something plastic.
I spy something that sometimes smells funny.
I spy something that can be held in your hand.
I spy something that is useful for writing notes.

Object 3: Paper Clip
I spy something metal.
I spy something that fits in the palm of your hand.
I spy something that is used to hold things together.
I spy something that is specially designed for use with paper.

Object 4: Match Stick
I spy something rounded at one end.
I spy something square in the middle.
I spy something made of wood.

Object 5: Yarn
I spy something long.
I spy something soft.
I spy something that can be tied around something else.
I spy something that does not keep its shape when it has been bent.

Object 6: Screw
I spy something small.
I spy something used to hold things together.
I spy something metal.
I spy something that requires you to use a tool to attach it to something.

Object 7: Plastic Tie
I spy something that is used to hold things together.
I spy something that is often found around computers.
I spy something long.
I spy something plastic.
I spy something square on one end.

Object 8: Penny
I spy something small.
I spy something metal.
I spy something round.
I spy something that has images etched on both sides.
I spy something that is good luck when thrown into a wishing well.

Photo 10: Students develop observational skills in “I Spy” game.
Thinking Like a Scientist - Why Ask Why?

This activity is intended to encourage curiosity, scientific inquiry, and conjecture. The activity is a modified lesson plan for Thinking Like a Scientist found at Access Excellence, a website for bioscience teachers and learners. http://www.accessexcellence.org/RC/AB/WYW/wkbooks/OBAS/thinkactivity1.html

Time Required: 1 hour

Materials

Choose a collection of objects that your students are familiar with, but perhaps have not given much thought to. For example, you could provide a pencil or pen, leaf, cotton ball, or strand of hair for students to examine.

Directions

Divide your students into groups of three to five. Give each member of every group an object to examine. Encourage students to study it closely. Each team is invited to come up with at least twenty questions about the object. Try to create enough space between the groups so they do not “borrow” questions from other teams.

To help your students fully understand the assignment give some examples of the types of questions you are looking for. For example, if you gave them a pencil they may ask, “Why does a pencil have six straight sides?” or “How do they put the graphite in the center?” Encourage them to be creative with their questions and remind them that there are no “wrong” questions.

After each group has had an opportunity to come up with its set of questions bring them together. Have the groups report back to one another. Ask the groups to choose two questions out of all that they heard that they find the most interesting. Next, invite the class to break up into their smaller groups and brainstorm questions that could help them answer the two interesting questions. For example, if the class decided that “Why does a pencil have six straight sides?” was an interesting question then one of the smaller groups might brainstorm the question, “If there were only five straight sides, would the pencil break more easily?”

To encourage discussion, you may want to ask students one or more of the following questions:
1) When you compared your list of questions with others in the group, did all the lists have the same types of questions? What could account for the similarities and differences between the lists?
2) Why do you think you were asked to create two sets of questions? What is the purpose of the second set of questions?

3) Think about one question from your list that you would like to answer. What steps could you take to answer that question? Do you think there is more than one right way of finding the answer? Why or why not?

The activity demonstrated how curiosity is an important trait that scientists and engineers possess. It also allowed us to create a cooperative learning environment where students feel comfortable asking questions.

**Lesson Extension**

Is there a question that your students came up with that could be answered with a simple experiment? During your next session show them how curiosity can often be satisfied with simple steps they are capable of completing.
Squid Science—An Introduction to Biology Careers

Lesson’s Purpose

This activity provides students the opportunity to think and act like scientists. In the first part of the lesson, they are asked to rely on their own knowledge to experiment, create a model, and report back their findings. In the second half of the lesson, students learn how to identify different parts of the squid and their functions.

Time Required

<table>
<thead>
<tr>
<th>Step</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Preparation</td>
<td>4 hours</td>
</tr>
<tr>
<td>Step 2: Profile a Role Model</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Step 3: Career Options</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Step 4: Getting Started</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Step 5: Role Playing</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Step 6: Modeling</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Step 7: Open-ended Dissection</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Step 6: Directed Dissection</td>
<td>1 hour</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7 hours</strong></td>
</tr>
</tbody>
</table>

Materials

Each student will need 2 squid, craft scissors, tweezers, paper plate, and a sheet of wax paper. You will also need a stack of newspaper and a tub of clay.

Directions

Step 1: Preparation

Begin by doing your own squid research and dissection. Squid is the second most abundant animal in the sea after fish. A Google search will give you a sufficient amount of interesting information to prepare for this lesson. To get you started you can review this lesson’s appendix for information on squid. Armed with some basic facts, direct yourself in a dissection by reviewing Step 8, the Directed Dissection section of this lesson.

You will need to prepare materials for each student. Each student should be given two squid, craft scissors, tweezers, a paper plate, some newspaper, a large lump of clay, and a sheet of wax paper.

Step 2: Profile a Role Model
Marsha Ogilvie is an anthropologist at the University of New Mexico. She uses her hands to do bone recognition. Marsha is an excellent example of how a person who is blind can do a field of science that is assumed to be visually based. Just like Marsha Ogilvie, students will rely on their hands to differentiate the various parts of the squid as they go through their dissections.

You may want to read this Smithsonian Magazine article about Ms. Ogilvie to your students and follow up with a discussion about her achievements and the ways she made adaptations for her visual impairment. http://www.smithsonianmag.com/smithsonian/issues01/may01/bones.html. You can find additional information about Ms. Ogilvie at the National Foundation for the Blind’s website (http://www.nfb.org/bm/bm01/bm0111/bm011112.htm) and the Alliance for Equality of Blind Canadians’ website: http://www.blindcanadians.ca/publications/index.php?id=109.

Step 3: Career Options

Help students understand career options in the biological sciences by doing a short question and answer session before beginning the dissection. We offer some questions and answers to share with your students.

1. What do biologists do?
   Biologists study how living systems work. This includes plants and animals.

2. What types of biology are available for study?
   Cellular biology focuses on living organisms at the cellular level as the name suggests. Marine biologists study sea life. Other fields of biology include biochemistry, physical therapy, zoology, and nutrition.

3. How would you prepare for a career in biology?
   Going to college and choosing an appropriate major is a good choice. Internships also provide valuable training for a career in biology. Case Study—Career Exploration through an Internship describes the experience of a student from the California School for the Blind.

4. What careers could one pursue with an understanding of biology?
   There are many job opportunities for biologists. It is expected that biotechnology will spur the next economic boom. There is promise that many medical ailments will be treated or cured with cutting-edge technologies. Students interested in biology may also wish to consider careers in teaching, physical therapy, and genetic counseling. You can find examples of role models in Health Care Professionals Who are Blind or Visually Impaired. It is part of the Jobs that Matter series published by AFB Press. Nearly every role model profiled in the book uses his or her knowledge of biology on the job. Our students particularly enjoyed discussing the work of Kristall Platt, a genetics counselor.

This project was funded by the Mitsubishi Electric America Foundation.
Step 4: Getting Started

Pair students into groups of two. You may want to pair up students with similar personalities, skill levels, or visual ability. Regardless of your criteria, you will want to be sure that one student does not dominate the other. Techbridge lessons require cooperative teamwork where students learn through participation, not observation.

Next, give each student a set of materials and ask the groups to set them up. They should lay the newspapers over their workspace to protect the furniture during the dissection. The sheet of wax paper should be put on top of the newspaper on the left or right side of their workspace. It will be used for organizing and laying out dissected parts. Ask students to place their plates in the center of their workspace. The plate is where all cutting should take place. Squid are really wet and the plate will collect excess water. Let students choose where to put their clay, but remind them that it needs to stay clean and dry. Finally, ask students to put the squid on their plates.

Step 5: Role Playing

Set up the role-play portion of this activity by reading the following statement, “You are a biological scientist working in a research lab. Your lab supervisor has brought you a creature collected from the sea. She has asked you to work with your partner to: 1) examine the creature, 2) record your findings, and 3) report your findings. When your team reports back you should describe how the creature swims, breathes, eats, hears, sleeps, sees, reproduces, and disposes of waste. You should also have a working model of the specimen. You have been provided clay for this purpose.”

