Makey Makey®

SAMPLE LESSON PLANS

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INTRODUCING MAKEY MAKEY

Makey Makey is an invention kit for the 21st century. Turn everyday objects into touchpads and combine them with the internet. It's a simple invention kit for beginners and experts doing art, engineering, and everything in between.

With the Makey Makey, students can make any conductive material act as the input device for a computer. Because it comes preprogrammed, students with no coding experience can use it and learn to experiment with it as they start to learn coding.

Makey Makey believes that the maker movement is more than just robots, 3D printing, or STEM, or even building things. It allows students to become hardware engineers and solve real-world design challenges by providing a landscape that fosters curiosity and creates vibrant learners.

BECOMING FAMILIAR WITH MAKEY MAKEY

MAKEY MAKEY BOARD   **ALLIGATOR CLIPS**   **INSTRUCTIONS**
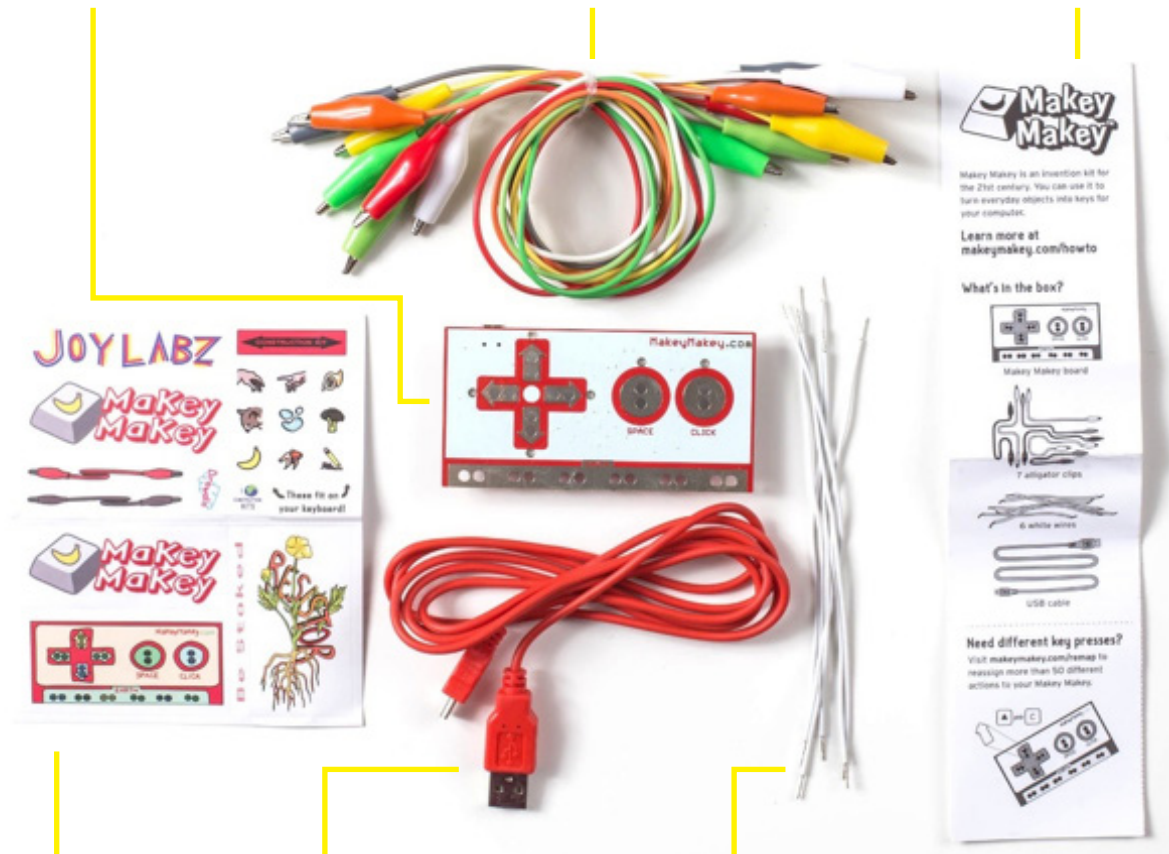
STICKERS   **USB CABLE**   **6 CONNECTOR WIRES**

SETUP

USB cable

red light should turn on
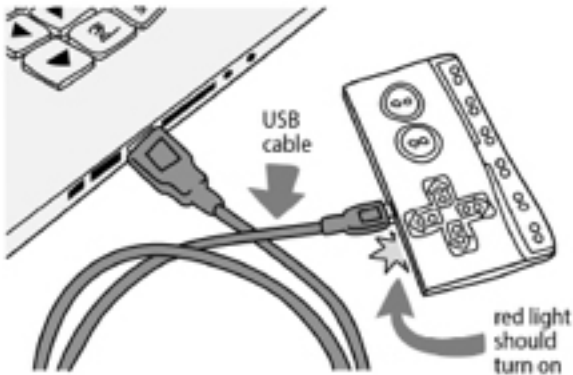
1. Plug in USB

Small side of USB cable plugs into Makey Makey, big side plugs into computer

2. Close Pop-Up window

Your computer may ask you to install drivers or do other setup. You can click cancel or close the window

INSTALL DRIVERS? DO SETUP? YOU DON'T NEED TO!

Alligator clip into "EARTH"
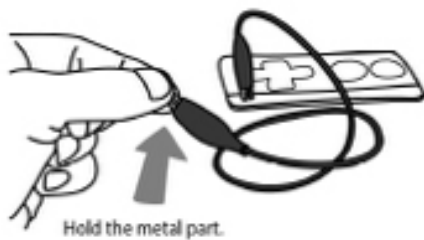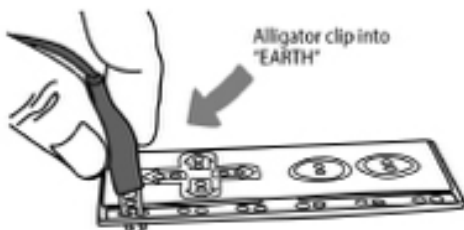
Hold the metal part.

3. Connect to Earth

Connect one end of an alligator clip to "Earth" on the bottom of the front side of Makey Makey

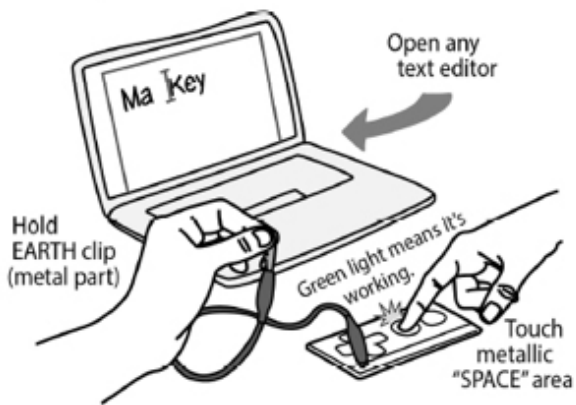Open any text editor

Ma Key

Hold EARTH clip (metal part)

Green light means it's working.

Touch metallic "SPACE" area

4. Connect to yourself

Hold the metal part of the other end of the alligator clip between your fingers. You are now "grounded". While you're still grounded, touch the round "Space" pad on the Makey Makey, you should see a green light go on.

5. Get creative and have fun!

Make anything into a key! You can make a connection through anything that's even a little bit conductive. You can also creative inventions that combine conductive and non-conductive parts.

Go to makeymakey.com/bongos

(hold earth clip)

Add second banana to left arrow input
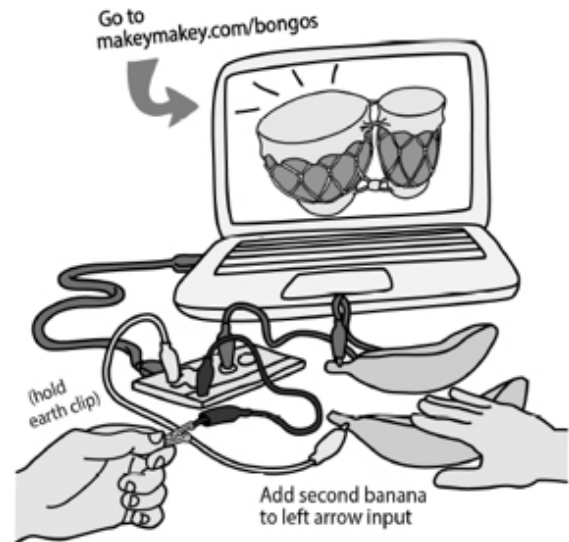
FREQUENTLY ASKED QUESTIONS

Is the Makey Makey easy to use?

Yes, no programming or software needed! All you have to do is alligator clip stuff together and surf the web to find a cool application to get started.

What is included in each Makey Makey educator's kit?

Everything you need to get started! Each Educator's Makey Makey includes:

- 1 x Makey Makey Board
- 1 x USB Cable
- 7 x Alligator Clips
- 6 x Connector Wires
- Illustrated Instruction Guide to Getting Started
- Educator's Guide Lesson Plans

What operating systems does Makey Makey run on?

