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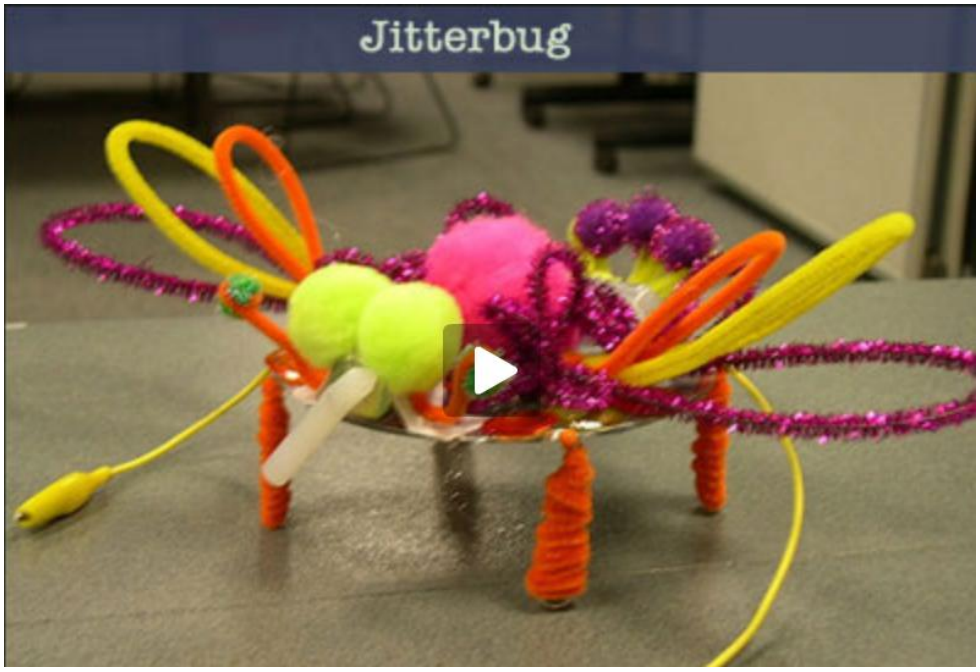
Fall 2010 Scribbling Machine Lesson Plan

Lesson Type: Project Based



Teaching Plan:

- Introductions/check-ins - “How was everyone’s week?” “This week we are going to make our own scribbling machines using motors!” “Who knows what motors are?” ~10min
- demos - show students a working model of a scribbling machine (Ask questions about why the contraption jitters and moves around? What is the role of each part (motor, wire, alligator clip, battery, the cork/glue stick)? Bring in other devices that operate on the same principles (jitterbug, etc) ~5min
- challenge time! - specify guidelines for the challenge: ~30min
    - break into teams of two
    - challenge specifications - make a scribbling machine that will make the most interesting patterns on paper and also has a creative design ~20min
    - test it together with each team ~10min
- conclusion ~15min
    - worksheet
    - have a discussion based on worksheet
    - check-ins again at the end - tells kids about next week’s activities and hear from them what projects they would find interesting

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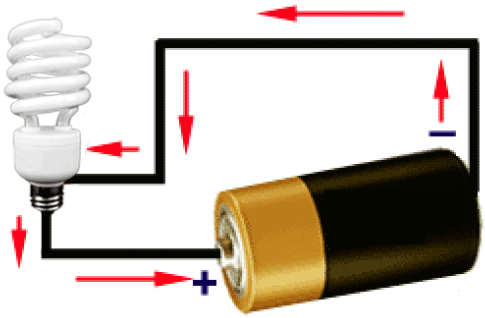
Mentors Scientific Background:

- circuit basics:



Simple circuit with light

A simple circuit is composed of: power source, conducting medium, and load (resistor). The power source (battery) generates the force because of a voltage difference and pushes electrons through the wire. Power is then dissipated via a resistor, in this case, a motor.

- rotational vibration: When a weight is attached to the axle of the motor, the motor is put off center. The off-center weight pulls the motor and the whole contraption off of its spinning axis and causes it to vibrate.
- practical applications: This concept of rotational vibration also occurs in cell phones, where a mini motor is attached to a small off-set weight so that when the phone rings, the motor engages and the off-set weight causes the vibration. Another example is car wheels. Cars where the wheels are not balanced will experience vibrations when traveling at higher speeds. The same idea applies to washing machines with uneven loads. Washing machines sometimes make very loud noises and “dance” around the floor when there is an unbalanced load. Another example of rotational vibrations is in compact discs (CD). When the mass around a CD is unevenly distributed, it causes both the disc and the drive to vibrate. Severe vibrations at high speeds can cause permanent damage to the spindle motor bearings.

Introduction for the Mentees:

Mentors will first ask mentees questions about simple circuits. A demo of the device will then be shown to the class. Use a role playing strategy to frame the challenge. Pretend that Mr. Scribbles needed to design art with very unique patterns, but the challenge is that he can not use his hands to draw it. Mr. Scribbles then hired teams of these students to come up with a machine that will make interesting patterns/art.

Modules/Demos, or Project:

The project that will demonstrate the concepts of circuits and rotational vibration is making a scribbling machine. This project makes a simple circuit with a motor as the resistor. A weight is then put on the spinning motor as an off-set to create an imbalance that causes the contraption connected to the motor to vibrate.

Instructions:

1. Select a small chassis for the scribbling machine. (Examples are yogurt cups, other round containers). It is important to choose a chassis that is rigid and supportive.
2. assemble the simple circuit consisting of battery, wires, and motor as the resistor.
3. To do this, first tape the battery to the chassis
4. Attach one end of the wire to an alligator clip. Do this for the two pieces of wire.
5. connect the other end of the wire to the motor. Do this for both wires.
6. tape the motor to the chassis as well
7. to create a switch in the circuit, tape a paper clip to the negative end of the battery
8. Test the circuit by clipping the wires to the positive and negative ends of the battery
9. Once a working circuit is made, put a cork/glue stick/eraser on the motor as an off-set.
10. complete the circuit again to ensure that there is vibrational motion
11. attach markers to the chassis and make sure that the structure stands up
12. connect the circuit and place the completed structure on large scribbling paper.
13. make art!

Closing Activity and Discussion:

The closing activity would consist of going through the worksheet with the students.
Mentors should also talk about the next week's activities and hear feedback from the students of their interests.

Worksheet:

The below questions are to be printed out and handed to the students. The worksheet will be completed as a closing activity to spark discussion on the topic.

1. What are the components of a basic circuit?

2. What is the role of a battery in a circuit?

3. What is the role of the motor in the circuit?

4. What caused the scribbling machine to vibrate and move around?

5. What are some common examples of rotational vibration?

6. What would happen if a compact disc (CD) has uneven mass around it?

7. What kinds of designs made the most motion?

8. What could you have done to improve your scribbling bots?

Materials:

- 1 plastic container for a chassis - everyone bring their own
- 1 AA battery - 120 ordered ($41.84)
- 2 thin 24gauge wires - 100+ ft ($14.00)
- 2+ paper clips - 3 boxes ($5.40)
- 1 small motor - 70 ordered ($170.00 including shipping and handling)
- tape (of any kind, scotch, masking, etc) - supplied by BEAM and schools
- 3-4 markers - 200markers ($27.00)
- 1 large sheet of butcher paper (or any large white sheet of paper) - will go to office max to ask for some donations
- wire cutter - 5 ordered ($27.00)

References/Citations:

http://www.exploratorium.edu/afterschool/activities/index.php?activity=136&program=579

http://www.mscience.com/faq17.html