In this scenario, you will play the role of the lab supervisor. As lab supervisor, you will observe the student groups. They are likely to ask for assistance, reassurance, or for the answers to the questions you have asked them to consider. In Techbridge, a student’s question is rarely immediately met with a direct “how-to” answer. For example, many students asked, “How do I cut the squid open?” In the classic Techbridge approach, students were reminded that they had been provided scissors and tweezers. It was up to them to determine how to use their tools. With this expectation, most students took the time to take greater inventory of the squid’s exterior and eventually decided to cut down the center of the mantle to expose the animal’s inner organs. However, there was one student that decided to simply behead the animal and examine the two halves separately. Give students at least a half hour to complete their dissection. At the end of their dissections, ask students to clean up their work spaces and wash their hands.

Step 6: Making a Model

Like the dissection, there is no right or wrong way of approaching the task of building a model from clay. Remind your students that their model is meant to be a tool for reporting back to the lab supervisor. It should be as accurate as possible based on their observation and knowledge.

This project was funded by the Mitsubishi Electric America Foundation.
Step 7: Open-ended Dissection

When each team has a working model ask them to report back. Some questions you may want to ask are, “What did your team find? What challenges did you face? Describe how you worked as a team. Can you describe how you think the creature swims, breathes, eats, hears, sleeps, sees, reproduces, or disposes of waste?” If students offer, “I don’t know.” as an answer you may want to reinforce the fact that conjecture is a valid aspect of scientific inquiry. Conjecture can be described to middle school and high school students as “guessing” based on their knowledge and experience.

Step 8: Directed Dissection

By now students should feel comfortable with handling their squid. Ask them to place a new, uncut squid on their paper plates. You will guide them in a directed dissection. The directed dissection has two goals: 1) demonstrate a methodical approach to scientific inquiry and 2) allow students to identify and label a squid’s anatomy. We suggest that you review the anatomy diagram and descriptions in advance.

Ask your students to begin by orienting the squid on the paper plate so its fins point towards the student’s stomach (assuming the student is sitting at a table) and its arms and tentacles face away from them. The squid’s trunk should face up—this is the dorsal view. Students will begin by examining the squid’s exterior from a dorsal view. From this position, identify the squid’s arms and tentacles, eyes, mantle, fins, and trunk. Each student should be able to find each part on their squid. If they have trouble finding a part show them where it is. Unlike the first half of this lesson, give students straightforward answers. For example, you may want to separate the squid’s gill from the inside of its mantle. It is a very thin membrane. Place it between the student’s thumb and forefinger. As you review each section of the squid’s anatomy describe the part’s purpose. See the squid anatomy definitions.

Next, ask students to lift their respective squid’s head and examine the mouth. They should feel for the radula, a beak-like tooth found in the center of the mouth, and pull it out with their tweezers or finger. Lots of other tissue will come out with the radula. This is expected.

Invite your students to examine the squid from the ventral view by turning the squid over. The fins should still face the student’s stomach and the arms and tentacles remain facing away from them. The siphon faces up. Begin by asking the students to cut through the mantle starting near the back of the head all the way through to the end of the tail. When they pull the mantle back the squid’s inner organs will be exposed. Have them identify the ink sac, esophagus, liver, stomach, reproductive organs, and gills. Each part should be isolated, pulled out of the animal, and put aside. Again, describe each part’s purpose.

Next, you will want to find the hard point at the end of the squid’s fin. Ask students to use their scissors or fingers to cut through the mantle. They can use tweezers to pull the...
pen out of the trunk. The pen is a favorite souvenir they can wash off and take home to show family and friends.

Finally, ask students to locate the squid’s eyes. Have them cut through the center of each eye. They will find a hard, marble-like object. This is the squid’s lens. Discuss how squid use their lens to see.

**Lessons Learned**

Most of our students were extremely concerned about the squid’s gooey texture. They verbalized their fear by asking questions like, “Will it come to life when I am dissecting it?” To assuage students’ fears and set an appropriate tone for the activity, we took time to discuss the value of dissection in the sciences and how it often leads to advances in medicine. Once students got past the “gross factor,” they valued the learning experience.

This lesson’s greatest challenge, and measure of success, is in how students approach the first half of the lesson which is extremely open-ended. It requires students to step up and immediately choose an implementation strategy. This activity was done near the end of the school year and our Techbridge students excelled. Within minutes they overcame their fear of touching the squid bare handed. Each of them examined the squid methodically and maximized use of their scissors and tweezers in dissecting the animal. If you do this activity early in a school year you may find that some students will sit and wait for how-to instructions. Other students may ask you a series of questions to help reassure them that they are doing the activity correctly. They will need to think for themselves and work independently to get the most out of the lesson.

**Comments on Modifications**

We adapted this lesson plan from curriculum developed at the Chabot Space and Science Center’s biology lab. This lesson plan expects students to do the dissection first without assistance and then to create a model that helped facilitate learning and discussion.

**Appendix 1 - Interesting Squid Facts**

1) Squid are distant relatives of the snail. They both belong to the phylum Mollusca. Slugs and oysters belong to the same phylum. Mollusca are unique because they have no bones.

2) Squid can be 5 cm to 6 m. Giant squid with tentacles up to 12 m long are rarely seen because they live in deep dark ocean waters.

3) Squid can swim up to 24 mph.

4) Squid are predators. They eat fish, shrimp, and other swimming creatures that are smaller than them.

5) Squid cannot smell because they have no noses.

6) Squid sometimes use color cells in their skin called chromatophores to hide, but most of the time their color reflects their mood.

This project was funded by the Mitsubishi Electric America Foundation.
Appendix 2 - Squid Anatomy

Arms – Squid have eight arms that are used for tearing apart prey. These arms are shorter than its two tentacles.

Tentacles – The animal’s two tentacles are longer than its arms and have suckers only on their ends. The tentacles are used to catch prey and pull them in.

Eyes – Squid eyes are similar to those of fish. They control the amount of light coming into the eye by opening or closing the pupil. They focus on an object by moving the lens back and forth inside the eye.

Mantle – The mantle is a large muscle that protects the squid’s inner body and plays a vital role in its ability to swim. Water is sucked into the mantle. The mantle closes shut and pushes the water out of the funnel. The squid is propelled forward as water is pressed through the funnel.

Fins – As a squid propels itself forward it needs a way to direct itself to the left or right. It uses its fins like a rudder on a boat or wings on an airplane.

Trunk – The pen is embedded inside the mantle. It gives the squid’s body some form. Students will often want to refer to the trunk as the squid’s back. The trunk describes a similar function; it gives the squid some form.

Radula – Squid chew apart their food with beak-like teeth called radula. Squid found in a grocery store generally have two large radula that are easy to find by touch.

Ink sac – Squid squeeze ink out of their sacs to confuse predators so they have a greater chance of escape.

Esophagus – Like humans, a squid’s esophagus helps transport food from its mouth to its stomach.

Liver – Like humans, a squid’s liver helps chemically break down food that has been ingested.

Stomach – The stomach is a large muscle that contains juices from the liver and other organs where food is broken down before it is passed into the squid’s cecum. The cecum is equivalent to a human’s large and small intestines.

Reproductive organs – Male squid have a single testis and Needham’s sac. Sperm is produced in the testis and stored in the sac. These organs are white in color. Female squid
have two nidamental glands that appear yellowish-orange. The glands produce a hard, bad tasting cover over the fertilized eggs the squid lays in sandy, shallow waters.

Gills – Clear in appearance, the gills are attached to the mantle and bring oxygen from the water to the squid’s ctenidia. Ctenidia serve a similar function to a human’s lungs. It helps pass oxygenated blood into the creature’s body.
Squid Anatomy Diagram A

Figure 12: Squid Anatomy - Side View
Squid Anatomy Diagram B

Figure 13: Squid Anatomy

This project was funded by the Mitsubishi Electric America Foundation.
Career Interest Survey

Lesson’s Purpose

We found this survey to be a useful tool that identifies students’ interests and helps with planning activities and recruiting role models. Students also appreciate the exercise. One student shared, “The career interest survey helped me out a lot...I took time to think about some of the careers that were out there and what I was really interested in.” The activity can also serve as a starting point for a discussion with students about what they can begin to do right here, right now to identify and work toward their goals. Based on these discussions, there may be misconceptions you can address or issues related to confidence that students can work on.

Name: ____________________________  Date: ________________

These questions are to help you think about your future and career options.