Makey Makey works on Windows, Mac, Chromebook and on many flavors of Linux (Ubuntu, etc). Makey Makey works on some tablets and mobile devices, but is not officially supported.

How many keys can be pressed at once with a Makey Makey?

Makey Makey can press as many keys as your keyboard allows at once, which is 6. You can use up to 18 in a session (6 on the front of Makey Makey and 12 on the back), but only 6 can be held down simultaneously.

Can I use multiple Makey Makeys at once on 1 computer?

Yes! You can plug in two or more at once and create an orchestra of Makey Makey! (Officially tested with up to 3, but could work for more).

How do I use the back of the Makey Makey?

The connections on the back of the Makey Makey are what's called "headers." They're rows of little sockets, designed for wires to stick into. One easy way to use them is with the included connector wires (a.k.a. jumper wires), which are wires with little pins on either end that stick nicely into the header. You can also buy additional ones separately, but be sure to get the male/male ones. You can also find clever ways to use stuff you already have — for example, we've found that both paper clips and safety pins work great for this purpose!

How do I remap the keys?

With a Makey Makey version 1.2, you can easily remap keys directly in your browser at this website: www.makeymakey.com/remap

LESSON PLANS

LESSON 1 — INTERACTIVE WORD PROBLEM POSTERS

By: Colleen Graves | Appropriate for ages 9 to 14

SUMMARY

Kids always struggle with word problems. Why not have them create their own word problems as an interactive poster? With Makey Makey you can help your kinesthetic learners write, answer, and share their own word problems in Scratch.

LESSON OBJECTIVES

- Write word problems appropriate for their grade level (or younger)
- Understand the functions of mathematical operators
- Create a logical sequence in Scratch to be played in the real world
- Utilize Makey Makey to have students physically interact with multiple choice questions

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COMMON CORE STANDARDS

CCSS.MATH.CONTENT. 6.G.A1-4	Solve real-world and mathematical problems involving area, surface area, and volume.
CCSS.MATH.CONTENT. 4.OA.A.1-3	Use the four operations with whole numbers to solve problems.
CCSS.MATH.CONTENT. 4.G.A.1-3	Draw and identify lines and angles, and classify shapes by properties of their lines and angles. (Depends on the type of word problem you have the student write.
CCSS.MATH.CONTENT. 8.G.A.1	Understand congruence and similarity using physical models, transparencies, or geometry software.
CCSS.MATH.CONTENT. 8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
CCSS.MATH.CONTENT. 8.EE.A.1-4	Expressions and Equations Work with radicals and integer exponents.
CCSS.MATH.CONTENT. 8.EE.C.7	Analyze and solve linear equations and pairs of simultaneous linear equations/ Solve linear equations in one variable.
CCSS.MATH.CONTENT. 8.EE.C.8.C	Solve real-world and mathematical problems leading to two linear equations in two variables.

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-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*
MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. Use mathematical and/or computational representations of phenomena or design solutions to support explanations.

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

LESSON MATERIALS

- Makey Makey for each student or partner groups
- Alligator Clips
- Manilla Paper/Poster Paper
- Copper Tape, thumbtacks, or pencils
- Scratch game to remix

LESSON GUIDE

DAY 1

Teach students how to write their own word problems

1. When students work a word problem, they often have to determine what equation they need to use to solve that problem. Therefore when writing a word problem, students should start by determining the equation that their word problem will be about.

2. Students will need to brainstorm, who is doing what and why? What type of activities would students like to write about? Soccer practice? Going for pizza? Going shopping? Apps on a phone? What type of numbers are involved? What kind of situation could use the equation they want to use? Generally there is a total number given and students must decide an equation for solving the problem, and find the missing info/number based on that equation.

3. Students need to read and revise word problems for fluency before making Scratch game and interactive poster.

4. Students must create wrong answers to accompany their word problem. They should consider what equations might trick students when playing their game.

5. Here is an interesting lesson on connecting English language arts and math through writing word problems on readwritethink.org for younger grades.

Example Word Problem:

On Saturday, Nico practices soccer twice. He drank a total of 32 fluid ounces of sports drink for the day. If he drank m fluid ounces at morning practice, which equation can be used to find n, the number of fluid ounces for the rest of the day?

1. $n = 32 - m$ - correct answer
2. $n = 32 + m$
3. $n = 32 \div m$
4. $n = 32 \times m$

If the variable m = 15 what is n?

https://scratch.mit.edu/projects/70430226/
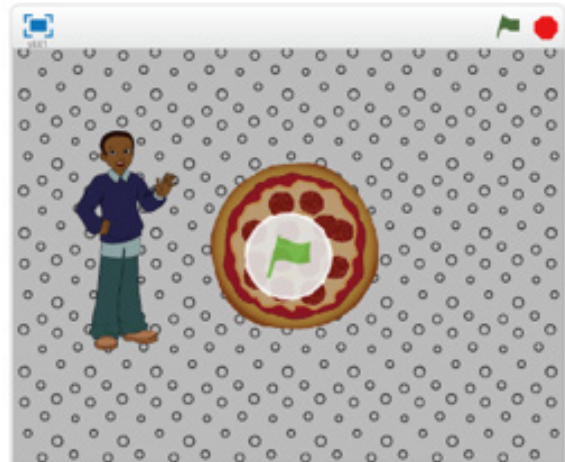
DAY 2

Students will learn to program keys for a Sprite (character in game) and create dialogue for the Sprite to make their word problem poster interactive.
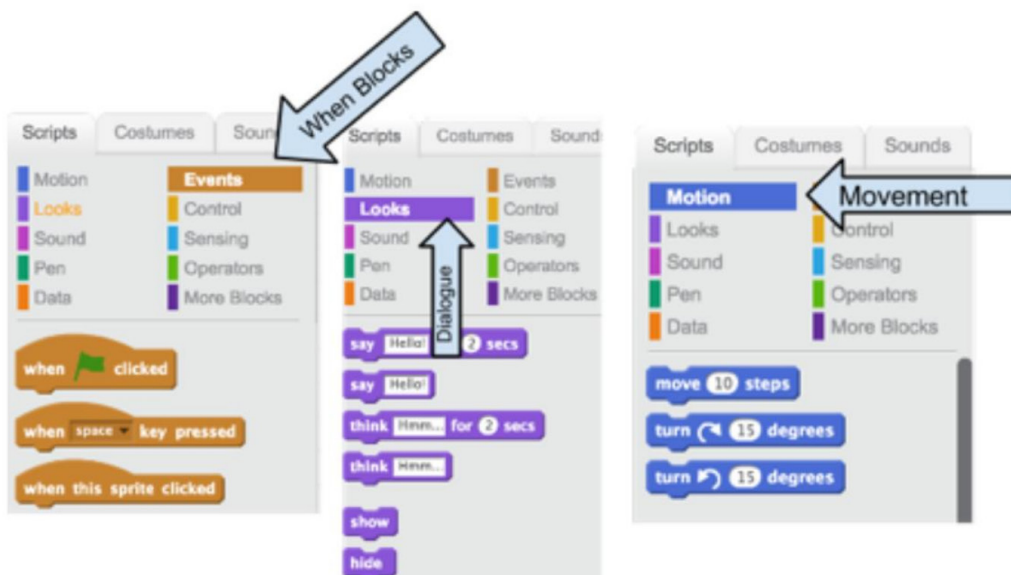
Have students remix this Scratch game with their word problems or start their own in Scratch.

Here is a basic tutorial from my ELA Logic Puzzle Lesson:

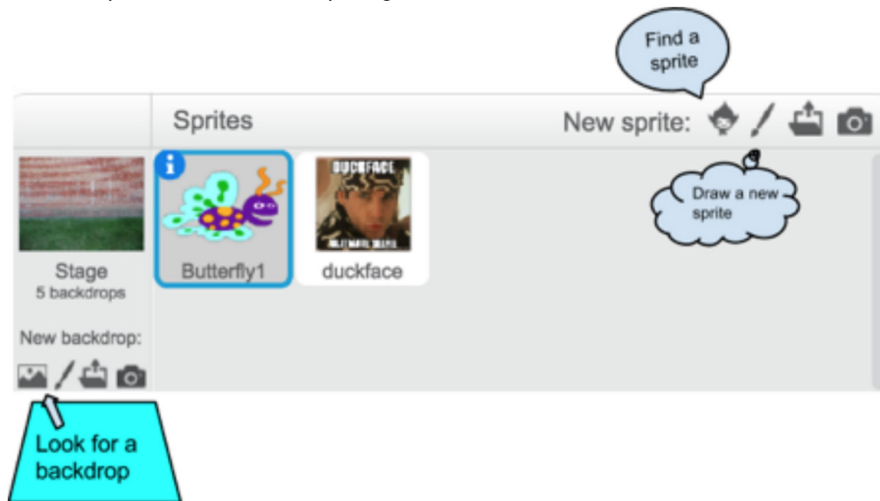1. Sign into Scratch.

