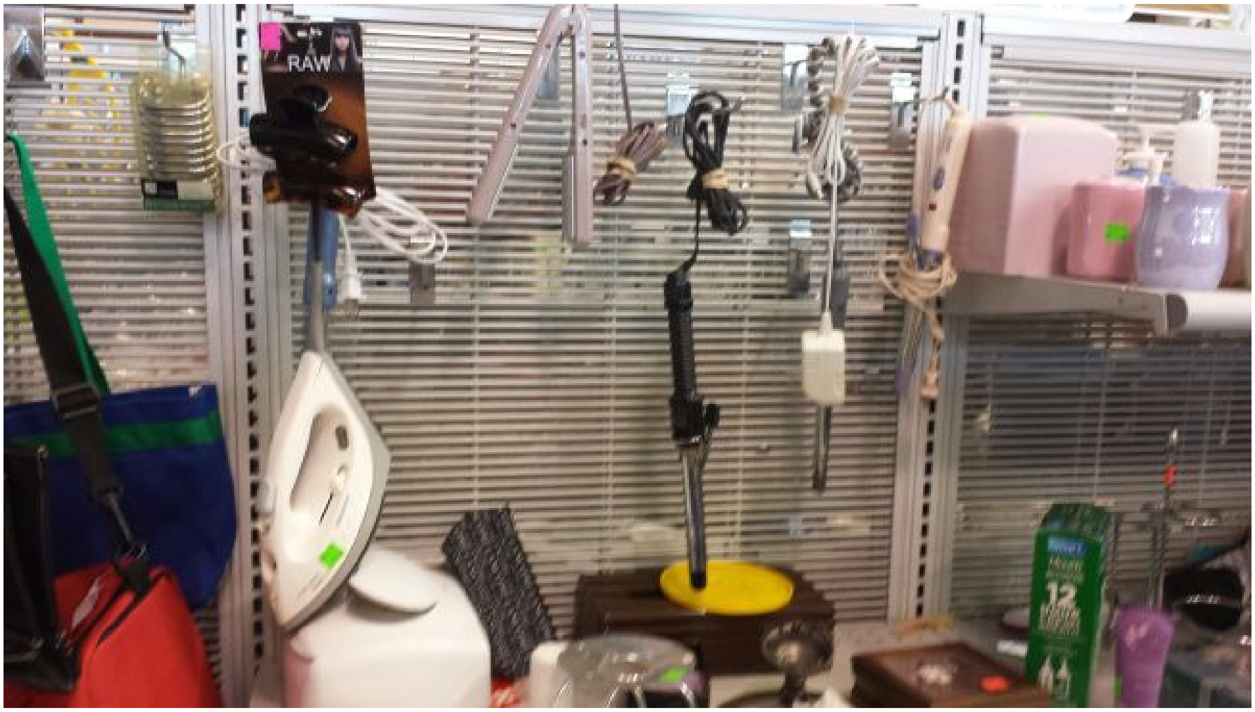
Kim Owens
CEP 811

Thrifting: Edible Electrolytes Circuit

This week in CEP 811, we were asked to order a type of maker kit, go thrift store window shopping, and come up with an idea of how to repurpose thrift store materials into a unique maker kit design. This creation should be able to be used in the classroom as a tool for teaching. I chose to order a Squishy Circuits kit since initially this whole maker-kit idea blew my mind and I wanted to order the kit that seemed the simplest. Upon receiving my kit, I was very excited to start playing. I began by going to the squishy circuits website and reading instructions on how to make various circuits. Before I could get started making the models shown, I had to make insulating and conducting clay (directions are on the Squishy Circuits website). While making the dough, I realized I did not have any food coloring to help me differentiate the conductive dough from the insulating dough. I did, however, have red powdered Gatorade. I thought, "*Gatorade is known for having electrolytes, so I will add this in my conductive dough for color*." The idea of edible electrolytes led me to think about the various foods we eat that are made of electrolytes. In chemistry, I teach about electrolytic solutions. To catch the interest of my students, I always tell a little story about how water would not conduct electricity if there were not minerals (electrolytes/ions) in the water. I further tell them if they were to stand in a puddle of distilled water (having no minerals or electrolytes), the water would not conduct electricity, thus if the puddle were struck by lightning, they would not get electrocuted!