1. Make a list of classes, interests, and hobbies you would like to explore.

2. What skills do you want to learn or improve on?
   If needed, you can offer examples: learn a language, learn how to program, improve on time management or money management, or work on mobility skills.

3. When you graduate from school, what do you intend to do?
   If needed, you can offer examples: go to college, get a job, or enter transitional program.

4. What career do you want to have and why?

5. What kind of work environment and work schedule do you want?
   If needed, you can offer examples: office, shop, outdoors; team or individual oriented; self-employed or employed by a large or small company; 9 to 5 or flexible schedule, full-time or part-time.

6. How do you plan to achieve your desired career?

This project was funded by the Mitsubishi Electric America Foundation.
Day Dreaming – A Career Exploration Activity

Lesson’s Purpose

Students who are blind and visually impaired are sometimes encouraged by family, friends, and teachers to pursue work that is perceived “good for someone with a visual impairment.” These careers are often in a narrow range of fields, and seldom involve science, technology, or engineering. Rather than allow others to determine their futures, in this lesson we encourage students to maximize their life choices—to think big. Students are introduced to careers they may assume are not accessible to persons who are visually impaired, and they are provided a forum to voice their thoughts about the future.

Time Required

Step 1: Clay Modeling 1 hour, 20 minutes
Step 2: Follow-up 20 minutes
Total 1 hour, 40 minutes

Materials

- Paper
- Pen
- Clay (We suggest Crayola’s Model Magic Dough. It dries into a hard, foamy texture within two hours.)

Directions

Step 1: Representing Dreams in Clay

Give each student a large lump of clay. Ask students to use the clay to create an object that represents something they want to do or achieve in life. Students are encouraged to start with what seems practical and move towards what may seem impractical or impossible. Tell students the goal of this activity is “To open your mind to all of the possibilities your future holds.” Facilitate idea generation by suggesting careers that may seem out of reach for a person with a visual impairment. You can facilitate discussion by asking students to brainstorm answers to these questions:

1. What kinds of careers are “good” for people with visual impairments? What makes these “good” career choices?
2. What are some “bad” careers if you have a visual impairment? Why are they “bad”?
3. What careers are you currently considering for yourself?
4. Others may have given you suggestions on possible careers you could pursue. What careers have they suggested and who suggested them? Are you interested in these careers? Explain.
5. If you had typical vision, what careers would you be interested in exploring or pursuing? Why?

Take notes on students’ responses and insights. These can be used to customize future lesson plans. For example, you could write, “Juanita said she is interested in being a forensic scientist.” Based on this information you may decide to plan a lesson on scientific observation. As part of the lesson, you would explain to the students how all scientists, including those who study forensics, work hard to develop strong observational skills.

As your students complete their models, ask them to pass their clay objects around for other students to examine. They should describe their model as it makes its way around the classroom. As an instructor you can provide basic knowledge about different career fields. Also, create a list of questions the students have about specific career paths or concerns about their futures. You can do additional research and introduce possible career paths in future lessons. We have found that this activity generates thoughtful discussions about concerns and feelings about the future. For example, concerns about not being able to drive were on the minds of some of our students. Being able to express their feelings was an important first step to problem-solving how to address transportation for different careers.

Encourage students to save their creations from this lesson. Crayola Model Magic Dough hardens after 2 hours so that students can take their art home as reminders of what is possible.

**Step 2: Follow-up**

At the end of the lesson ask students again, “What makes a good career for people who are visually impaired?” Help them reframe their answers by talking about the real possibilities they have in pursuing the careers they have expressed interest in. Use your notes on the day’s discussion to address the group’s interests and concerns.

Be explicit and reinforce the idea that preconceived notions of what is possible or impossible should not limit their futures. Your classroom is a place to dream big and work hard.

Lessons like *Day Dreaming* can help younger students expand their options and begin to plan for their future. The lesson helps older students overcome the self-imposed limits on the types of career options they are considering.

This project was funded by the Mitsubishi Electric America Foundation.
Photo 11: Day Dreaming: A Career as a Horse Trainer.
Learning How to Network

Being a professional—regardless of the industry—is serious business. Unlike previous generations of American workers, today’s employees have more tentative relationships with their employers. Rather than rising up through a company’s chain of command, many professionals move from one job to another in hopes of gaining a competitive edge in the workforce. It takes a significant amount of personality, courage, and dedication to successfully negotiate the challenges of today’s business world. Individuals who want to achieve professional success must view themselves as leaders and make those around them aware of their professional accomplishments and aspirations. Networking is a key element of being a successful professional. This activity introduces students to the purpose of networking and teaches strategies for being successful in the process.

Time required:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>½ hour</td>
</tr>
<tr>
<td>Networking role play &amp; debrief</td>
<td>1 hour</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1 ½ hours</td>
</tr>
</tbody>
</table>

Materials

- Personalized business cards for each student
- Snacks and beverages
- Photos and short biographies of famous persons who are blind or visually impaired along with objects associated with the career of each role model

Preparation

Create business cards for each of your students. If you have a mailing list for your students, you can use the mail merge function in Microsoft Word to make personalized business cards for your students. We suggest printing your school’s or program’s logo, the student’s name, and a place for the students to write their phone number or e-mail address. You may wish to Braille these cards or use large print.

Shakira Rocks

Phone or e-mail address

This project was funded by the Mitsubishi Electric America Foundation.
Although snacks and beverages are not required for this exercise, they are helpful in simulating the networking environment. Networking events almost always provide attendees with some kind of food. Eating and networking will create challenges for the students. For example, students may find it difficult to hold plates while shaking hands or feel comfortable chewing while a stranger watches them eat standing up. Managing these challenges adds an interesting amount of realism to the activity.

The Internet is a resource where you can download biographies and photos of famous persons who are blind or visually impaired. We created stations where these documents were available to study. We also provided items for students to examine that related to the role models. For instance, we highlighted Erik Weihenmayer, a former middle school teacher turned professional mountain climber and the first blind person to reach the summit of Mt. Everest, at one of our stations. Along with biographical information about Erik that we found on the American Foundation for the Blind’s CareerConnect website, we also included climbing gear like specialized ropes, a climbing ax, and climbing boots. For Stevie Wonder, we included some of his most popular music on a laptop computer for students to listen to. Use your imagination to make the gallery interesting and inviting.

Directions

Step 1: What is Networking?

To begin this activity, ask students to write or Braille their phone number or e-mail address on their business cards.

Tell your students that they are going to learn about networking. They are going to learn about it by doing. Ask them if they know what networking is. If they do not know, ask them to guess what it might be. After they have offered some guesses, describe to them what networking is. For example, “Networking is the process of getting to know other people in your field. Professional organizations often hold networking events so you can meet other people. Often your goal at such a function is to figure out ways to advance your career or make your business more money.”

Step 2: Learning How to Network

Scenario: Read students the following statement.

_The <<THE NAME OF AN IMAGINARY PROFESSIONAL ASSOCIATION>> is holding a networking breakfast at a local art gallery. The gallery is displaying works of famous people who are visually impaired who have achieved great success. This month’s event is special. Students from <<THE NAME OF YOUR SCHOOL OR PROGRAM>> have been invited. Chapter President <<INSTRUCTOR'S NAME>> hopes the event will allow <<SCHOOL OR PROGRAM’S>> students to connect with one another so they may support one another. Gallery owner <<OTHER INSTRUCTOR OR THE NAME OF A DESIGNATED STUDENT>> (a supporting_
Tell your students that they have the following tools and resources: “Your voice, ideas, experience, confidence, and business cards.”

**The Challenge:** Students are expected to exchange business cards with at least one person they do not know well. They can legitimately exchange cards if they can identify a common interest or project they would like to work on together in the future. They may also exchange cards if they feel like they have made a genuine connection with someone and would enjoy connecting with them in the near future.

**Rules of the Game:** This is a role-playing game. The students’ role is to be themselves, but they must conduct themselves professionally and with confidence. Students may not exchange cards with good friends. The goal is not to collect as many cards as possible. The goal is for students to get to know someone and determine if there is a way they can support one another. Ideally, students will want to find other persons who can help them achieve their school and/or career goals.

**Suggestions for students:**

- Be yourself.
- If you do not know what to say, ask the other person a question.
- If the conversation is boring, bring up something you recently heard about on the radio or television.
- Don’t be shy. No one can get to know you if you are not willing to speak up.
- Use your friends. Does your friend know someone you don’t? Ask them to introduce you.
- If you feel nervous or uncomfortable, it’s okay! We all feel that way at times.