2. Familiarize students with the Scratch work area.
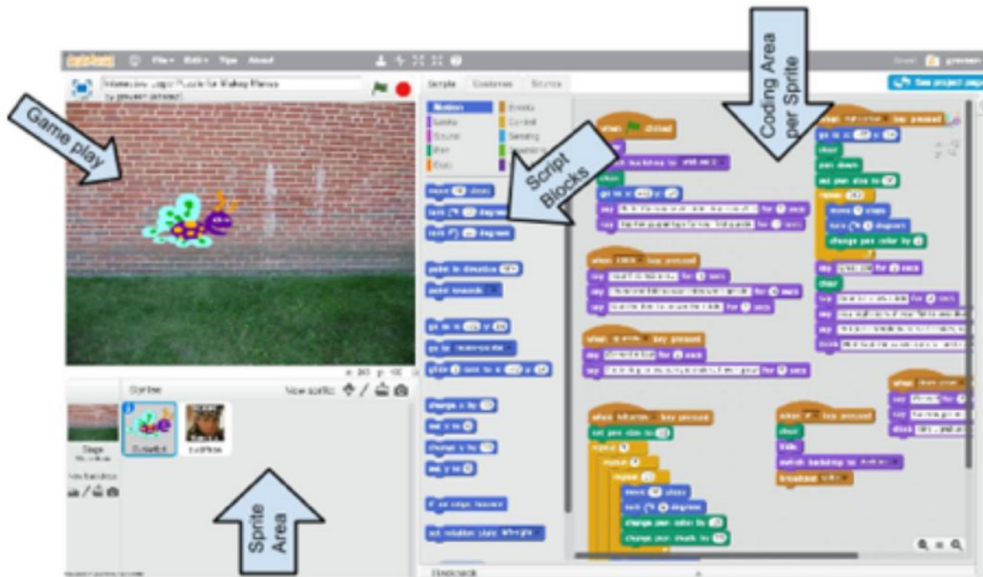
3. Familiarize students with the Scripts (Blocks) for today's lesson.

4. Pick a Sprite and a backdrop to get started.

5. When Block- all games need to start somewhere, and the first thing you need to do is program your game to start by dragging a "When (Green Flag) Block" to your "Scripts" area for your main Sprite.
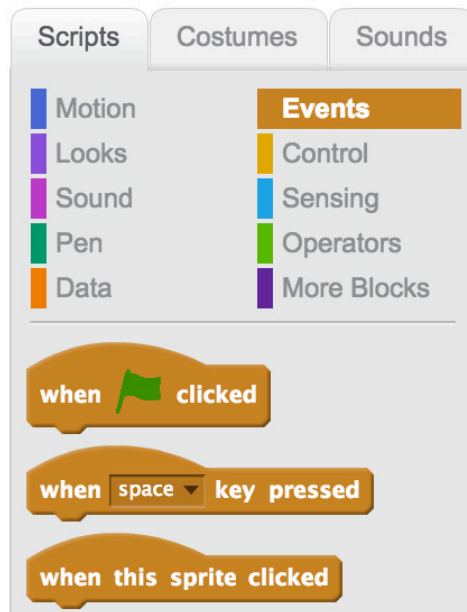
6. Looks Block- Next you need to program your Sprite to speak. Click on the purple "Looks" in the Scripts area to find a "say Hello! block." Change "hello" to the word problem. You may have to use a few "hello" blocks to have enough room to write your question. Drag the purple block to your "When (Flag) clicked" until it clicks together. You can click on your script to run it and see how it functions.
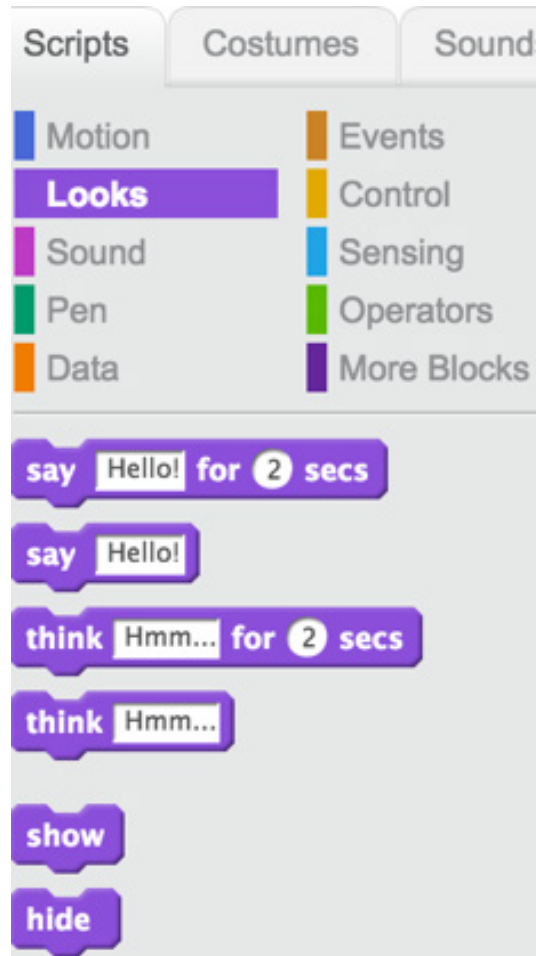
7.   Coding Logic - Small bits of code that can create complex games.
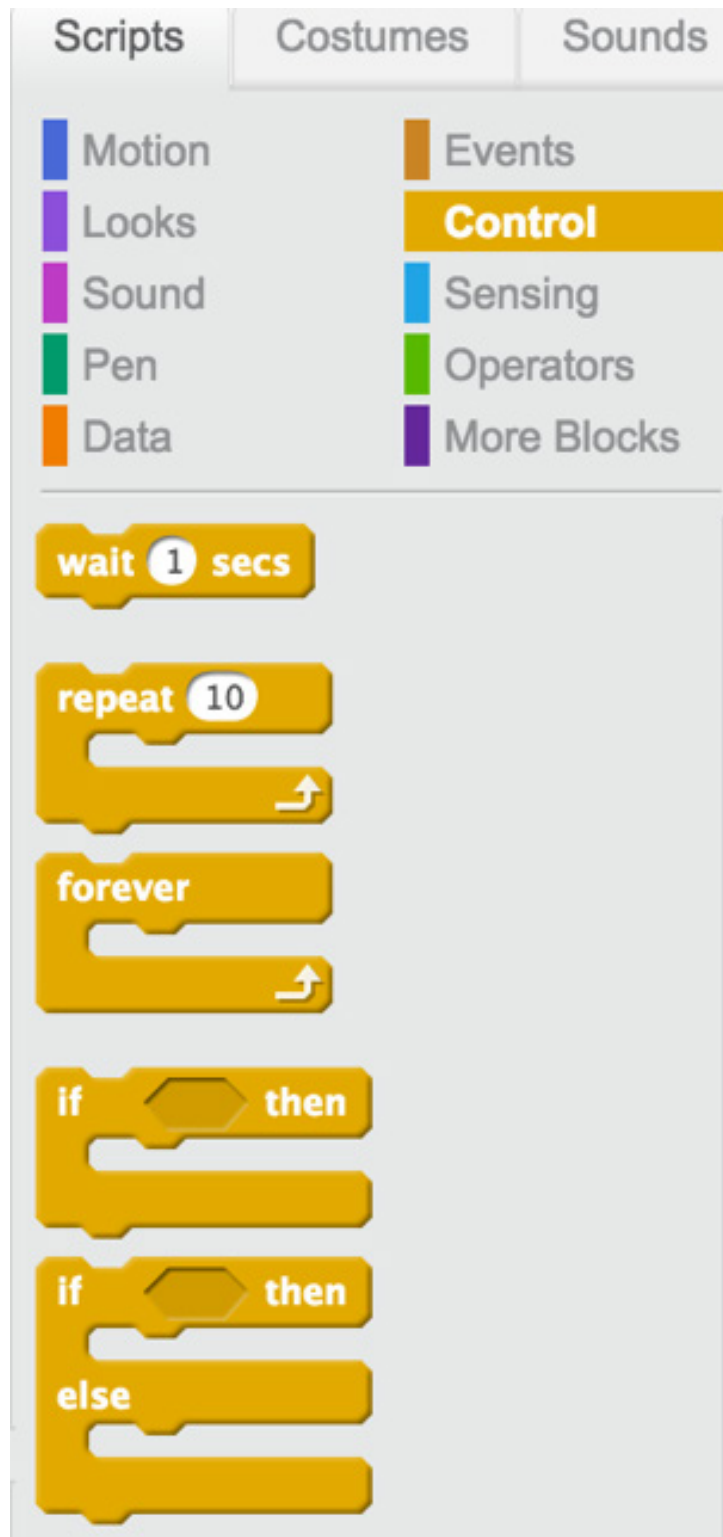
DAY 3

Make your word problem poster interactive by attaching Makey Makey to pencil drawings or copper tape.

Decide your conductor: Have students decide if they want to use copper tape, thumbtacks, or pencil drawings to create their posters.

Draw and Write: Students need to write the equations for their game. In my game, I had the operators as the switch for students to know if they are correct. So each operator is the "key" attached to the Makey Makey.

Connecting to earth: Students should make an aluminum foil bracelet for others to wear when playing their game.

