Making Physical Science Accessible to Students with Visual Impairments

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- Identify strategies that can be used when teaching students about magnetism, electricity, and sound.
- Choose materials that can be used to make science accessible in the areas of magnetism, electricity, and sound.
- Recognize when accommodations may need to be made for a student who is blind or visually impaired and what those accommodations might include.
- Identify ways in which inquiry-based learning can be used to help students who are blind or visually impaired understand the concepts of magnetism, electricity, and sound.

GOALS

- Many of my ideas have come from the FOSS kits
- These kits were originally designed for students who were blind or visually impaired so they use a multi-sensory approach!
- Now they are available for any classroom
- http://www.delta-education.com/science/foss/

FOSS (formerly Savi/Selph)

- Magnetism and Electricity http://www.delta-education.com/science/foss/replacement/742-5022.pdf

- Physics of Sound http://www.delta-education.com/science/foss/replacement/742-5023.pdf

FOSS Materials

- TEST-OBJECTS INVENTORY:
  - Shiny nails, Dull nails, Soda straws, Sponges, Black rocks, River pebbles, Pieces of screen, Paper fasteners, Paper clips, Pieces of copper, Screws, Pieces of yarn, Pieces of cardboard, Rubber bands, Brass rings, Craft sticks, Washers, Plastic chips, Aluminum foil
- Container with 2 sections, 2 separate containers, or a cookie sheet

Magnetism Modifications, Accommodations, and Materials

- Investigating Magnets and Materials:
  - Students are asked to use the test objects to see how the magnet interacts with them. What sticks and doesn't stick and why?
  - Then go on a search around the classroom or school for other items that are made of iron or steel and things that are not.

Magnetism Teaching Strategies and Inquiry-Based Learning


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- FOSS Balances
- Magnet on a post/dowel
- Washers (large)
- Spacers
- Paper, notetaker, or Perkins brailler to record on
- Graph paper (dark line, tactile, etc.)
- Marking tools or objects

Magnetism Modifications, Accommodations, and Materials

- Breaking the Force:
  - Students use a balance and large washers to measure the force of attraction between two magnets.
  - They systematically investigate what happens to the force of attraction as the distance between the two magnets increases.
  - Students graph their results with number of spacers horizontally and number of washers vertically.

Magnetism Teaching Strategies and Inquiry-Based Learning


CLARITY

- Boxes with a magnet taped inside the box and are sealed shut (use a different place in each box)
- Items which are magnetic
- Tactile stickers or something that can be used to mark or draw with

Magnetism Modifications, Accommodations, and Materials

- Detecting Magnets:
  - Students should mark or draw where they found the magnets in each box
  - Students should explain how they know the magnets are there.
  - Students should explain which device worked the best for detecting magnets and why they think so?