**Step 3: Debrief**

The debrief is meant as a way of reinforcing public speaking concepts. It is also a way of creating dialogue about the importance of leadership, the need to practice public speaking skills, and strategies for overcoming difficult or awkward situations.

For persons who are visually impaired, networking may be even more of a challenge since they won’t be able to scan the scene and know who’s in the room or what the layout is for furniture, food, or other objects in the room.

To help start the discussion you can ask your students:

- How did you feel?
- What did you learn?
- How might you network in your real life?
- How did you introduce yourself?

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• How did you end your conversations?
• Did you make a genuine connection?
• Who will you be calling after the school year (or program) is over? Why?

We recommend that you write down the responses your students give. It is a good reminder of what they should be taking away from the activity.

**Step 4: A Review of Networking Basics**

• Demonstrate confidence.
• Come prepared. Bring business cards and be ready to talk.
• Give firm handshakes at the start and end of a conversation.
• Always orient towards your partner.
• Do not approach only people who are like you. Approach people with different backgrounds, personalities, and experiences.
• Always have fun. If you are not enjoying the function it will be obvious to others and they will not be interested in what you have to offer.
Cookie Capital

Lesson’s Purpose

Science and technology are not only important areas of research, they are fields for big business. In this lesson, students are introduced to career possibilities in business, particularly those related to business management and marketing.

Time Required

<table>
<thead>
<tr>
<th>Step</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Market research, build prototypes, develop business plan</td>
<td>1½ hour</td>
</tr>
<tr>
<td>Step 2: Refine prototypes, reporting back to group</td>
<td>1½ hour</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3 hours</strong></td>
</tr>
</tbody>
</table>

Materials - Cookie Making

*Per student:*
- Three cookies
- Butter knife or frosting utensil

*Per group:*
- Frosting
- Candy sprinkles
- Paper
- Pens

Materials - Packaging

- Wax paper
- Boxes
- Ribbons
- Bows
- Construction paper
- Markers
- Tape
- Paper
- Pens

You may wish to customize the handouts for this activity. Modify them appropriately after reading the lesson plan.

Directions

Divide students into groups of 4 or 5. Designate an instructor or student to serve as “project manager” for each group. Each project manager is responsible for ensuring his or her group completes all of the tasks, encouraging every member of the group to participate, and reporting back to the class. The project manager should take notes for the group.

Step 1: Set-Up

Read the following statement to your students. “You are a member of the executive team of a proposed cookie company. In the next 45 minutes, your team must choose a company name, design a line of cookies or cookie product to be sold, and develop a
marketing campaign to sell your product. How you accomplish these tasks is up to your team. What is important is that you develop the best product possible in the time given.”

**Step 2: Market Research**

To be successful, a company needs a competitive advantage. Companies sometimes discover their competitive advantage before getting their product out to market by conducting market research. Give each group’s project manager the *Cookie Capital Competitors* handout. Ask them to think about the following questions that relate to each competitor’s product line and target consumers. The handout provides the answers to some of the questions. Encourage your students to think carefully about what is outlined in the handout as they create their business plan.

1. If you go into the cookie business, who are your competitors?
2. What products do your competitors provide?
3. Do you intend to provide the same type of product or ones that are very similar?
4. Who is the target consumer of your competitors?
5. What do you know about the target consumer? (i.e., age, gender, income, reason for wanting to buy the product, etc.)
6. Why would a consumer buy your product over your competitors?
7. How much is the target consumer willing to spend on your product(s)?

**Step 3: Write Up a Business Plan**

After your students finish their market research, they will need time to put together a business plan. A business plan is a document that outlines the steps a company will take to successfully launch and grow its business. Your students will write up their own business plan by completing the *Cookie Capital Planning Sheet*. Your project managers are responsible for the documentation. The handout ensures each group answers all of the questions you set forth in setting up the activity.

**Step 4: Prototype Cookie Designs**

While they are designing their business plan ask the students to prototype cookie designs. The group does not have to agree on a particular design. Every student can come up with his or her own unique cookie design and pricing schedule and define the target audience.

Distribute three cookies to each student, and frosting, sprinkles, utensils and packaging items to each group. It is helpful to place all of the communal supplies in an area that is accessible to all members of the group.

Invite your students to prototype cookie designs. Encourage them to be creative in decorating their cookies with the supplies they have been given. They should keep in mind what they think a customer would like to eat, not just what they like. In coming up with cookie designs students may work individually or in groups. When everyone is done prototyping the group does not have to agree on a particular design. Instead, all the

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students must be able to explain their design, price their product, and define why their target audience would want to buy the cookie(s) they have designed.

**Step 5: Sales Presentation**

When time is called, ask each team to present its work. Each student in the group should take a turn during the report back. The reports should include their company name and slogan as well as an explanation of why they chose them. Students will also need to describe their line of cookies or cookie product and explain what makes their product line unique. Lastly, ask them to pitch their product or line. They must describe how they will market their product to their target audiences.

**Lessons Learned**

The comment students made as they left Techbridge after this lesson was, “I really had fun today.” We believe the lesson provided students a good balance of fun and knowledge. The lesson’s greatest value was in teaching students terminology like market research and target consumers. Few of them knew what the terms meant before beginning the lesson, but after hearing the series of questions related to the topics, they quickly realized that they already knew the concept even though they did not know the jargon.

At the end of Techbridge sessions students are asked what they had learned or what was the greatest challenge they had overcome during the activity. In Cookie Capital most students gave one of two answers, some gave both: “I learned what market research and pricing are.” or “I learned how to squeeze the frosting out of the tubes.” Although we are pleased to teach practical hands-on skills—a key tenet of Techbridge—we never want the larger concept to be lost. For this lesson and future ones, the quick round-robin of “What I learned today” was followed by a short summary of the lesson’s objectives.

Students should walk away from this lesson with an understanding that marketing, planning, prototyping, and pitching are not unique processes to starting a cookie company. They are steps all companies take to sell their product or service. At the end of your Cookie Capital lesson invite your students to ask themselves questions next time they go to the mall or purchase an item over the Internet. For example, “Who produces the product? Who are their competitors? Who is the target customer for the product? Why did the company price the product so?”
## COOKIE CAPITAL COMPETITORS’ HANDOUT

<table>
<thead>
<tr>
<th>Competitor</th>
<th>Product Line</th>
<th>Target Consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mrs. Fields Cookies</td>
<td>• Mall stores for small purchases&lt;br&gt;• Gift packages for “seasons, celebrations, sentiments, &amp; business”&lt;br&gt;• Individual cookies - $1.25 to $3.00 each; Gift packages from $25.00 to over $80.00 each</td>
<td>Mall and Internet shoppers</td>
</tr>
<tr>
<td>Pacific Cookie Company</td>
<td>• Gift packages&lt;br&gt;• Executive packages&lt;br&gt;• Wholesales to cafes and restaurants</td>
<td>Internet shoppers, executive accounts, distributors, &amp; wholesalers; “We service restaurants, hotels, convention sites, caterers, hospitals, schools, delis, coffee shops, grocery stores, golf courses, and airlines.”</td>
</tr>
<tr>
<td>Lucky Touch Fortune Cookie Company</td>
<td>• Fortune cookies with Braille or large print fortunes; also chocolate dipped&lt;br&gt;• Fortune cookie gift packages&lt;br&gt;• Affordable pricing</td>
<td>Clients that are visually impaired</td>
</tr>
<tr>
<td>Other cookie companies?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company name and motto (optional):</td>
<td></td>
</tr>
<tr>
<td>Notes on competitors:</td>
<td></td>
</tr>
<tr>
<td>Target consumers:</td>
<td></td>
</tr>
<tr>
<td>Target price range with justification:</td>
<td></td>
</tr>
</tbody>
</table>

This project was funded by the Mitsubishi Electric America Foundation.
COOKIE CAPITAL PLANNING BRAINSTORM QUESTIONS

Question 1: What is your company name and motto?

Things to think about:
- What idea(s) do you want your company name to reflect?
- Is the name easy to remember?

Question 2: What do you know about your competitors?

Things to think about:
- How successful have your competitors been?
- What challenges do you think they face?
- How could you learn more about your competitors? Where would you look? Who would you ask?
- What is going to give your company a competitive edge?

