

# Banana Piano Lesson Plan

## Overview for grades 1-4 —300 students

### Common Core Objectives

1. apply scientific processes, communicate scientific ideas effectively, and understand the nature of science.
2. generate evidence using the processes of scientific investigation i.e. framing questions, designing investigations, conducting investigations, collecting data, drawing conclusions.

### Leadership & Teamwork Skills

1. Follow directions
2. Listen to ideas
3. Pick the best one; combine ideas
4. Take turns
5. Listen

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### Overall Outcome

To experiment, have fun, and develop a love of science.

### Learning Objectives

Students will learn that:

- Electricity must flow in an unbroken circle (or circuit) for something to work
- Water and metal conduct electricity
- Plastic does not conduct electricity
- Human beings are made of water
- Conductivity means electricity can flow through easily
- Plastic protects or “insulates” people from electricity.

### Activities—60 minutes

1. Electrical conductivity demonstration
2. Piano Building Demonstration
3. Student Piano Building and Tune Practice
4. Team Concerts
5. Conductivity Basket Investigation
6. Free-time Inventing

### Resources

View a video about the “maKeymaKey” circuit board at  
<http://vimeo.com/60307041>

View a video about the MIT doctoral students who invented the maKeyma-  
Key.com invention kit at

<https://www.youtube.com/watch?v=RRwqutcy5B0>

Order the maKeymakey.com kit at [makeymakey.com](http://makeymakey.com)

Access the piano keyboard at [makeymakey.com/piano](http://makeymakey.com/piano)

# Banana Piano Lesson Plan

## Preparation and Electrical Circuit Demonstration

### Materials Needed

#### *For Banana Pianos:*

7 MaKeymaKey Kits (teams of 3)  
If your class size is larger, you'll need more kits.

7 computers with USB ports and internet access

5 bananas per computer (35)

- Note: After being played by 150 students, all bananas need to be replaced with fresh ones due to "banana fatigue."

Permanent marker

#### *For conductivity baskets:*

Anything plastic or metal such as  
Pipe cleaners

Coins

Fruit or vegetable

Plastic coated paper clip

Metal paper clip

Instruction sheet for each team

### Vocabulary

Electrical circuit

Conductive, conductivity

Insulate

Protect

### Leadership Skills

1. Follow directions
2. Listen to ideas
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### Preparation (20-30 minutes)

1. At each computer, go to [makeymakey.com/piano](http://makeymakey.com/piano).
2. Number each of five bananas and make arrow markings correspond to the arrows or S (for space) on the first five piano keys. This will help students set up their own Banana Pianos quickly within the time allotted.
3. Draw a little circle to help the children know where to plug the alligator clips into the bananas. (The clips should be plugged in at the top of the bananas so kids can play the bottom of the bananas. See picture).
4. Furnish each station with an instruction sheet.



### Electrical Circuit Demonstration (5-7 minutes)

Most grade 1-4 students will know that light switches turn lights off and on because the electricity turns off and on inside the wall. Use this knowledge to introduce the concept that electricity must flow in an unbroken circle (or circuit) for something to work. Help demonstrate your explanation by having students stand in a circle holding hands and pretend they are a wire in the wall. The light is on. Break the circle by dropping one person's hand. The light is off. Tell students they will be making Banana Pianos today by creating electrical circuits. This is the hardest concept for young children to grasp, but it will become very important to them as they build their pianos.

# Banana Piano Lesson Plan

## Demonstration & Piano Building; Concert

### Objectives

Students will learn that:

- Electricity must flow in an unbroken circle (or circuit) for something to work (whether it's a light switch or a Banana Piano)
- Water and metal conduct electricity
- Plastic does not conduct electricity
- Human beings are made of water
- Conductivity means electricity can flow through easily
- Plastic protects or "insulates" people from electricity. That's why electric wires have plastic around them.