Connecting keys: Hook the operators/equations/ numbers on the poster to the appropriate keys on the Makey Makey.

Play and answer: Have students gallery walk the room and answer each other's word problems. I'd suggest carrying pencil and paper or iPad to record answers for each station.

Evaluate: At the end of the day, have students discuss which word problems they like best and why. Ask students to reflect on the hardest/easiest parts of crafting their own word problems.
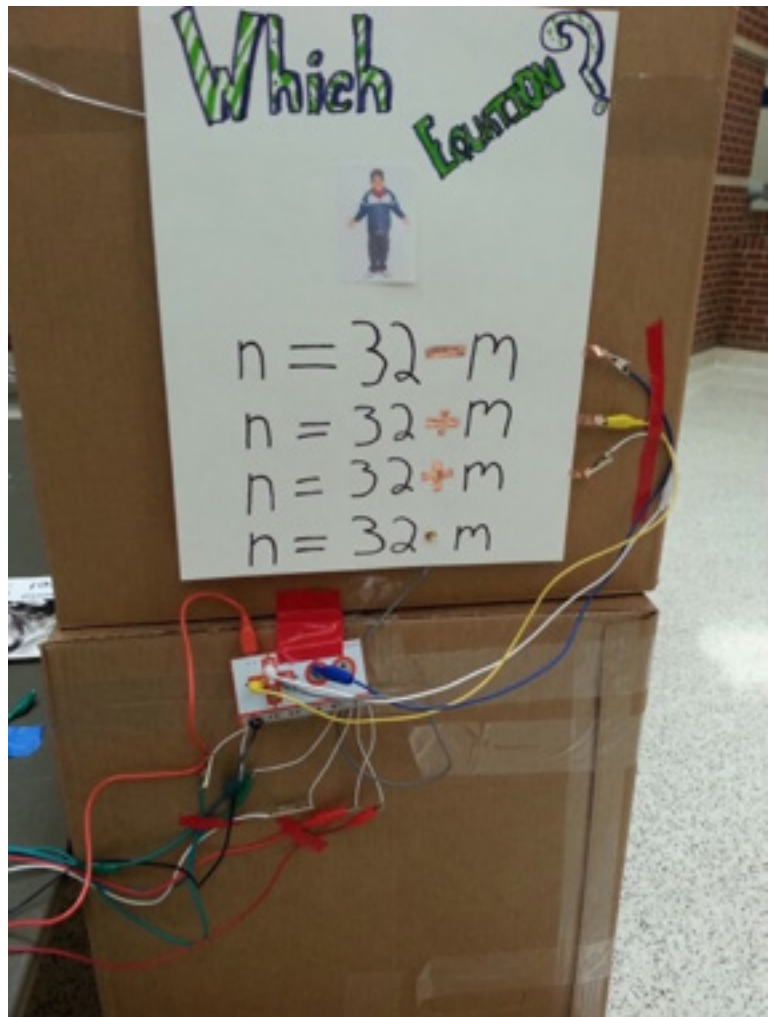
LESSON 2 — DISTANCE, RATE AND TIME FOR MATH/SCIENCE/PHYSICS

By: Colleen and Aaron Graves | Appropriate for ages 13 to 18

SUMMARY

How does acceleration change from a downward drop, to a flat surface, to an uphill ramp? With Makey Makey and Scratch you can measure the change in rate over your desired distance and catch the correct time as your toy cardrives over simple DIY switches.

LESSON OBJECTIVES

- Define distance (inches, feet, miles), rate (centimeters/inches per second, mph), and time (milliseconds, seconds)
- Measure velocity with a given distance
- Using distance formula, students will calculate the speed of travel (rate)
- Experiment with potential and kinetic energy by weighing an object and calculating rate with different weights
- Measure slope and the effect it has on acceleration/rate

COMMON CORE STANDARDS

CCSS.MATH.CONTENT. 8.EE.B.5	Understand the connections between proportional relationships, lines, and linear equations.
CCSS.MATH.CONTENT. HSN.VM.A.3	Solve problems involving velocity and other quantities that can be represented by vectors.
CCSS.MATH.CONTENT. 8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
CCSS.MATH.CONTENT. 8.EE.C.7	Solve linear equations in one variable.

NEXT GENERATION SCIENCE STANDARDS

| 4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.
4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

LESSON MATERIALS

- Makey Makey for each student or partner groups
- Alligator Clips
- Hotwheels Track (or off-brand)
- Toy Cars
- Magnetic weights to add to cars
- DIY switches – foil, copper tape, paper clips, coffee stirs, straws, Legos, etc.
- Scratch game to use or remix
- Telephone wire or other long wire

LESSON GUIDE

HOOKING UP MAKEY MAKEY TO TRACK

Use the Makey Makey to effectively time your car's speed- Students will use this Scratch game (or create their own game) to record the amount of time the car travels over a given distance.

1. Students will set up ramps for the toy car. Make sure they create a potential and kinetic energy scenario by having a downward ramp at the start and an upward ramp near the middle or at the end of each track.

2. Demonstrate how to measure the slope for each ramp and record data on the experiment log.

3. Create DIY switches to start and stop each experiment. In the game I've created, there is a start/stop for acceleration and a start/stop for deceleration. (That makes four switches total.)

4. Attach switches to Makey Makey as follows:
   - Acceleration Start- Spacebar (and earth)
   - Acceleration End- Up Arrow (and earth)
   - Deceleration Start- Down Arrow (and earth)
   - Deceleration End- Right Arrow (and earth)
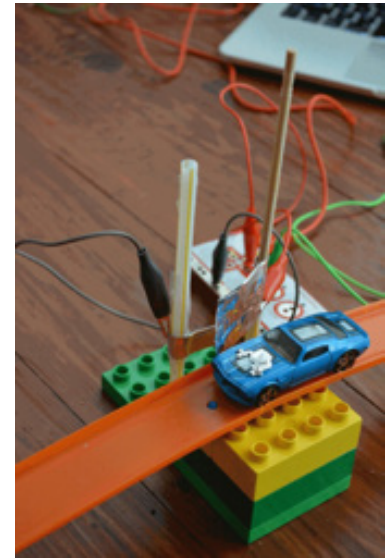
DIY SWITCH IDEAS FOR YOUR TRACK
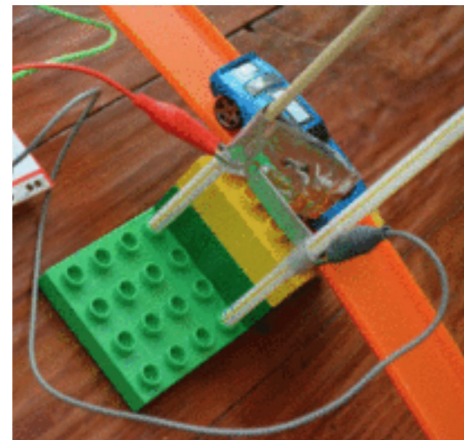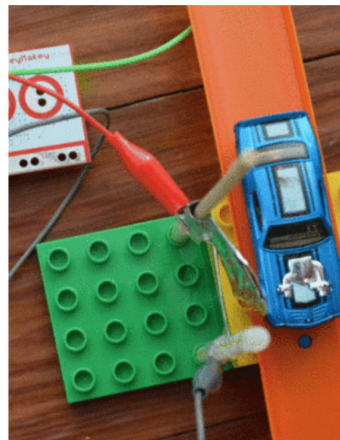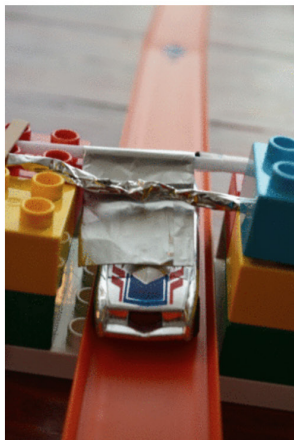
LOGGING DISTANCE, TIME AND SLOPE

Students can use this chart or create their own to log the dedicated distance, changes in slope, time of travel, and added weight for each experiment. Students will need to log the time for each car trip and hit the green flag to reset the time. They can run as many experiments as you desire.

https://scratch.mit.edu/projects/69958978/

UTILIZING DISTANCE FORMULA TO FIND RATE

The Scratch game has a formula built in and is programmed to run the equation 10 times
- To use the built-in formula have your students connect the 'w' key to an 'equation' switch.
- If students want to log more than 10 answers, they can hit the 'w' key again to start the equation over.

EXTENSIONS

- Convert rate from inches per second to mph.

- Change the slope of the ramp and perform the experiment over again! How much did the rate change in conjunction with the change in slope? Create a line graph of your experiments.

- Create a word problem based on this experiment.

- Use a small ball or marble to recreate the experiment.

- Add friction to the track with strips of double stick tape or adhere sections of paper to the track.

- Create a jump on the track between two timers. Does the car travel faster or slower now? Why?