Question 3: Who are your target consumers?

Things to think about:
- Describe them demographically.
- Why and/or how did you choose the target consumers? How will you distribute your product?
- Will your distribution plans impact how you choose your target consumer?

Question 4: What is your target price for each product you will be selling?

Things to think about:
- What do your competitors charge for similar products?
- What price are your target consumers willing to pay?
- Will the price you select cover your manufacturing and labor costs?
Career Explorations: Role Models Expand Options

When we started hosting Techbridge, we learned an important lesson—that even with positive experiences in the program, most students did not aspire to careers in science or technology. Students enjoyed the program’s hands-on activities and acquired skills and confidence required for scientific and technical careers, yet these experiences were not always sufficient to motivate students toward a science or technical career. Role models are the best ambassadors for expanding students’ career options and providing academic guidance.

Role Models

Role models are particularly important for students who do not have family members in a scientific or technical career to share their work and to encourage students to follow in their footsteps. For these students, role models help combat stereotyped images and also communicate information about the work and the steps needed to prepare for a career in technology or science.

With each role model and field trip our staff learned lessons about introducing role models to students. From follow-up conversations with role models, feedback from students and teachers, and survey and interview data, we have identified the following seven key ingredients for success.

• Be Personal and Passionate About Your Career
• Introduce Fun and Interactive Activities
• Do Some Public Relations About Why Technology and Science Matter
• Share Your Struggles and How You Gained Confidence
• Fill a Gap with Academic and Career Guidance
• Facilitate Work Site Visits
• Find Training and Support

For more information about bringing in role models, please visit the Techbridge website at http://www.techbridgegirls.org.

Audio and Video Presentations

We can’t bring in a role model every week to Techbridge, but we can present students with career information through other avenues. Our Techbridge team designs PowerPoint presentations of role models related to the hands-on projects that students work on. For example, for a lesson on aerodynamics and kite design, we present a PowerPoint on career opportunities in the aerospace industry. These presentations engage students and provide valuable information on educational requirements, statistics on pay rates and

This project was funded by the Mitsubishi Electric America Foundation.
industry growth, and personal stories about the journey from the classroom to the worksite.

Cisco Systems has a video, “I am an Engineer” in which young hip women employed by Cisco address a series of questions about their careers. The video is set to music and encourages students to consider careers in engineering. We played the video for our students at the California School for the Blind. They enjoyed the music and the stories of the different women in their own words. It was a good lead-in that introduced students to computer-related careers and stimulated a discussion of how visually-impaired people – both men and women – face some of the same obstacles or worries as other under-represented groups. The video made the students feel excited and interested in engineering. The follow-up conversation provided students with the information they needed such as education, experience, pay rates, etc.

**Reading about Role Models**

It is often difficult to identify visually-impaired role models locally that perfectly fit a given lesson. However, you can find stories about role models that you can read as ice breaker activities. We found appropriate role models profiled in the American Foundation for the Blind’s *Jobs That Matter* series and also located biographies on the Internet or in magazines. At the start of a Techbridge session we often read abridged stories of a selected role model. These stories helped launch a discussion on the role model’s career path. For example, before a solar LEGO lesson we read a short article from *Mental Floss Magazine* on Ralph Teetor, a mechanical engineer who was visually impaired. His invention of cruise control in cars engaged the interests of our students and generated a discussion of what it takes to become a scientist or engineer.

*Photo 12: Role model introduces students to solar technology.*

This project was funded by the Mitsubishi Electric America Foundation.
Field Trips—Expanding Students’ Options

When we ask students what they enjoy most about the Techbridge program we often hear about a field trip. Field trips to work sites give an up-close look at technical jobs. Tours of a college campus help students visualize the next step along their academic path and provide practical tips for preparing for college. Museum tours spark an interest in science and technology with their hands-on activities. For students who are blind or visually impaired, field trips can be especially valuable in expanding options and providing them greater access to opportunities in science and technology.

Over the past three years, we have sponsored a wide range of field trips and would like to highlight some of our successes.

Making it Relevant and Hands-on: A Visit to Hiller Aviation Museum

A trip to the Hiller Aviation Museum in San Carlos, California complemented a lesson on aerodynamics. Our students not only got the chance to hear about the museum’s collection of aviation history, they also got an up-close study of some of the aircrafts, exploring their parts to better understand the advances made in airplanes and helicopters. The experience allowed the students to apply what they had learned in a kite-building lesson on the physics of flight.

Museums often are designed for persons with sight and rely heavily on vision to process their exhibits and activities. However, a phone call in advance can help set the stage for a visit that will be meaningful to students with visual impairments. For science and technology centers, we recommend that you first visit and familiarize yourself with what they have to offer to decide how best to plan an experience that will benefit your students. For instance, we scheduled our visit to the Hiller Aviation Museum after hours when staff could devote its time and attention to our students. It was also quiet and easy for our students to take in the information presented and go at a pace that was comfortable for them. Knowing the needs and interests of our students in advance, the staff allowed them to go behind the ropes, and feel elements of the exhibits that most visitors can only look at.

A Guided Tour with a Unique Perspective: Año Nuevo State Reserve

What made this field trip so special was that the tour was led by Kim Pomatto, a former student at the California School for the Blind. Año Nuevo State Reserve is the site of one of the largest mainland-breeding colonies in the world for the northern elephant seal, and its interpretive program attracts many visitors each year. On the tour, our students listened to Kim describe the migratory patterns of northern elephant seals at Año Nuevo. Along the trails, Kim stopped at various points of interest and brought out her collection of shells, fur, and fossils for the group to study. She encouraged them to take a close look.
at each item while she described its importance. Kim invited our students to stop, listen, and make their own observations.

On this field trip, the students learned about the northern elephant seals at Año Nuevo and the history of this reserve. But they learned another lesson of great value—by Kim’s example our students learned that a future in science is possible. All it takes is passion and dedication and a supportive community.

A Personal Connection: Smith-Kettlewell Eye Research Institute

The visit to the Smith-Kettlewell Eye Research Institute in San Francisco was one of our students’ favorite field trips. Smith-Kettlewell conducts clinical research on the diagnosis and treatment of eye diseases, the development of devices to aid the visually impaired, and basic research on the eye and brain. While what the Institute does was of interest and importance to our students, who they met was even more so.

Our students were introduced to a team of engineers. Recognizing the abundance of personally and professionally rewarding careers in the field of engineering, we often introduce our Techbridge groups to engineers. What made this meeting unique was that all three engineers were blind. Tom Fowle, Bill Gerrey, and Josh Miele work at the Institute as scientists and engineers. While each has a different area of specialization, they all have a passion for what they do and each made a personal connection with our students.

The visit began with an introduction to some of the research projects conducted by the team to help with mobility and employment of persons with visual impairments. They included a gyro device to help wheelchairs navigate more safely on uneven terrain and a level that lets its user know when it is level with a beep. Our students especially liked the research project shared by Miele—tactile maps. Knowing the street addresses for each student’s home, he had maps of their neighborhoods all ready for them to study. Miele explained that in the past, maps like these would have to be embossed by hand by volunteers. What used to take an afternoon is now completed within minutes with the aid of Miele’s software.

Best of all were the personal stories shared by each scientist. Experiences in childhood, school, and career, and lessons they learned along the way were much appreciated by our students. The role models were honest about the challenges they faced, which made it easier for our students to ask questions and share their own ideas and feelings. For one student, knowing the details about how the engineers chose a career was important. For another student it was learning about the road blocks. “Did anyone ever tell you that you shouldn’t do that because you’re blind?” The answer to this question was part amusing and part serious. Miele recounted how his family had been told that physics wasn’t a realistic field for him because he couldn’t write on a blackboard. Fortunately, Miele didn’t let this advice keep him from pursuing his interest. Instead he learned ways to accommodate his visual impairment and do what he wanted to do. Miele explained, “Every job has something that a blind person can’t do. All of these things have some
solution.” By their examples, each of these scientists showed our students that science and engineering are rewarding fields and that there are ways to get around the challenges related to a visual impairment. In fact, most professionals do this to some extent, trading off assignments and taking on what they’re better at. It’s called teamwork.