Magnetism Teaching Strategies and Inquiry-Based Learning

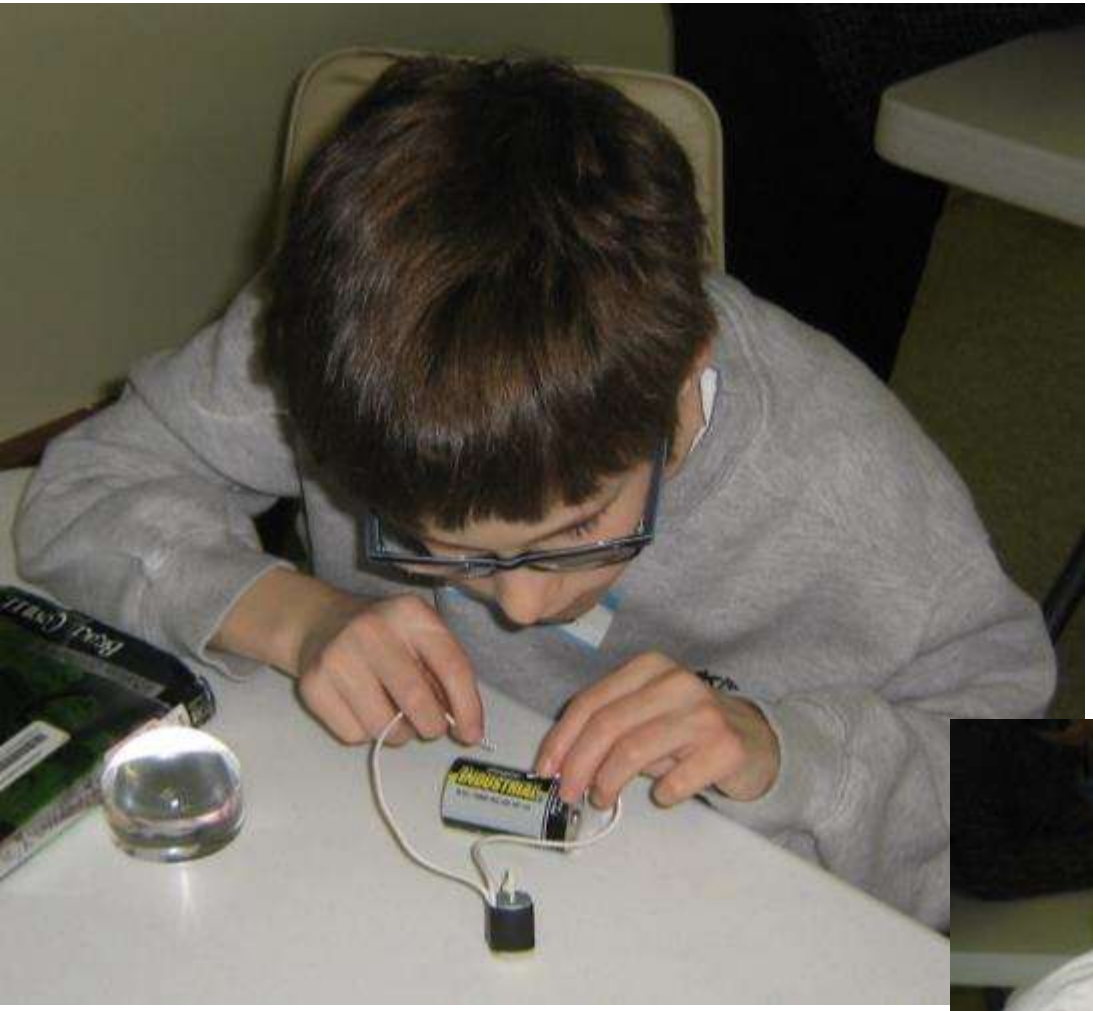
- D-cell batteries
- FOSS D-cell holders, Circuit Bases, & Switches
- Motor (A masking tape flag can be put on the turning part of the motor so it is easier to hear, see, and feel)
- Wires with alligator clips are easiest to work with, but Fahnstock clips can also be used
- Rivets with rubber washers
- Washers (small)
- Steel strip

Electricity Modifications, Accommodations, and Materials

Circuit Base, Motor, Rivet D-Cell Holder, Switch

- Making a Motor Run
  - Students use a circuit base to build a circuit with a D-cell and a motor.
  - They add a switch to the circuit to control the flow of electricity.
  - Students learn the conventions for drawing schematic diagrams of circuits.

Electricity Teaching Strategies and Inquiry-Based Learning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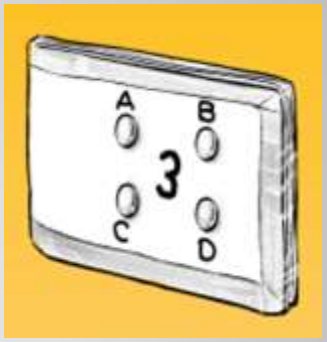
- Finding Insulators and Conductors
  - Students build a circuit to test whether objects are conductors or insulators.
  - They search the classroom for insulators and conductors
  - What do you notice that is similar about all the conductors? What can you say about the insulators?

Electricity Teaching Strategies and Inquiry-Based Learning

- Make mystery boards using brass fasteners, wire, and cardboard with only certain fasteners connected by wire.

- Pictures for tactile learners can be drawn using WikkiStix or graphic art tape between the fasteners.



Electricity Modifications, Accommodations, and Materials

- Investigating Mystery Circuits
  - Students work with mystery boards to reinforce the concept of conductor and check their understanding of how electricity flows through a circuit
  - Have students find where the wire connections are located and draw a picture

Electricity Teaching Strategies and Inquiry-Based Learning

- Building an Electromagnet
  - Students discover that, when current flows through an insulated wire wound around a steel core, the steel core becomes a magnet. They find out where to wind the wire on the core to produce the strongest magnet.
  - Students experiment to find out how the number of winds of wire affects the strength of magnetism. After collecting data for a 20-wind, 30-wind, and 40-wind electromagnet, students graph their results. They predict the strength of magnetism based on the graph.