### Vocabulary

Electrical circuit

Conductive, conductivity

Insulate; insulator

Protect

### Leadership Skills

1. Follow directions
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### Piano Building Demonstration (10 minutes)

Demonstrate how to set up a Banana Piano at one of the computers. Have a student read the instructions and point out that each student on the team will have a role and one will be instruction-reader (Teamwork skill.)

Demonstrate how you can hold the ground wire and play each note or you can have a child play each note if you hold their hand. Why? Because human beings are made of water and water conducts electricity (Of course, it's more complex than that, but for this age, that's the basic concept. Together, you are completing the electrical circuit.

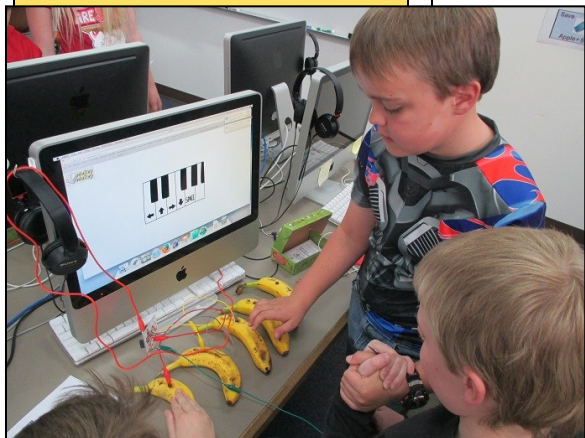
Always use the green wire as the ground. This will help when you visit different teams to diagnose problems. The most frequent problem children experience is not holding the ground wire to make a complete electric circuit, or not holding the alligator clip but holding the plastic around the wire instead. These are the most teachable moments.

### Piano Building, Experimentation, Concert (20—25minutes)

Most children get the instructions once two notes are connected. Assign teams to their computers, then circulate to coach and encourage. Trial and error is part of the scientific and teamwork process at this point. Kids will soon learn they can hold each other's ears and link arms and hold hands. If they try to hold shoulders and the note won't play, they'll learn that clothing is not conductive. If bananas are touching, they experience the problem of two notes playing at once and learn that bananas are conductive of each other. The goo that squeezes out of the plug hole will become sticky. That's how we know there's water in the bananas. Water conducts electricity. Pointing out that other wires and cables in the room are covered with plastic reminds them that plastic is an insulator and protects people from electricity.

If wires are crossed, multiple notes may play at the same time. Hanging the USB cord from the top of the monitor helps children de-tangle the wires and play clear notes.

Once the Banana Pianos are set up, children can learn to play Mary Had a Little Lamb and prepare to give their concert. Our music teacher also provided the numbering for tunes students were learning in music class. About halfway through the lesson period, stop the activity and have each team play a tune for the rest of the class.



# Banana Piano Lesson Plan

## Scientific Investigation and Creativity

### Conductivity Baskets

Pipe cleaners

Coins

Fruit or vegetable

Plastic coated paper clip

Metal paper clip

Playdoh (playdoh is very difficult to clean from the alligator clips, so use this cautiously)