In CEP 810, we learned about Dr. Punya Mishra and Dr. Matthew Koehler's TPACK model. Dr. Mishra (2012) states that technology in the classroom can be any item used in a classroom to aid in learning, even a pen and paper. Mishra (2008) also discusses how good teaching is creative and connects technology with pedagogy and content; repurposing thrift store items has the potential to demonstrate Mishra and Koehler's concept. Mishra states that teaching is a wicked problem that requires creative solutions; creative solutions are “tweaking knobs” in the process of solving the problem (2008).



During my thrift store expedition, I was looking for inspiration. I found a lot of items that required electricity to work. I thought, in an ideal world, I could create a wired circuit that runs from a battery pack to an iron, to a coffee maker, to a curling iron, to an alarm clock, and back to the battery. I knew, however, this would be unrealistic because it would require 1) a lot of wiring and, more importantly, 2) a very high powered battery pack! My small squishy circuit battery pack would not be able to handle this extravagant idea! I looked around a little more and saw a deck of cards. I thought about making a motor circuit with a fan, which would then blow down a house of cards. I, however, wanted to create an model that gave my students an electrolyte experience using items we think of as non-conductors but actually do conduct electricity! I really wanted to use the idea of edible electrolytes to hit home to my students. I thought “*what if I created a circuit through a bunch of different foods containing electrolytes and prove that these these foods could conduct electricity*.” I also thought this lesson would be good for biology as well as chemistry because our body depends on electrolytes to perform needed functions at the cellular level. Many fruits, vegetables, and other foods provide us with these necessary electrolytes. So this is where I began the designing process. The image at the bottom shows my Edible Electrolyte diagram. This, unfortunately, does not work without a fairly high powered battery pack. I do, however, see this as a little more possible than the first idea I came up with. Also, a lot of these pieces could be taken out and still demonstrate the point. Ideally, one would be able to locate a motor, fan, buzzer, and LED lights at a thrift store. Below is a set of instructions I would give my students so they could create this Edible Electrolyte circuit.

Directions

1. Insert the black (negative) wire inside the banana.
2. Use an LED light bulb and insert the shorter lead (wire) attached to the LED inside the banana. The longer LED lead should be inserted into the tomato.
3. Use a motor (with a fan attached) and insert either wire of the motor into the tomato and the other wire into the glass of milk
4. Use another LED light bulb and insert the shorter lead into the milk and the longer lead into the potato.
5. Use a buzzer and insert either wire into the potato and the other wire into a stick of celery.
6. Use a 3rd LED light bulb and insert the shorter lead into the celery and the longer lead into the lemon.
7. Insert the red (positive) wire into the lemon.