LESSON 3 — SIMPLE CIRCUITS CHALLENGE

By: Colleen Graves | Appropriate for ages 9 to 13

SUMMARY

Simple Circuit: To complete a simple circuit, you must create a loop for the electrons to flow. So you need to get power from your power source to the LED and back to the power source. If you build a successful current, your light will shine! In this lab, you will create your own simple circuits with Makey Makey and once you've mastered that, you'll move on to parallel circuits. Lastly, you'll create your own DIY switch with Makey Makey!

LESSON OBJECTIVES

- Introduce the TMI Design process from Invent to Learn — Think Make Improve
- Complete circuit challenges
- Create simple circuits with LEDs and Makey Makey
- Create switches with playdoh, paper clips, pennies, and other conductive resources
- Engage students in simple electronics
- Entice students to create with technology rather than just consume it

NEXT GENERATION SCIENCE STANDARDS

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.
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-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

LESSON MATERIALS

- Makey Makey for each student or partner groups
- Alligator Clips
- Prepared Telephone wires (tutorial below)
- Tinfoil
- Playdoh
- Popsicle Sticks
- Strawberries or other conductive fruits
- Small conductive items for switches: copper brads, paperclips, pennies, etc

LESSON GUIDE

SIMPLE CIRCUITS

To complete a simple circuit, you must create a loop for the electrons to flow. So you need to get power from your power source to the LED and back to the power source. If you build a successful current, your light will shine! In this lab, you will create your own simple circuits with Makey Makey and once you've mastered that, you'll move on to parallel circuits. Lastly, you'll create your own DIY switch with Makey Makey!

PREPARING TELEPHONE WIRES
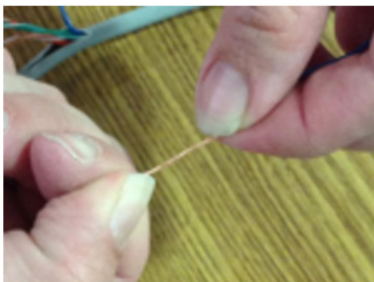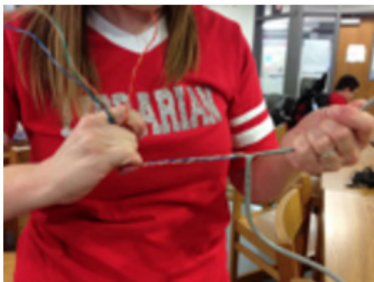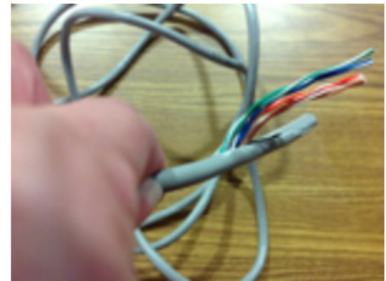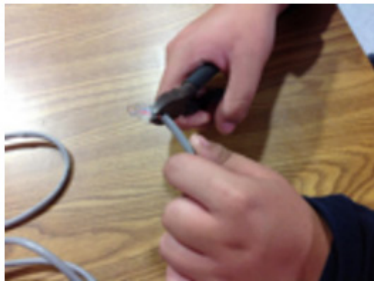
STUDENT MAKEY MAKEY CHALLENGE CARDS

Note: You will facilitate this like a Science Lab

Simple Circuit Challenge 1:

Simple Circuit: Can you figure out where to plug in the LED on the Makey Makey and complete a circuit by touching playdoh? (Remember that LEDs have a short leg to indicate the negative side. You need to create a loop for the current to flow!)

Simple Circuit Challenge 2:

Can you use people to complete the circuit? Can you add people and the LED still light up? How many people can be in your chain and still complete the circuit?

Simple Circuit Challenge 3:

Create a Makey Makey keyboard with tinfoil and popsicle sticks. (Hint you will need to create your own piano with Soundplant application or find a piano on Scratch that uses WASDF keys)

Simple Circuit Challenge 4:

Can you create human piano keys? Can play the piano by playing your friends?

Simple Circuit Challenge 5:

Building a Switch: Can you make a switch with Playdoh that will still light up your LED on the MM without using yourself or another person as a ground? (Hint: You will need two alligator clips to Earth.)

Simple Circuit Challenge 6:

Parallel Circuit: How can you create a parallel circuit that will successfully light up a second LED? (Hint: Where is your LED getting output from?)

Simple Circuit Challenge 7:

Parallel Circuit: How many LEDs can you power? What ports on MM will allow you to power LEDs? (Hint: Earth is your ground/Attach your LED negative led to earth!)

Simple Circuit Challenge 8:

Building a Switch: What other materials can you use to build your own switch? What materials work? What won't work? Why?

Simple Circuit Challenge 1:

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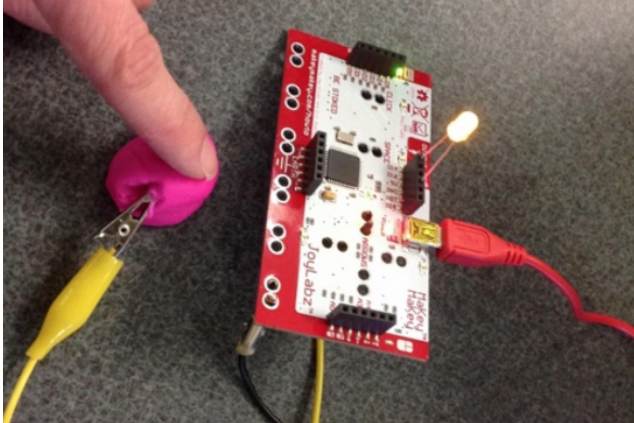

Simple Circuit Challenge 8:

Building a Switch: What other materials can you use to build your own switch? What materials work? What won't work? Why?

LESSON 4 – MAKEY MAKEY ELA CANDID CAMERA

By: Colleen Graves | Appropriate for ages 9 to 18

SUMMARY

Combine Makey Makey with a webcam to create candid stories about your classroom. In this lesson you can also learn how students can write out short tableaus and create GIF cards for visualizing ideas in a text or even vocabulary reinforcement. Tableaus also work for other contents. Social studies teachers can use this lesson for understanding historical events and science teachers could ask students to act out scientific ideas and concepts.

LESSON OBJECTIVES

- Learn to build a switch
- Review or analyze literature concepts, vocab, or sentence structures
- Use kinesthetics to reinforce sentence structures, vocabulary, or plot of a story
- Write a GIF as a dramatic tableau (visual still dramatizations of the ideas in a text)
- Practice script writing from visual clues
- Story writing and the elements of a plot
- Discuss privacy issues and digital citizenship

COMMON CORE STANDARDS

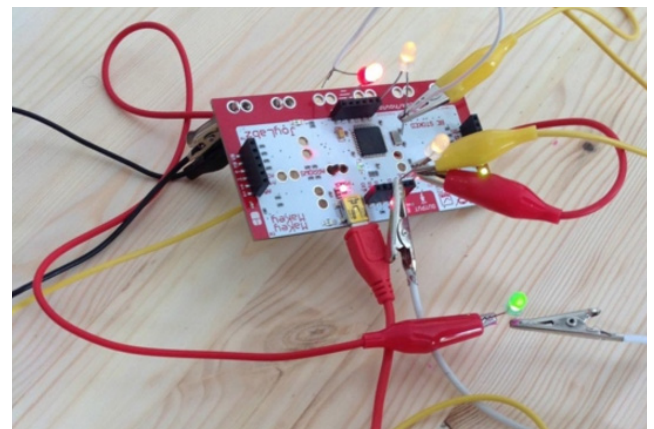|	
CCSS.ELA-LITERACY.W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
CCSS.ELA-LITERACY.W.4.8	Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
CCSS.ELA-LITERACY.SL.6.1.D	Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.
CCSS.ELA-LITERACY.RL.6.3	Describe how a particular story's or drama's plot unfolds in a series of episodes as well as how the characters respond or change as the plot moves toward a resolution.
CCSS.ELA-LITERACY.W.8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
CCSS.ELA-LITERACY.RL.9-10.2	Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.
CCSS.ELA-LITERACY.RL.9-10.3	Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a text, interact with other characters, and advance the plot or develop the theme.
CCSS.ELA-LITERACY.RL.9-10.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).

NEXT GENERATION SCIENCE STANDARDS

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.
4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

LESSON MATERIALS

- Makey Makey for each student or partner groups
- Alligator Clips
- Computer with webcam
- Tinfoil

LESSON GUIDE

DAY 1

Create a switch and review a literature concept, vocabulary, or discuss sentence variety.

1. Discuss the concept of creating loops to complete circuits and have students create 1-3 switches for the GIF maker computer (s). (If you have enough Makey Makey's and computers, you could have students work in groups of 2 to create multiple GIF Maker stations.)

2. Have students perform and record dramatic tableaus with the GIF cards you've created that review a literature concept or vocabulary. (You could also create sentence strips, pass out to small groups, and have students create GIFs of the variety of ways you could structure the same sentence.)

DAY 2

Discuss storytelling without words, review plot guidelines, and have students create their own GIF cards for others.