**Challenging, but Not Too: Challenger Learning Mission**

After months of preparation, 16 students from the California School for the Blind embarked on a space mission. A mission simulation in Chabot Space & Science Center’s Challenger Learning Center, that is. The Center provides a unique hands-on learning experience on a simulated space mission, complete with mission control and spacecraft!

The Challenger Learning Center experience is normally a very visual one—creating a big challenge for students who are blind and visually impaired. But our students were well-prepared, having participated in crew training at their school for nearly 5 months. As a result, they were able to accomplish tasks including conducting scientific investigations, monitoring life support gauges, assembling a probe, and following task card directions.

In preparation for this voyage, a number of accommodations were made. Volunteers at the California School for the Blind translated the task cards for the mission into Braille and staff at Chabot equipped the computer screens with magnification programs. On the day of the mission, teachers from the school and Challenger volunteers were nearby to lend a hand when needed. For Flight Director, Tony Idarola, this mission was his most memorable, “I was involved in the development of technology to aid their mission. What a great group of people—not just the kids but their teachers and support staff too. It was a deeply rewarding time.”

Working together, the crew of students, along with their teachers and Challenger Learning Center staff, demonstrated the true spirit of teamwork. With determination and effort, no challenge was beyond their reach. These students showed that you don’t have to see the stars to reach for them.

This project was funded by the Mitsubishi Electric America Foundation.
Fantastic Field Trips

Field trips require considerable time to plan and host but are well worth the effort (or can be if they are well planned). Field trips to work sites give an up-close look at technical jobs that may seem abstract to students. Visits to a college campus help students visualize the next step along their academic path and provide practical tips for preparing for college. Here are tips to plan field trips that excite students:

1. Look for destinations that have a person who is blind or visually impaired. The lessons learned from these role models will be as valuable as what students learn about science and technology, or other subject matter.

2. Plan the details well in advance of the trip. Check back shortly before the visit with partners to confirm arrangements and find out if there are any last minute questions.

3. Help prepare your students in advance by inviting them to research the work site or museum they will be visiting. Encourage them to come up with questions that they can ask during the field trip. In fact, we encourage you to give the expectation that every student will ask at least one question.

4. If possible, exchange biographies of role models and students before the visit. This exercise helps the groups connect right from the start.

5. Find out if presenters have had experience working with students who are visually impaired. If not, they will need more help planning the visit and activities.

6. Consider a work place visit. Students enjoy learning about a variety of careers in technology and science firms. Our field trips included meeting with professionals in law, human resources, and marketing.

7. Take into account the dynamics of your group and decide if it would be beneficial to organize students into teams or partners. You will want to plan these arrangements ahead of time.

8. Begin visits with an icebreaker. Ask your guide if they need help coming up with an icebreaker for your students.

9. Keep students' interests in mind. You're likely to maintain interest with a schedule that includes a short introduction, hands-on activity, and tour. Be sure to keep to your timetable.

10. Engage students with hands-on activities and round-robin discussions. It’s best to limit lecture time to no more than 10 minutes, especially with younger students.

This project was funded by the Mitsubishi Electric America Foundation.
11. Invite students to give feedback on what worked well and how to improve future field trips.

12. Be sure that your students send thank-you notes to the sponsors of the visit. Field trips require considerable time to plan and host.

13. Schedule a follow-up call with the sponsors of the trip to talk about what worked well and how to improve your next field trip.

Photo 13: Students get a behind-the-scenes tour of Hiller Aviation Museum.
Mind Mapping: A Tactile Approach to Career Exploration

Lesson’s Purpose

The Techbridge program is fortunate to have the support of role models from a variety of companies throughout the greater San Francisco Bay area. This lesson plan evolved from a visit to the California School for the Blind by women employed by Mindjet, a company that develops a suite of tools that are used for planning, collaboration, and business process management. (http://www.mindjet.com/us/)

The purpose of this activity is to simulate the functionality of Mindjet’s MindManager software. Students who are visually impaired experience computer software through linear, verbal interactions. Mindjet’s software does not allow users to interact in this capacity. We developed this lesson to allow our students to have a MindManager type of experience through a tactile activity.

This lesson allowed our students to explore their aspirations relating to education, career, family, and lifestyle. The project also allowed our Mindjet role models to discuss their career paths and interests in the fields of computer programming, user-interface design, and information technology support. It gave us a new avenue to encourage students to think about careers that are based in a visual paradigm.

Materials

• 1 large rectangular piece of felt for each student
• Puff paint
• Thick paper stock
• Yarn
• Hole punch
• Scissors
• Velcro tape

Directions

Step 1: Preparation

Obtain large felts rectangles approximately 12” by 18” to represent a computer monitor. Use puff paint to equally divide the felt horizontally and vertically into four sections. You will want to complete this step at least 24 to 48 hours in advance of the activity since the puff paint will need time to dry.

Cut 2 or more of the following shapes out of thick paper stock for each student in your class: star, circle, rectangle, triangle, and square. The shapes should be big enough for
you to write 3 to 5 words with felt marker or place Braille tape across. Punch 4 holes around the edges of each shape. Their exact location does not matter.

Make 10 to 15 long rectangles approximately 1” by 4” out of thick paper stock for each student in your class. Punch two holes on each end of the rectangle.

Cut the Velcro tape into ¼ inch pieces. You can place them on the back of each shape you cut or you can have students do this during the activity. You can also precut yarn approximately 5 inches long or have your students do this.

**Step 2: Brainstorming Plans for the Future**

When brainstorming, you start with a central idea or question. In this activity, a star represents the central idea. We asked students to brainstorm about their life after leaving the California School for the Blind. You can choose any topic you feel is appropriate for your group. The central idea should be placed with Velcro at the center of the felt where the four quadrants meet.

Each quadrant represents a sub-topic relating to the central idea. You can ask your students to focus on specific sub-topics or allow them to choose their own. For example, we asked students to brainstorm on education, career, family, and lifestyle. A unique shape represents each central idea related to the sub-topic.

You can invite students to write a few words in large print or in Braille on each shape to describe their thought process. Or an instructor may assist them. Have students connect the shapes from the central idea to the sub-topic and subsequent shapes with yarn. Those shapes should be placed with Velcro in the appropriate quadrant.

As students go through the activity ask them to think broadly about the different opportunities they have in determining their futures and how they will go about making their dreams come true. This is an exploration activity and they should be encouraged to talk about their dreams (and any concerns they have about reaching their goals). When the activity is complete each student will have a full “map” on his or her thoughts around the topics.
A Case Study—Career Exploration through an Internship

Kim Pomatto had a lifelong interest in marine biology but she never imagined she would have the opportunity to share her passion and educate others at a California State Park. She had been discouraged from considering a career in science by well-meaning persons in her past because she is blind. Yet, it is her interest and passion for science along with her unique perspective that give Kim the ability to inspire and inform visitors to Año Nuevo State Reserve in a special way.

As part of the Park’s outreach program, Ranger Chuck Edgemon visited the California School for the Blind in Fremont, California to speak with students about Año Nuevo State Reserve. Instructor Marcia Vickroy had arranged for this visit as part of her commitment to broadening her students’ science education. While everyone in this group enjoyed learning about the northern elephant seals, Kim made a lasting impression on Edgemon with her perceptive comments and questions. On her own, Kim had studied marine wildlife and their habitat through reading and watching videos and had taken an elective class on the topic in high school.

Edgemon saw a place for Kim at Año Nuevo, and a year after his visit, contacted the California School for the Blind to discuss the feasibility of Kim coming to the Reserve for training. While the invitation was very appealing, it was not so easy to make happen. Año Nuevo is a couple of hours away from the campus of the California School for the Blind, and there is no public transportation between the sites. For Kim to train with Ranger Edgemon someone at the school would have to drive Kim. The administration realized the potential value of the experience for one of its students and allowed Marcia to take time from her usual responsibilities on campus to support Kim’s internship. With the go ahead, Marcia worked out a schedule for Kim’s visits to Año Nuevo.

Under the guidance of Edgemon and volunteers, Kim learned about the migratory patterns of northern elephant seals at Año Nuevo and the history of this Reserve. She also visited tide pools at the Fitzgerald Marine Reserve and learned how to recognize the tide pools’ many plants and animals like the black turban snails and limpets by touch. On another trip, Kim got a behind-the-scenes tour of the Seymour Marine Discovery Center, studied sea stars and sea urchins in the Center’s lab, and saw "Ms. Blue," the largest blue whale skeleton displayed anywhere in the world.