Electricity Teaching Strategies and Inquiry-Based Learning


THE ALA
ANTONIO, TEXAS

- Reinventing the Telegraph and sending messages
  - Students apply their knowledge of circuitry and electromagnetism to build a telegraph. They invent a code and use their telegraphs to send messages to each other.
  - Students hook up two telegraphs so they can send messages from one group to another. In meeting the challenge, students have to solve a number of problems, including circuit design, resistance imposed by the long lines, and long-distance procedural signals.

Electricity Teaching Strategies and Inquiry-Based Learning


NAVY
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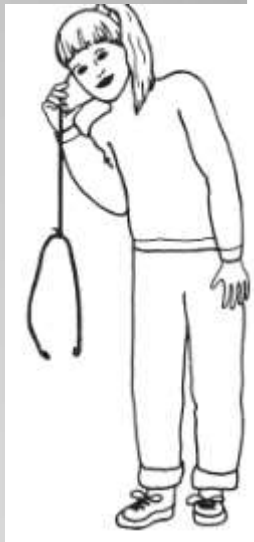
- Properties of Sound
  - Drop Chamber with a vision barrier
  - Different types of objects that sound different when dropped
  - Sorting Tray to keep track of objects
  - Letter Stickers

Sound Modifications, Accommodations, and Materials

- Drop Challenge:
  - Students explore their ability to discriminate sounds. They listen to sounds made by objects dropped into a drop chamber and attempt to identify each object from its sound.
- Drop Codes:
  - Students develop a code by assigning letters of the alphabet to a selection of objects. Using this sound code, the students send messages to one another by dropping a series of objects into the drop chamber.

Sound Teaching Strategies and Inquiry-Based Learning

- Vibration
  - Tuning forks
    - Block of wood, Cups of water, Piece of paper or cardstock, Ping pong ball on a string
  - FOSS tone generator and beans
  - Door fiddle (cord with a large wooden bead or wheel at one end) and a block of wood
  - Long Gong (piece of wire hanger connected to a string which is connected to the bottom of a plastic cup)



Sound Modifications, Accommodations, and Materials

- Sound Vibrations:
  - Students explore the production of sound with a door fiddle, an electronic tone generator, a tuning fork, and a long gong. Through these explorations, students look for vibrations at the sound source, identify sound receivers, and compare sound volume to vibration intensity.

Sound Teaching Strategies and Inquiry-Based Learning

- Vibration and Pitch
  - Tongue depressors
  - FOSS tone generator and beans
  - Door fiddle (cord with a large wooden bead or wheel at one end) and a block of wood

Sound Modifications, Accommodations, and Materials

- Vibration and Pitch:
  - Using their voices and tongue depressors, students look for evidence that different vibrations produce different pitches of sounds. They revisit the door fiddle and tone generator to look more closely at the vibrations that make high and low pitches.

Teaching Strategies and Inquiry-Based Learning

- Length and Pitch
  - Waterphone - Bottles filled at different heights with water and mallet
  - Xylophone tubes and mallet
  - Kalimba
  - String Beam

Sound Modifications, Accommodations, and Materials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- Length and Pitch:
  - Students use a waterphone, xylophone, kalimba, and string beam to look at how length affects pitch. They study what happens when the length of the vibrating sound source changes.

Sound Teaching Strategies and Inquiry-Based Learning

- Tension and Pitch
  - Minigutbucket
  - FOSS-ulele

Sound Modifications, Accommodations, and Materials

- Tension and Pitch
  - Students use a minigutbucket and a FOSS-ulele to look at how tension affects the pitch of a sound. They study what happens when the tension applied to a sound source changes.

Sound Teaching Strategies and Inquiry-Based Learning

- How sound travels
  - Tuning Fork and block of wood
  - Listening tube (through air)
  - Megaphone
  - Stethoscope and a tub of water (through water)
  - String telephone
  - Wooden dowel (through wood)

Sound Modifications, Accommodations, and Materials

- Sounds Through Air, Water, and Solids
  - Students use listening tubes and tuning forks to compare how sound travels through air in two ways—simply by playing the tuning fork in air, and then using a tube to direct the sound.
  - They compare the shape of a megaphone to that of their outer ears for directing sound through air.
  - They use stethoscopes placed in water to determine whether sound can travel through liquid.
  - Students listen through string telephones and wood dowels to determine how well sound travels through solids.

Sound Teaching Strategies and Inquiry-Based Learning

- 1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- 1-PS4-4 Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
- 3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

Magnetism, Electricity, and Sound & Next Generation Science Standards

- 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS4-3 Generate and compare multiple solutions that use patterns to transfer information.
- MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Magnetism, Electricity, and Sound & Next Generation Science Standards