1. Have students read a wordless picture book in small groups. Here are some great titles:
   - Journey
   - Mr. Wuffles
   - Flotsam
   - The Red Book
   - Zoom

   While high school students can enjoy picture books, here are some other books older students might enjoy:
   - The Arrival
   - Unspoken: A Story from the Underground Railroad
   - Robot Dreams
   - Blood Song

2. To reinforce the concepts of narratives for younger grades, have the students prepare comic strips of a story without any words. (Ex: How would they act out a story about a student late to class?) Then let students exchange comics and act out and record the GIF at a Makey Makey GIF maker station.

3. For older students, let them choose to create their own wordless story with drawings, or create the story by writing actions on the GIF cards for the other players.

4. Exchange cards and create GIFs at a GIF maker station. Save GIFs on class Tumblr, Weebly, or collaborative Google Doc.

DAY 3

Discuss digital citizenship and privacy issues, create a candid camera station with signage.

1. Digital Citizenship lessons on Teaching In Ctrl

2. Digital Citizenship and Living in a Digital World

3. Digital Footprint lesson on oversharing.

Students can create their own digital citizenship public service announcement or explain how their candid camera works and upload a unique QR code

4. Have students create a sign about the classroom Makey Makey Candid Camera to let others know that appropriate behavior is expected when creating a candid camera story. Above is an editable version in Canva that was created.

Position sign, student made GIF cards, and GIF Maker Station in the classroom to collect images for a selected period of time.

FINAL DAY

After you've collected enough Candid Camera GIFs, have students watch GIFs and create original stories based on the GIF of their choice. Review narrative elements: plot elements, sensory details, word choice, ideas, organization, etc. You could even create a persuasive digital story with the images and overlay text and voice like this video poem by Eric Shabazz Larkin.

GIF MAKER STATION

Students will need to:

1. Create instructions

2. Create switches with numbers (One connection to earth and one connection to click)

3. Hook up computer and Makey Makey

4. Navigate computer to webcam and hover the arrow over the camera click

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GIF CARDS

Use these GIF cards as examples for students to act out and create GIFS with GIF pal then upload to class Twitter or class Tumblr account.

TABLEAU INVENTIVE STORY EXAMPLES

Create a wordless story by acting out this card in just 3-5 images. The story should have a beginning, middle, and end. ———— Getting a bad grade in class

Create a wordless story by acting out a story with your body in just 3-5 images. Your story should include a beginning, middle, and end. ———— Feeling claustrophobic.

Create a wordless story by acting out a story with your body in just 3-5 images. Your story should include a beginning, middle, and end. ———— A surprise party for a friend

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VOCABULARY REVIEW EXAMPLES

1	2	3	4
Walk on one side of the room	Stop and smell flowers	Walk distractedly to other spot in room	Walk in a circle

(Vocab review for word: meander)

IMPORTANT PLOT POINT EXAMPLE WITH ROMEO AND JULIET

1	2	3	4
Romeo and Juliet meet, fall in love, get married	Romeo kills Tybalt and gets banished	Juliet pretends she died, Romeo finds her...	Families make amends over the loss of their children.

WRITING YOUR OWN GIF CARDS

Create partners or small groups, and instruct students to write their own GIF as a dramatic tableau that reviews a concept from a literature book, vocabulary, or desired content. Students will then exchange GIF cards and have other groups create their GIF with Makey Makey and computer and upload to class Twitter or class Tumblr account.

Examples for GIFs:

- Students can be instructed to portray the beginning, middle, and end of the most important plot points in a short story or book.
- Students might create a tableau of the changing aspects of a character throughout a story.
- Students could write a visualization of important themes from a book.
- Students could write out actions for understanding a vocabulary word.
- Students could write out sentence structure cards to act out a variety of structures for the same sentence.

LESSON 5 — MATH/SCIENCE CLASSIFY AND SORT

By: Colleen Graves | Appropriate for ages 9 to 14

SUMMARY

Inspired by the Operation game, you'll finally have a reason to make a sorting game with Makey Makey!

LESSON OBJECTIVES

LESSON A

- Identify Shapes: polygon, quadrilateral, triangle, square, rectangle, rhombus, trapezoid, parallelogram, hexagon, diamond, pentagon, octagon, decagon
- Use a geoboard to brainstorm shapes
- Describe objects: vertices, angles, sides, quadrilateral, right, acute, and obtuse angles, parallel, intersecting, perpendicular lines

LESSON B

- Identify types of triangles by sides: Scalene, Isosceles, Equilateral
- Identify types of triangles by angles: Acute, Right, Obtuse, Equiangular
- Draw all types of triangles, figure out the angles, calculate the sum of the angles of each triangle

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COMMON CORE STANDARDS

CCSS.MATH.CONTENT. 4.OA.A.1-3	Use the four operations with whole numbers to solve problems..
CCSS.MATH.CONTENT. 4.G.A.1-3	Draw and identify lines and angles, and classify shapes by properties of their lines and angles.
CCSS.MATH.CONTENT. 6.G.A1-4	Solve real-world and mathematical problems involving area, surface area, and volume.
CCSS.MATH.CONTENT. HSG.SRT.A.2:	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

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-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*
MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. Use mathematical and/or computational representations of phenomena or design solutions to support explanations.

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

LESSON MATERIALS

- Makey Makey for each student or partner groups
- Alligator Clips
- Protractor
- Ruler
- Lesson A: Hinged cardboard box, duct tape, copper tape, aluminum foil and Classifying Shapes Scratch game example
- Lesson B: Poster board, pencils and Classifying Triangles Scratch game example

LESSON GUIDE

LESSON A – CLASSIFYING SHAPES

DAY 1

Creating Shapes and Shape Sorter

1. Brainstorm shapes with a geoboard that you want to use for your Operation style game.

2. Using a ruler or stencil, have students draw the shapes you want them to study on a thin piece of cardboard (like an old cereal box.) Students should measure angles, count sides and vertices, define line types, and make an answer guide/ cheat sheet with all of the information of their drawn shapes. (View video tutorial here.)

3. Use an exacto knife to cut a slit and then use scissors to out the shapes students have drawn.

4. Once shapes are cut, use them to trace the shapes on the hinged box and then cut out the shapes from the lid of the hinged box. If desired, use the holes on the box lid to trace shapes onto the inside of the box. (See original Operation pdf for pictorial guidelines.) Students may need to do this twice. Once for the "guts" of the game and the other for creating tactile holes on the lid of the shoebox for game play.

5. Students need to check that the cut out shapes have the correct amount of sides, vertices, and line types for corresponding shapes. Ask students to refer to their answer guide/cheat sheet to double check. (See - we are getting tricky here making them remember their math, but they just think they are making a game!)

6. Cover the lid with duct tape , but trim away where the shapes are cut out. See this tutorial.

7. Line the shape holes with copper tape and make sure all of the tape leads to EARTH on the inside of the box. This will be how students make a switch. When they place their shapes into the right spot, it will signify to Scratch that they have placed their shape into the sorter.

DAY 2

Create a corresponding game in Scratch

1. For each shape, students need to create a "When block" that will announce the shape when it is placed inside the correct slot and score points if desired.

2. If you have enough time, students could add questions to their Scratch game based on the shape's:
   - right, acute, or obtuse angles
   - vertices
   - sides
   - parallel and intersecting (including perpendicular) lines

This will further cement the math vocabulary in their head!

Trade and play!

1. Students will have blank charts to determine for each game they play:
   - right, acute, or obtuse angles
   - vertices
   - sides
   - parallel and intersecting (including perpendicular) lines

2. Have students play with the shapes, and fill in charts.

3. Evaluate games with "I like, I wonder" stickies

LESSON B – CLASSIFYING TRIANGLES

Maybe your student don't have time to make a board game, but you will want them to create a sorting activity. In this lesson, students can make a simple sorting poster by drawing shapes with a pencil!

1. Give students this triangle guide.

2. Using a protractor and ruler, students should draw each type of triangle on a poster. They need to measure all sides and label at least one angle in each triangle.

3. Students will draw a kite tail from each triangle to the end of the poster so they can attach an alligator clip.

4. In Scratch, students need to create a corresponding game that will speak when students interact with the poster.

5. Trade games and play! (Follow guidelines in Lesson A for day 2-3)
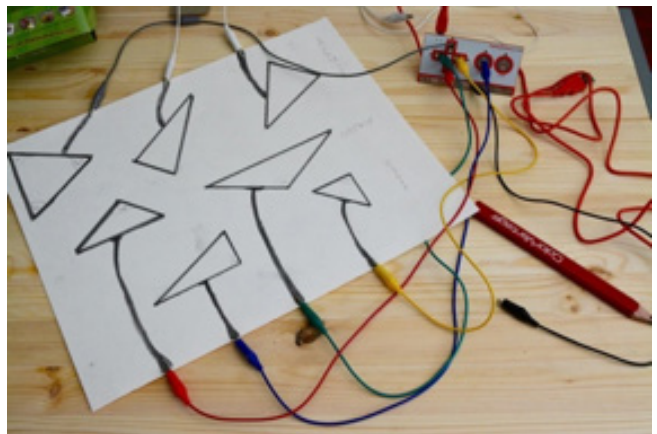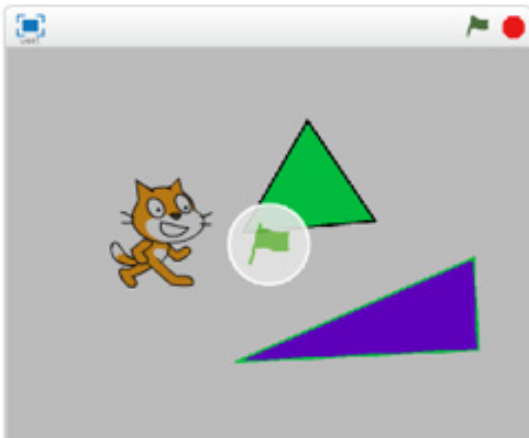
LESSON 6 — MAKEY MAKEY GAME CONTROLLER CHALLENGE

By: Colleen Graves | Appropriate for ages 10 to 18

SUMMARY

Want to get your whole school involved in coding and game creation? Maybe even challenge another school and host a maker faire? Connect with others by starting a #makeymakeychallenge and start building your maker community.