Edgemon encouraged Kim to use her senses of touch and hearing, to value her perspectives, and to find her voice. Kim has become a docent at the Reserve and has developed a presentation style that is uniquely her own. She draws the attention of visitors—sighted and visually impaired—to aspects of Año Nuevo that reflect her unique experiences and encourages them to experience the wildlife and environment utilizing all their senses. She has led several tours for students who are visually impaired and these
experiences give her an opportunity to be a role model, showing by example that science can be an accessible field to a person who is visually impaired.

Kim knows the importance of role models. During the summer, she had the opportunity to meet Dr. Gary Vermeij, biology professor at the University of California, Davis. In advance of the meeting, Kim read his autobiography, *Privileged Hands*. The two talked about their shared interest in science, and Dr. Vermeij showed Kim his extensive collection of shells gathered from his travels around the world. Kim was inspired by her visit and she reflected, “Seeing Dr. Vermeij’s work made me realize that I can pursue my love for animals and science.”

The staff and administration at the California School for the Blind fully supported Kim’s participation in this project. They also learned from it. Marcia noted, “Opportunities like this one help expand the options for students at the California School for the Blind. After seeing what students like Kim can accomplish, I will never say what they can't do.” Superintendent Stuart Wittenstein reflected, "We're very proud of Kim but not surprised by her success. Kim's accomplishments reflect our school's philosophy of believing in the abilities and potential of students who are blind. We find that the more we expect of our students, the more they achieve."

At a recent workshop for teachers of the visually impaired, Kim described how her experience becoming a docent at Año Nuevo State Reserve has been “a dream come true.” We are pleased that Techbridge has been able to help support Kim.

Internships are a good way to help expand the career options of students and provide the experience and training to help them achieve their dreams. Internships like Kim’s can help students turn a passion into a concrete career goal to study and work towards. Are there students that you could support in an internship? We encourage you to explore the prospects for internships with role models in your community.

This project was funded by the Mitsubishi Electric America Foundation.
Photo 15: Kim with “Ms. Blue” skeleton.

This project was funded by the Mitsubishi Electric America Foundation.
Career Resources for Students with Visual Impairments

Books

Kendrick, D. *Jobs to be proud of: Profiles of workers who are blind or visually impaired*. AFB Press.

Kendrick, D. *Teachers who are blind or visually impaired*. AFB Press.

Kendrick, D. *Business owners who are visually impaired*. AFB Press.

Kendrick, D. *Jobs that matter: Health care professionals who are blind or visually impaired*. AFB Press.

Vermeij, Geerat. *Privileged hands. A scientific life*. Vermeij’s autobiography will inspire students with visual impairments to challenge stereotypes and encourage teachers and parents to recognize that youth with visual impairments are not precluded from working in science. W.H. Freeman & Company.


Organizations and Programs

**American Council for the Blind**
The Council serves as a national organization of blind people. Its services include conducting a public education program to promote greater understanding of the capabilities of blind people; improving educational and rehabilitation opportunities; providing scholarship assistance to blind and visually impaired students; and consulting with industry regarding employment of blind and visually impaired persons.


**American Foundation for the Blind**
AFB is dedicated to improving accessibility in all aspects of life by providing resources on advocacy, collecting and analyzing research, and offering resources to families, educators, and employers. The Employment section contains resources for employees and employers on how to accommodate workers who are visually impaired. Of special interest is CareerConnect, which has a database of over 1,000 blind or visually impaired people. Students can learn about role models who are pursuing a variety of careers including astronomer, electrical engineer, physical therapist, and website designer.

[http://www.afb.org](http://www.afb.org)

**American Printing House for the Blind**
APH promotes independence of persons who are blind and visually impaired by providing specialized materials, products, and services. Of particular interest is *Navigating the Rapids of Life*, which highlights employment success for young people with visual impairments along with resources to promote organizational skills and social skills.

http://www.aph.org/

**Association for the Education and Rehabilitation of the Blind and Visually Impaired**

AER is an international membership organization that provides support to professionals who work in the education and rehabilitation of blind and visually impaired children and adults. AER highlights programs and research on career opportunities for persons with visual impairments through its conferences and publications.

http://www.aerbvi.org/modules.php?name=Content&pa=showpage&pid=1

**Disabilities, Opportunities, Internetworking, and Technology**

DO-IT promotes the use of technologies to increase the independence, productivity, and participation in education and employment of persons with visual impairments. It is committed to increasing the participation of persons with visual impairments in science, engineering, business, and technology. DO-IT supports summer programs, mentoring, and internships for youth. Check out Access CAREERS for a variety of resources to promote career exploration with youth.

http://www.washington.edu/doit/

**ENTRY POINT!**

This internship program is a partnership between the American Association for the Advancement of Science and IBM, NASA, Texas Instruments, JPMorgan Chase, NIH, and the National Science Foundation. The program supports undergraduate and graduate students with disabilities who are pursuing degrees in science, engineering, mathematics, computer science, and business.

http://ehrweb.aaas.org/entrypoint/

**Roadmaps and Rampways**

This outstanding project by the American Association for the Advancement of Science chronicles the journeys of three dozen students from childhood to higher education in science, engineering, or mathematics, and on through their early career decisions. Check out the stories about students with visual impairments including Ivonne Mosquera whose visually impairment didn’t keep her from studying mathematics at Stanford and climbing Mt. Kilamanjaro.

http://ehrweb.aaas.org/entrypoint/rr/index.html

**Smith-Kettlewell Eye Research Institute**

The Institute conducts research on the diagnosis and treatment of eye disorders, on how the eyes and brain work, and on the development of devices and vocational programs to assist persons with visual impairments.

http://www.ski.org/

This project was funded by the Mitsubishi Electric America Foundation.
Evaluation

How do you know that your program is accomplishing what you set out to do? How can you make certain that your efforts are making a difference in your students’ lives? Not only will collecting information to answer these questions be important in running your program, but administrators, parents, and potential funders are likely to ask how you plan to measure your program’s success.

Defining Success

Evaluations often focus on how the program has affected participants over time. In order to do this, you will need to define your measures of success, such as skills, confidence, career interests, or attitudes towards technology and science. In part, this may depend on requirements of your school district, granting agencies, or other project partners. These will help to define the questions that you will ask and the kind of information that you will need to collect.

One method for measuring change over time is using a survey, such as the one we developed for Techbridge, and giving it to students at the start and finish of the program. We have provided a sample evaluation for your review. You could develop a similar survey, selecting questions that address the measures of success you have identified for your program.

We have also found it helpful to gather input from teachers and parents who see our students in other settings outside Techbridge. From them, we have learned how the program affects students in other settings. For example, we learned that the technology skills acquired in a Techbridge project were used by a high school student in a PowerPoint presentation in her history class. For another student, the confidence she acquired in Techbridge was displayed in presentations made at a state conferences to educators of the visually impaired.

We encourage you to take a look at the W.K. Kellogg Foundation Evaluation Handbook, which is available online at the Foundation’s website (http://www.wkkf.org) for an in-depth look at program evaluation and as a planning guide. Reading this before you start your program will help you design an evaluation to fit your needs.

Day-to-Day Evaluation

Beyond the larger question of long-term program effectiveness, we would like to suggest some simple evaluation activities that can help you fine-tune your program and determine how your efforts are working on a day-to-day basis. You can use short and simple methods to check in with your students at the end of every session.
The resources developed by Patricia Campbell, are simple, inexpensive, and effective techniques that help evaluate and improve programs for youth. It is much better to find out what students liked and did not like immediately than to wait until the end of the program. You can create a short evaluation form of your own or try one of the following ideas recommended by Campbell.

On the Bean. Gather three kinds of beans in three different cups. Label the cups “Great,” “OK,” and “Awful.” At the end of each program meeting ask students to select beans based on how they feel about what happened in the meeting and place them into an empty container. The beans will show very clearly how well the program is going, and provide a neutral, non-personal starting point for talking candidly about the program.

Words, Words, Words. **Ask students to share three words that describe how they feel after each meeting. This information will help you gauge the students’ responses to each activity and help plan upcoming sessions.**

The Big Three. Ask students at the end of their meeting to express how they felt about the session using the prompts “What I liked most,” “What I liked least,” and “What would improve the program.”