Anything plastic

Instruction sheet for each team

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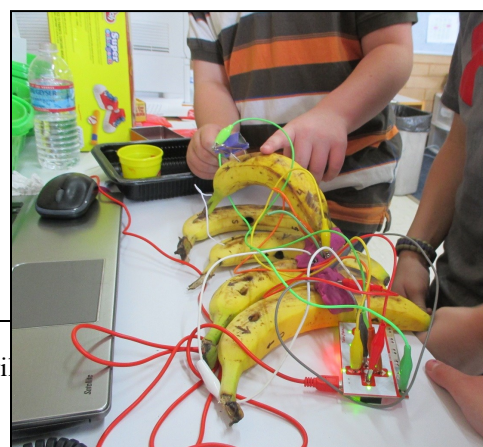
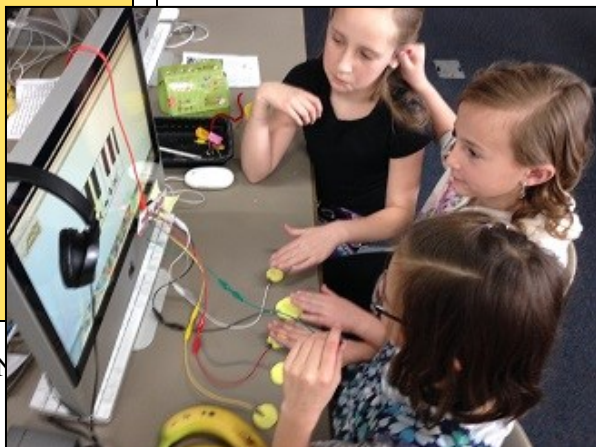
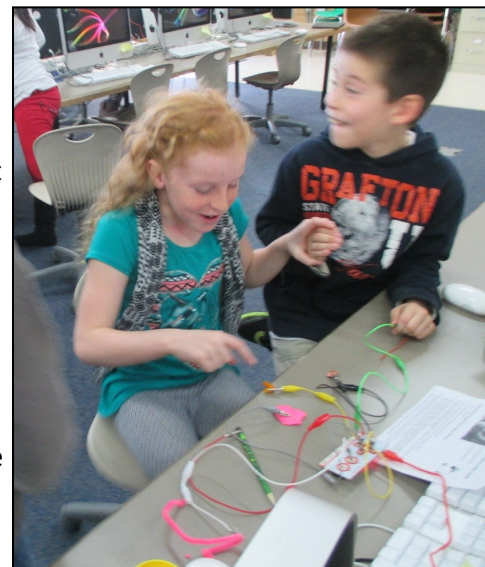
### Conductivity Baskets

From first grade on, students are taught the scientific process of investigation, but in the heat of the moment, young children forget. Demonstrate how to fill out the grid on the instruction sheet. Have the class predict which materials in the basket will conduct electricity. Demonstrate how to make a "clean" test: hooking the material to a wire, putting the hook-up on the counter and tapping the *actual material*. Students will get false results if they don't do this — for example, a positive result (piano key sound) will occur if a student attaches an alligator clip to a plastic-coated paper clip and then taps the alligator clip, not the paper clip. Crossed wires can also give a false result. As you visit each team to check on their work, reinforce the learning objectives.

### Creativity & Inventing — Common Core Objectives

Once students find out that many different materials can be used to make a piano, they just naturally start experimenting. This is the most creative part of the lesson and results in the all important goal of generating a love of science. Clockwise beginning right.

1) The piano is now made of playdoh, a vegetable (piece of yellow pepper), a penny, the metal part of a pencil and a pipe cleaner. 2) This team used the materials to make all the bananas conductive. All piano keys could be played at once by tapping the Top Banana. 3) This team made keys from yellow playdoh and played Hot Cross Buns. The student on the left is holding the ground; the others are part of the electrical circuit by holding arms and an ear.





## Mary Had a Little Lamb

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### Instructions for Banana Piano Factory Workers

1. Find the USB cord.
2. Insert the USB plug into the back of the computer.
3. Insert the smaller end of the USB cord into the maKeymaKey board.
4. ATTACH THE GREEN WIRE TO ONE OF THE LOWER PAIRS OF HOLES in the makey makey board. THIS IS YOUR "GROUND."
5. Use the arrow markings on the piano, the board and the bananas as your guide. Be sure to go in order, left to right. Attach one end of the alligator clip to the maKeymaKey board and the other end to the first banana. Keep going with all the wires until you have connected the maKeymaKey board to all the bananas.
6. Tap each banana. See if you can play a note on each banana. You must create an electrical circuit. The person playing the banana must hold the ground wire!
7. See how well you've done. Ask to play the piano for a teacher.

### What Materials Conduct Electricity?

Extra Credit — Hook each material up to an alligator clip and try to play the piano key.

**DO NOT TAP THE ALLIGATOR CLIP—TAP THE MATERIAL ONLY!**

Material	Yes	No
Tin foil		
Coin		
Plastic coin		
Colored paper clip		
Metal paper clip		