LESSON OBJECTIVES

- Introduce the TMI Design process from Invent to Learn — Think Make Improve
- Design and create a video game in Scratch
- Create an interactive game controller to control the student made game
- Engage students in innovation and creation
- Entice students to create with technology rather than just consume it

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COMMON CORE STANDARDS

CCSS.ELA-LITERACY.W.8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.
CCSS.ELA-LITERACY.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
CCSS.ELA-LITERACY.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
CCSS.ELA-LITERACY.SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
CCSS.ELA-LITERACY.SL.9-10.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

NEXT GENERATION SCIENCE STANDARDS

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.
4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

LESSON MATERIALS

- Makey Makey for each student or partner groups
- Alligator Clips
- Tinfoil
- Playdoh
- Copper Tape, thumbtacks, or pencils
- Scratch game to remix

LESSON GUIDE

DAY 1

Invitation to Innovate

1. Set out a computer, a Makey Makey and a box of conductive and nonconductive items for each small group.

2. Share the Makey Makey page and basic how to

3. Direct students to open one of the games on the how to page.

4. Help students connect alligator clips to Makey Makey and some conductive items.

5. Let students play and test out different materials.

DAY 2-3

Storyboard and Design Sketches (Think)

1. Now that the students are familiar with the Makey Makey, have them create storyboards for a game they would like to design in Scratch.

2. Students should also begin to sketch ideas for their controller, but don't worry if they aren't ready to do this, it might change as they create their games.

3. Have small groups discuss game and controller plans. Do the other students think the game sounds playable? Do they have different ideas on how to control the game? Pair up students to collaborate if needed or desired. You may have some students who only want to create the game and some who only want to make a controller. That's okay! Pair them up!

DAY 4-5

Create Games in Scratch and Build Controllers (Make)

Note: Your students may prefer to create the game and the controller simultaneously or separately- all that matters is that the concepts are held together with a common theme.

1. Give students time to create games in Scratch.

2. Bring in boxes and boxes of scrap and junk for students to tinker with. See if you can get some old electronics donated. Let students take things apart and use the old electronics for their game controllers. Also, give them a project shelf to store their creations over the course of your design challenge.

While you have students creating games in Scratch, demo some of the different ways a Makey Makey can control a game somewhere in your room. Create a graphite drawing that controls a Scratch Piano, or make a Playdoh sculpture that resembles Tetris. Be imaginative and show the kids that adults can tinker too!.
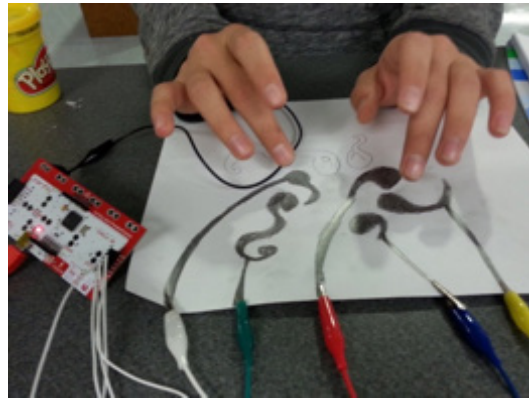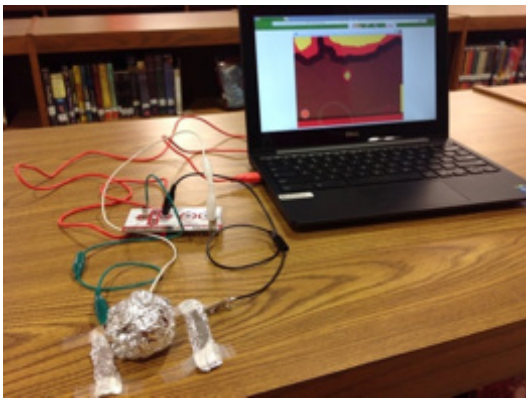
DAY 6

Share student games and ideas with Experts for feedback (Improve)

Find an expert like another class who has completed the challenge, or a group in a makerspace with Makey Makey experience to conference with. Ask them to chat with your students. Let your students share ideas about their creations and gather feedback from the experts. This chat should help to, in the words of Jay Silver, "instill creative confidence" in your young makers.

DAY 7

Set up Game Installations (Make/Improve)

1. Have students set up games and controllers in a gallery setting like the library.

2. Give them clipboards and feedback sheets and allow them to try each other's controller games and list some "I think" and "I wonder" statements about each game they try.

3. Allow students to read feedback and improve controllers as necessary.

(Before Challenge)   (During Challenge — Embrace the mess!)

DAY 8

Set up a Mini Maker Faire and invite community to participate!

Once games and controllers are finished, invite the community to your Makey Makey Maker faire! If you can, share your student products on social media and have them launch another classroom's Makey Makey Game Controller Challenge!

LESSON 7 – MAKEY MAKEY MUSICAL WATER

By: Colleen Graves | Appropriate for ages 10 to 18 (with adaptations)

SUMMARY

Don't know coding? Want to dip your feet in the Makey Makey pool with minimal start up or fuss? Then this is the lesson for you! Let students explore soundscapes with real objects in this musical water lesson that utilizes a key mapping software called Soundplant.

LESSON OBJECTIVES

- Introduce the key mapping concept
- Use time order to sequence steps and music
- Identify how important sequence is in music
- Use singing to reproduce melodies
- Demonstrate awareness of rhythm and phrasing in music
- Identify themes, musical phrases and note structures in music
- Preform rounds, partner songs, and four-part harmony from vocal arrangements

COMMON CORE STANDARDS

CCSS.ELA-LITERACY. RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
CCSS.ELA-LITERACY. SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

NATIONAL CORE ARTS STANDARDS

|	
MU:Cr1.1.6	Generate simple rhythmic, melodic, and harmonic phrases within AB and ABA forms that convey expressive intent.
Music - Composition and Theory Strand: Anchor Standard 1	Generate and conceptualize artistic ideas and work.
MU:Cr2.1.C.Ia	Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.
MU:Cr3.2.C.IIa	Share music through the use of notation, solo or group performance, or technology, and demonstrate and describe how the elements of music and compositional techniques have been employed to realize expressive intent.
MU:Pr4.1.C.IIa	Identify and select specific passages, sections, or movements in musical works that express personal experiences and interests, moods, visual images, concepts, texts, or storylines in simple forms (such as binary , ternary , rondo) or moderately complex forms.
MU:Cr1.1.T.IIIa	Generate melodic, rhythmic, and harmonic ideas for compositions and improvisations that incorporate digital tools, resources, and systems.
MU:Cr2.1.T.IIIa	Select, develop, and organize multiple melodic, rhythmic and harmonic ideas to develop into a larger work that exhibits unity, variety, complexity, and coherence using digital and analog tools, resources, and systems.

LESSON MATERIALS

-       Makey Makey for each student or partner groups
-       Alligator Clips
-       Cups or tubs
-       Water
-       Prepared telephone wires (tutorial below)

LESSON GUIDE

PREPARING TELEPHONE WIRES
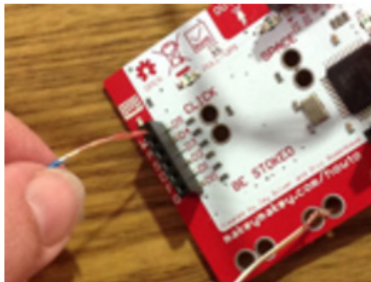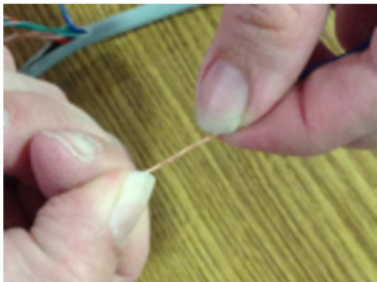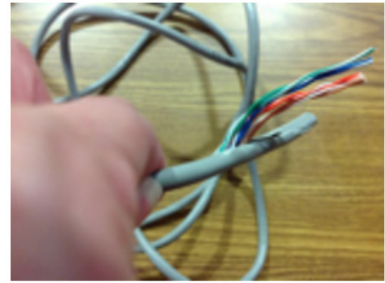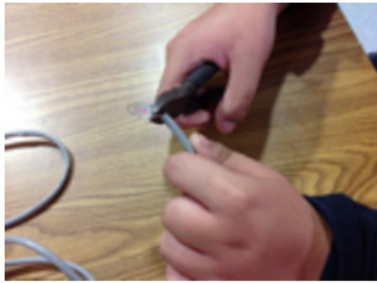
OVERVIEW

