



Title: Bend This! Introduction to CircuitBending and DIY Culture

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Grade Level: 8th

Type of Lesson: STEM

Objective: The goal of this lab is to give students practical experience with simple circuits and for them to produce a unique musical instrument.

BVSD Middle School Physical Science Standard 2: *Students know and understand common properties, forms, and changes in matter and energy.*

Explains that energy appears in different forms and can be transferred (moved) and be transformed

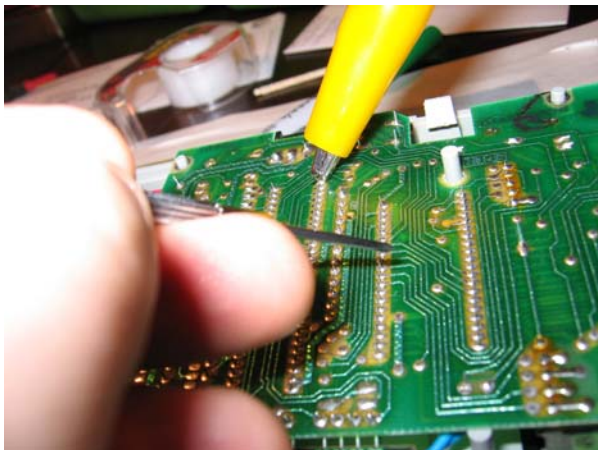
Explains that electric circuits provide a means of transferring electrical energy

PYS13: *Explains that electric circuits provide a means of transferring electrical energy.*

Describes the flow of electrons through a circuit

Identifies series circuits and parallel circuits, and compares the two types of circuits

Background Information: Circuit bending is the intentional hacking and permanent shortcircuiting of low voltage, battery-powered children’s toys and simple electronics to create unique musical instruments. According to circuit bender Jane Crayton, “Experimental electronic artists look to re-appropriate lo-fi, antique digital items for manipulation during live performances” (www.stem-a.org). Circuit bending emphasizes experimentation, spontaneity and randomness and circuit bending techniques have been commonly associated with noise music and DIY (Do-It-Yourself) culture.



<http://www.piksel.no/2010/02/call-circuit-bending-workhop>

References: http://www.stem-a.org/class_circuitbent.html,
http://www.ehow.com/video_2372518_learn-circuit-bending.html,
<http://www.youtube.com/watch?v=Ut5PKEsOr9k>

Lesson Vocabulary: (introduced prior to the lesson and reinforced through the lesson)

Electricity: a form of energy generated by the flow of electrons (-)

Circuit: a path followed or capable of being followed by an electric current

Parallel circuit: a closed circuit in which the current divides into two or more paths before recombining to complete the circuit

Series circuit: an electric circuit connected so that current passes through each circuit element in turn

without branching

Switch: device used to close and open circuits

Voltage: (V) a measure of the pressure under which electricity flows

Volts: the unit of voltage

Current: (I) a measure of the movement or flow of electricity

Amps: the unit of electrical current

Power: the current and voltage of a flow of electricity

Solder: a metal alloy with a used to join metallic surfaces (soldering)

Flux: a chemical cleaning agent that makes soldering easier by removing oxidation (rust)

Materials Required:

Children's toys/thrift stores

Found, purchased, or reappropriated (buying new is generally counter to the spirit of circuit bending)

Enough toys for students to work individually or in small groups

If you have enough time, take the students on a field trip to thrift stores so they can find and pick out their toys to be hacked

Batteries /grocery, hardware or electronics stores

AA and AAA are the most common sizes used in children's toys

Opening the back of the toys to check and replace the batteries is the first step for students to explore the toys

Screw drivers/hardware or electronics stores

Plastic cups or containers to hold the screws and pieces (the toy will eventually be reassembled)

Insulated copper wire / hardware or electronics stores

Solder/hardware or electronics stores

Flux/hardware or electronics stores

Soldering irons/hardware or electronics stores

Preparation: After purchasing materials, use tape and markers to number then toys. If students do not bring in their own toys, have them draw numbers so that they randomly pick out the toy they will hack. Set up classroom space so that materials are easily accessible.

Safety Information: The circuits are low voltage and can be short circuited by physical touch. Soldering irons are very hot, so students should exercise caution and wear safety glasses. Also, some of the toys can be difficult to open; students should be careful if they need to break the toys to open them.

Engagement: Start by reminding the students what they have been studying so far and review some of the components of simple circuits. Ask them what every circuit needs to work, what electricity is, and how it is transported and transformed. After reminding the students about their prior knowledge, introduce the activity: “Today we will be creating unique musical instruments by permanently changing the electrical circuits.” Ask them what they know about DIY culture and experimental music. Finally, show them a video of a circuit bent toy (such as <http://www.youtube.com/watch?v=Ut5PKEsOr9k>).

Exploration: Group the students (if necessary), have them draw numbers, and distribute the toys by what number they drew. Ask the students to test their toy and replace the batteries if necessary. Then they will use the screw drivers to open the toys and find the circuit board(s). Have them explore their toys—what do the different buttons do, what sounds or lights does the toy have, does it have any moving parts. Once they get to know their toy, have them start exploring the circuit. While the toy is on and running, have them touch the circuit in different places, listening and looking for changes in how the toy’s working (new weird sounds especially). To change the circuit, they must make physical contact with the circuit in two places at the same time (so that the circuit is closed). Give them lots of time to find places on the circuit board that will make an interesting noise. The focus of this activity is really on the exploration phase and letting the students get their hands on real circuits.

Explanation: Have the students diagram their circuits in their science notebooks (a simplified schematic is fine, especially since some of the circuits might have a lot of components). Ask them to write what they think is happening to the circuits when they touch it in two different places. As a class, discuss why they think the sounds/lights/movements change? Introduce the concept of short circuiting (a short circuit in an electrical circuit is one that allows a current to travel along a path where essentially no (or a very low) electrical impedance is encountered) and remind them that circuit bending is intentional short circuiting.

Elaboration & Extension: Now the students will make their bends permanent by soldering a piece of electrical wire between the two contact points. Very carefully they will use the solder, electrical wire, and soldering iron to make a new connection in the circuit. Have them test that their toy still works and that it makes the new weird sound/movement/light they wanted. Once they have successfully bent their circuit, ask them to write and/or diagram how they changed their circuit.

Evaluation: Evaluation will be from the students’ science notebooks, including the writing and diagrams from the Explanation and Elaboration sections. In addition, the students will write a brief statement on what circuit bending is and how it is used and why they think they were assigned this exercise.

Wrap-Up: To close the lesson, the students will play a short song, such as “Happy Birthday,” all together on their instruments, symphony style (or cacophony as the case may be).