**Involving Students**

You can use evaluation to show students that their ideas and opinions are valued. At the end of a summer academy we hosted at Chabot Space & Science Center, we asked students for their ideas for the following year. One of the suggestions made by a student became the theme for the next summer’s academy. You can imagine the student’s surprise to learn that what she had to say counted. On her application, she wrote, “A questionnaire last summer asked what we wanted to do this summer and I wrote that I wanted to learn about cars. I was so excited to find out that that is what we would be doing. I am very privileged to be a part of the Techbridge program and I can’t wait until this summer.”

We also conduct focus groups with our students. These sessions allow us to look in-depth at the program’s impact on students and also identify areas where our students may need additional support. From focus groups we learned that most of our Techbridge students could benefit from additional career and academic guidance. This information is helping us define new goals for the program.

Let students see that their opinions matter and will be used to improve your program. The experience may help them speak up—both for what is right and for what needs work—in other areas of their lives. For students who are visually impaired, this opportunity to critique constructively may be as important as the technology and science they learn.

This project was funded by the Mitsubishi Electric America Foundation.
Dear Techbridge students,

Now that the school year is coming to a close, we are interested in learning about your experience in Techbridge. Your answers will help us understand what you learned in the program, and how it affected your plans for your future. There are no right or wrong answers to the questions on this survey. Just be honest and tell us what you really feel. And your name and answers are still confidential. Thanks!

Last Name ______________________ First _______________ Grade level _____ Birth date ___/___/____

1) Because of Techbridge, I am better at following directions.  
2) Because of Techbridge, I have learned how things work (like batteries and kites).  
3) Because of Techbridge I am better at building things with my hands (like with LEGOs).  
4) Techbridge teachers expect me to try hard and do my best.  
5) I feel safe trying new things and making mistakes.  
6) Techbridge has helped me to feel more confident.  
7) Techbridge has helped me to learn I can do things I didn't think I could do before.  
8) Techbridge has made me interested in thinking about a career in technology, science, or engineering.

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<th>Agree (2)</th>
<th>Slightly agree (3)</th>
<th>Uncertain (4)</th>
<th>Slightly disagree (5)</th>
<th>Disagree (6)</th>
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9) I have adults in my life (at home, at school or another place) who help me explore career options.

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<th>I have one adult who helps in this way (2)</th>
<th>I have no adults who help in this way (3)</th>
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This project was funded by the Mitsubishi Electric America Foundation.
Techbridge Focus Group Guide

About Techbridge:

1. What has been your favorite project or activity so far? Tell me about it. What did you learn from that project?
2. What do you do when a project is difficult or challenging? What happened when you got stuck? How did you feel about it?
3. How does your visual impairment affect how you work on Techbridge projects?

Additional Questions about the Program:

4. I hear that you worked on activities to help you think about careers and your future. Tell me about these activities. What did you learn from them?
5. What field trips have you gone on in Techbridge? Tell me about these. What did you learn? What would make it better? Have Techbridge field trips had any influence on your future plans/career choices/class selections? How?
6. What role models have come to your Techbridge program? Tell me about them. What did you learn? What would make their presentation better? Have Techbridge role models had any influence on your future plans/career choices/class selections? How?
7. If a returning student: How does this year's program compare with last year? What is your main reason for staying in Techbridge? What new skills are you learning?

About Careers:

8. What do you want to be when you grow up? Tell me about how you came up with that career.
   *If a career in technology, science, or engineering, then ask:*
   Did you have that career choice before Techbridge? If not: What about Techbridge made you change your mind? (i.e., role models, activities in Techbridge)
   *If not a career in technology, science, or engineering, then ask:*
   It sounds like you're not planning a career in science, technology, or engineering. Can you tell me why not?

9. Why do you want to do that job? What about that job specifically interests you? (i.e., money, emotional rewards, prestige, etc.)
10. What would you like to do in the next few years to help you explore career options? (classes, internship, work)
11. How does your visual impairment affect how you think about your career? Your future?
12. Do you know anyone who is studying or working in the career you're interested in? Please tell me about that person.

This project was funded by the Mitsubishi Electric America Foundation.
13. Where do you think you will be in 10 years? What do you have to do to get there? Have you ever been given advice on classes to get there? (Explore any contradictions between what he/she wants to do vs. what he/she is doing to get there.)

14. How does your visual impairment affect how others think about your future?

Questions about your family and other persons in your life:

15. What advice does your family give you about school? A career? Are there additional ways that they could help you think about/plan for the future?

16. Did Techbridge help you and your family talk about/plan for your future?

17. How involved are your parents: Do they help you make decisions? Do they make some decisions for you? Do you like their involvement? Why? What kind of involvement would you prefer?

Closing Questions:

18. What would make Techbridge a better program?
Partnerships and Resources

The success of Techbridge at the California School for the Blind relies on the partnership between Chabot Space & Science Center and the California School for the Blind. The Center contributes its proven curriculum, expertise in after-school programming, and resources. The California School for the Blind hosts the after-school program on its campus and provides the adaptive resources needed for the activities. Without its qualified staff, Techbridge would not be the success it is. Instructor Marcia Vickroy is vital to the program’s success; her imagination and resourceful have generated projects that are extremely rewarding. In the process, everyone has learned an important lesson: When presented with high expectations and special adaptations, the students at the California School for the Blind have proven that there isn't anything they can't achieve.

We invited the California School for the Blind to participate in Techbridge because we had expected the program, with its hands-on approach, would benefit students with visual impairments. But we did not anticipate how much Techbridge would benefit from the students and staff from the California School for the Blind. Marcia and her students taught us a valuable lesson with their approach to working on the hands-on projects. A slow methodical approach, with the group moving one step at a time, works best. By encouraging all our after-school programs to follow this approach we now have our highest success rate for projects.

Techbridge has been extremely grateful for the many partners that have supported the program at the California School for the Blind. The National Science Foundation funded the start-up of the program and the American Association of University Women, Oakland-Piedmont branch helped support its continuation. Currently, the Gordon & Betty Moore Foundation and the Adobe Foundation Fund are supporting the Techbridge program at the California School for the Blind. The Mitsubishi Electric America Foundation funded the development of Explore It After School!, which has allowed us to share our resources and lesson learned. We are especially appreciative of the Mitsubishi Electric America Foundation for this opportunity.

Our experience hosting an after-school program for students with visual impairments has been very rewarding. We encourage you to look for partners with whom you can host a program like Techbridge. Here are resources that may help you find a partner or source of funding to start an after-school program like Techbridge in your community.

- **Adobe** offers one-time cash only grants for general operating and program support through its Action Grants and Community Investment Grants. These grants range from $5,000-$20,000 and help cover materials and supplies, field trips, and staff salaries.
  

This project was funded by the Mitsubishi Electric America Foundation.
• **American Association of University Women (AAUW)** is a national organization with more than 1,500 branches that promotes education and equity for all women and girls. AAUW’s Educational Foundation funds research, community-action projects, and fellowships to advance education and equity. If you wish to host a program for girls, a grant from AAUW may help you get started.


• **Association of Science-Technology Centers (ASTC)** is an organization of science centers and museums dedicated to furthering the public understanding of science. ASTC encourages the creation of successful partnerships and also promotes equity and diversity by helping its members extend their outreach to women, people with disabilities, and members of underrepresented ethnic and racial groups. Look for a member of ASTC in your community and explore the possibility of co-hosting an after-school program for your students.

  [http://astc.org/](http://astc.org/)

• **Mitsubishi Electric America Foundation (MEAF)** helps young people with disabilities maximize their potential and participation in society. The Foundation provides national grants to projects and organizations throughout the United States, giving preference to areas where its company facilities are located. The Foundation also supports charitable giving by Mitsubishi employees and encourages them to contribute their time and talent to strengthen their local communities.


• **National Science Foundation** is a government agency that promotes science and engineering through research and education. Of special interest for funding, are: (1) Research on Gender in Science and Engineering program seeks to broaden the participation of girls and women in science, technology, and engineering and (2) Research in Disabilities Education program seeks to increase the participation of persons with disabilities in science, technology, and engineering.


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Photo 16: Students display the rockets they built on a field trip to Chabot Space & Science Center.

This project was funded by the Mitsubishi Electric America Foundation.