Using Audacity (or a web application), students can record their own voice or instrument and make a wav or mp3 file. The students will connect those wav/mp3 files to keys on the computer utilizing Soundplant. Lastly, the Makey Makey will allow students to play the parts they've recorded by linking the water to the keys on the computer keyboard.
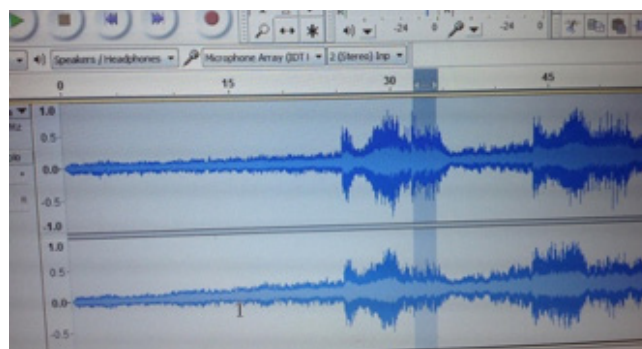
OVERVIEW (CONT.)

Musical lesson ideas that will work with this concept:

- Using Audacity, students can record each musical section of a song (verse/chorus/bridge) and then challenge others to play the water in the correct sequence or find the correct rhythm, or whichever objective you decide to cover.

- Since the Makey Makey will allow you to layer songs, this would be a great activity to introduce the concepts of singing in the rounds or perpetual canon.

- Students could compose a song for four part harmony and use Audacity to record each vocal section. (If band or orchestra wants to recreate this lesson you could have students record themselves playing notes on an instrument). In this way, when students "play" the water, they can test the harmony in their composition.

- You could introduce rhythmic notation by having students draw notes on the water cups, so others would have to correctly read and play the water to get the correct duration. (Students could practice timing of 16th notes, 8th notes, whole notes, etc.)

- Students could record a pitch scale, and draw notes on a water scale to practice pitches.

DAY 1

After teaching the musical theory concept you want to cover, get your kids excited about the musical possibilities with Makey Makey by watching videos at makeymakey.com/gallery/?tag=soundplant

- Use Audacity to record voices or instruments and export files as wav or mp3 files. You can also use these web applications:

- Vocaroo - super simple, you will just need to download the mp3 or wav file.

- Audioboom - record up to 10 min the only downside is you have to create a log in.

- Soundcloud- You'll have to create an account, click upload, and then "start new recording." Then you can download your file when you are happy with your recording.

- Alternatively, you can import a file into Audacity and have student select a musical phrase and then export each selection as a wav file.

DAY 2

Introduce key mapping concept with software Soundplant.

View Soundplant tutorials and creations at makeymakey.com/gallery/?tag=soundplant

1. Choose keys and upload wav files or drag and drop wav files to desired keys

2. Connect ports on Makey Makey to match keys programmed with Soundplant

3. Connect wires to water – Set up in cups, tubs, etc.

4.   Create an "earth" or ground

5.   Play Musical Water! Have students play water to experience to concept in which you focused your lesson.

MAKEY MAKEY TIPS AND TRICKS

SOLVING COMMON PROBLEMS

The following tips and tricks can help you solve some common problems you may encounter when using the Makey Makey in your classroom.

I can't get a key to press!

- Make sure your Makey Makey is plugged into the computer.

- The Makey Makey should have a red light on the back showing that the power is on. Is it lit? If not something is wrong with the computer, the USB cable, or the circuit board.

- If the USB connector on your computer is blue, it's USB 3.0, and may not work with Makey Makey. Try using a USB 2.0 port.

- Try making a connection in the simplest way you can. One way is to connect an alligator clip to "earth" and then touch other end to "space."

- When you make a connection, you should see an LED light up on the front of the Makey Makey

- When you are making a connection using everyday materials they need to be at least a little bit conductive. For example, play-doh, a banana, your skin, or aluminum foil should work, but plastic, most fabrics or paper will not work directly. You can always combine materials, for example by wetting the paper or putting play-doh onto the plastic.

One of the keys won't stop pressing over and over! What should I do?

- Try unplugging the Makey Makey from your computer, then plug it back in again

- Disconnect all of you alligator clips from the Makey Makey, then start reattaching them one by one

- If your stuck key is still pressing, have a look at your connections. They might be touching accidentally somehow. Try taking things apart and putting them back together again.

- Perhaps one of the things that you are using as an insulator (or non-conductor) isn't insulating enough. Try using a different material.

- If one of the objects connected to the Makey Makey is your own body, then perhaps you are "grounded" to the earth via touching your computer's metal case, or by not wearing shoes. Take a step back and see what you are touching.

One of the keys won't stop pressing over and over! What should I do? (CONT.)

- Perhaps one of the objects connected to the Makey Makey that you think is well insulated is not. For example, if you connect a banana to your Makey Makey and it's sitting on a wooden cutting board, is that cutting board moist or dry? If it's moist then perhaps all of your bananas on the cutting board are connected to each other through the cutting board. Try a dry table instead.

- Is it raining? Is it extremely humid- are you in a rainforest? This can sometimes cause porous materials, such as paper or clothing, to become conductive.

It works sometimes, but not other times...

- Your materials might not be conductive enough. For example, if you are making a connection with your fingertip, it can help to moisten your skin by licking it.

- If you are using a drawn graphite line from a pencil, make sure the line is heavy and dark. Draw your line on a hard smooth surface, such as a table without any grain in it. Take care in folding the paper, because it can sometimes break the graphite connection. Once you are expert at drawing the lines, you don't have to follow any rules, but if you can't get it to work try the tips mentioned.

TRY OUT DIFFERENT MATERIALS

Make anything into a key! You can make a connection through anything that's even a little bit conductive. You can also create inventions that combine conductive and non-conductive parts.

Conductive Materials

Here are a few things to try:

- Most fruits and vegetables work great.

- Lots of other foods work too. We've tried marshmallows, gummy candies, macaroni and cheese, cupcakes, shrimp, and lots of other things.

- Plants can work too. Try some leaves or flowers, but nothing too dry.

- Play-Doh, Model Magic and other clays work very well as long as they stay moist.

- People are conductive! Connect one person to ground, and another to an input, and you can trigger sounds when they high-five.

Conductive Materials (CONT.)

- Graphite from a pencil can work. Make thick, dark lines, and be sure to draw on a smooth surface.

- Foil and other metal objects will work. Try out coins, magnets, nuts and bolts, forks and knives, or pots and pans.

Craft Materials

When you're inventing, anything goes! Here are a few things we have enjoyed using:

Inflatable beach balls, paper plates, cardboard boxes, various types of soft and rigid foam, Lego bricks, plastic storage boxes, stuffed animals and other toys, funny hats and other pieces of clothing, sheets of fabric, string, yarn, elastic, and paper.

It's also important to have around some tools for cutting, like scissors and exacto knives, and ways to stick things together, like hot glue, superglue, various kinds of tape, and clips or clamps.

MAKEY MAKEY COMMUNITY

In addition to the resources referenced throughout this guide, these web resources will provide continued support as you implement Makey Makey in your classrooms.

LESSON PLANS ONLINE
makeymakey.com/lessons/
Additional full lesson plans that you can implement into your classrooms.

GROUP ACTIVITY GUIDES
makeymakey.com/guides/
Detailed inspiration for leading a group of curious activities in your home, Makerspace or school!

SHARE YOUR IDEAS

Have a great Makey Makey lesson idea? Or do you want to share some of your experiences with the Makey Makey? Please share with us at info@joylabz.com.

CONTACT US

Our team is happy to help with any of your questions, comments and enquiries:

info@joylabz.com

+1-831-460-6242

Facebook https://www.facebook.com/makeymakeykit

Educators FB group https://www.facebook.com/groups/makeymakeyeducators/

Twitter http://twitter.com/makeymakey

MEET THE AUTHORS

COLLEEN GRAVES is a high school librarian and blogger, obsessed with Learning Commons transformations, Makerspaces, Makey Makey, technology education, making stuff, and getting girls involved in STEM. She offers the unique perspective of starting/creating two different makerspaces and Girl STEM groups in established public schools. Colleen writes and presents about creating makerspaces in the book Challenge Based Learning in the School Library Makerspace. Plus, she collaborated with her husband to create two makerspace project books for makers on any level The Big Book of Makerspace Projects and 20 Makey Makey Projects for the Evil Genius. (Photo Credit: Michael Madsen)

AARON GRAVES is a school librarian with 15 years of experience. He is a mash-up of robot geek, book lover, and tech wizard. Aaron gained his perseverance for projects through collaborative and interactive art experiences as a member of the Good/Bad Art Collective. (Photo Credit: David Minton)