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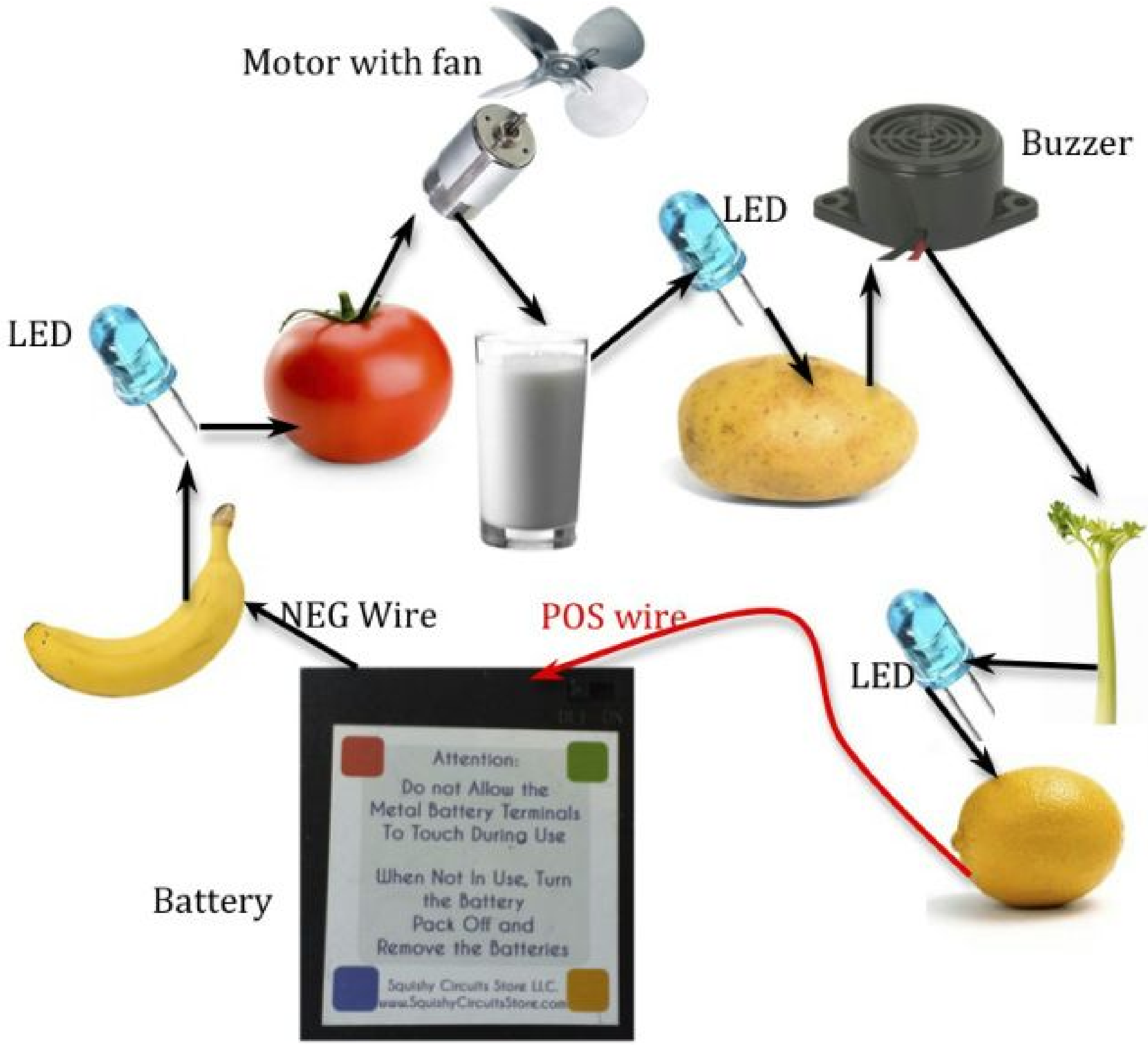

*NOTE: “The LED (Light Emitting Diode) produces light from electrical power. To work, it has to be oriented properly (this is called polarity). Usually the two leads are different lengths. The longer lead goes to the positive, or red, side of the battery pack. The shorter goes to the negative, or black, side of the battery pack” (Squishy Circuits).

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The Chemistry Behind Electrolytes

Electrons can flow through materials that allow the transfer of electrons. Ions, for example, have either a negative or positive charge. They, by nature of their charge, encourage the flow of electrons by repelling electrons (if an anion) or attracting electrons (if a cation). Many of the foods we eat contain ions (also known as electrolytes), thus, these foods are conductors of electricity. Edible electrolytes are necessary to perform various biological functions at the cellular level. Essentially, we need electrolytes in food to live! The Edible Electrolyte circuit demonstrates how common foods can conduct electricity.

The Physics behind the Edible Electrolyte Circuit

Electrons flow from the negative end of the battery to the positive end. We can create a circuit through which electrons flow by attaching various conductors (food in this case) together with buzzers, motors, and LED lights. When the buzzer, motor, and LED lights turn on, this demonstrates electrons (or electricity) is not only flowing through them, but also through the food. Almost everyone knows bananas are known for having potassium (K^+) and milk has calcium (Ca^{2+}). These and all of the other foods in the diagram also contain ions/electrolytes and conduct electricity. I think demonstrating this would be a great, visual way to teach students about electrons and ions/electrolytes.

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