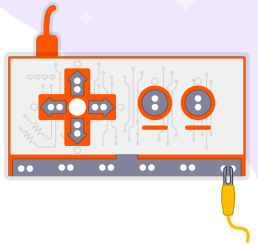
SCRATCH LESSON PLAN



Physical Computing with Scratch and Makey Makey

The Makey Makey brings the physical world together with Scratch by mimicking a keyboard, letting you control any computer program with everyday conductive objects like food, conductive tape, graphite pencil, metal, Playdoh, your own body, and more! You can connect it to Scratch and build creative projects that combine the magic of the digital and physical worlds.

Audience:

Classroom Teachers, Instructional Technology Specialists, Library Media Specialists, Informal Learning Environments

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Time: Approx 1.5 hours total

- Part 1: Setup and Test - 15 min
- Part 2: Create a Makey Makey Project - 30-60 min
- Part 3: Reflect and Share - 30 min

Objectives (Learners Will):

- Identify ways to connect the physical to the digital world
- Create projects that utilize the Makey Makey blocks
- Remix and/or adapt projects that used keyboard keys, a mouse, etc., as inputs to use a Makey Makey as the controller
- Evaluate problems/identify bugs and test solutions
- Reflect on the design process
- Communicate and share their projects with their learning community

See page 10 for aligned standards.

Resources for Learners:

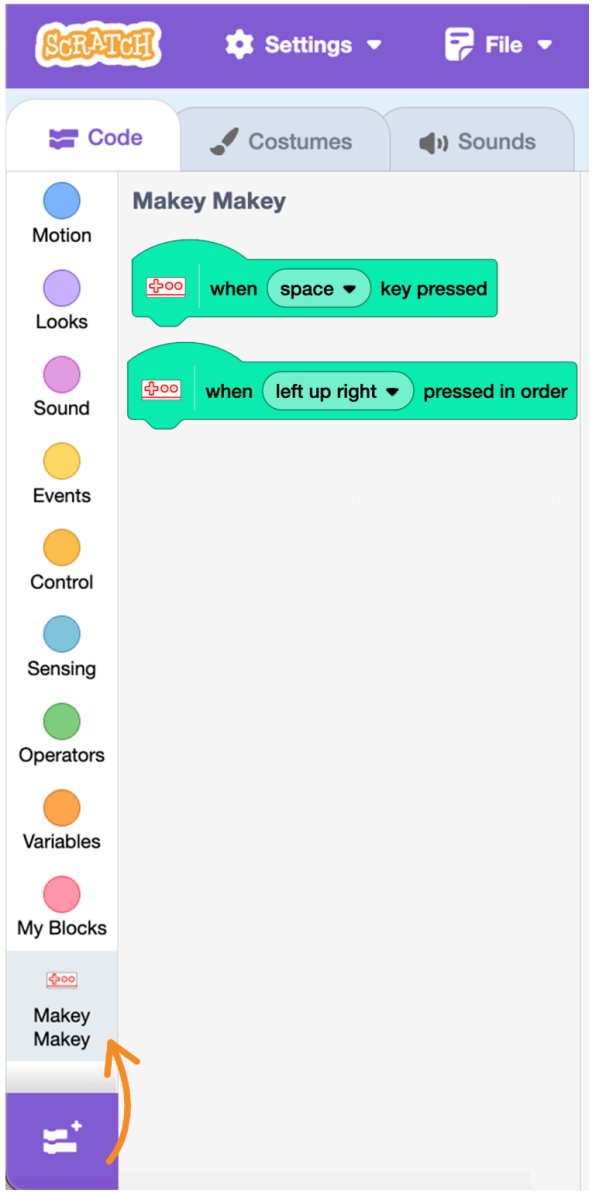
- Makey Makey Coding Cards (Student-Facing) - printable cards students can use to follow along with the lesson
- Scratch All Blocks Posters 18x24 including Makey Makey hardware diagrams and blocks
- Scratch Design Journal (Worksheet)
- Sprite Creation Cards (Student-Facing)
- Sound and Music Cards and Video Tutorial (Student-Facing)
- Conditional Statements Cards and Video Tutorial Part 1 and Part 2 (Student-Facing)
- Variables and Lists Cards and Video Tutorial Part 1 and Part 2 (Student-Facing)

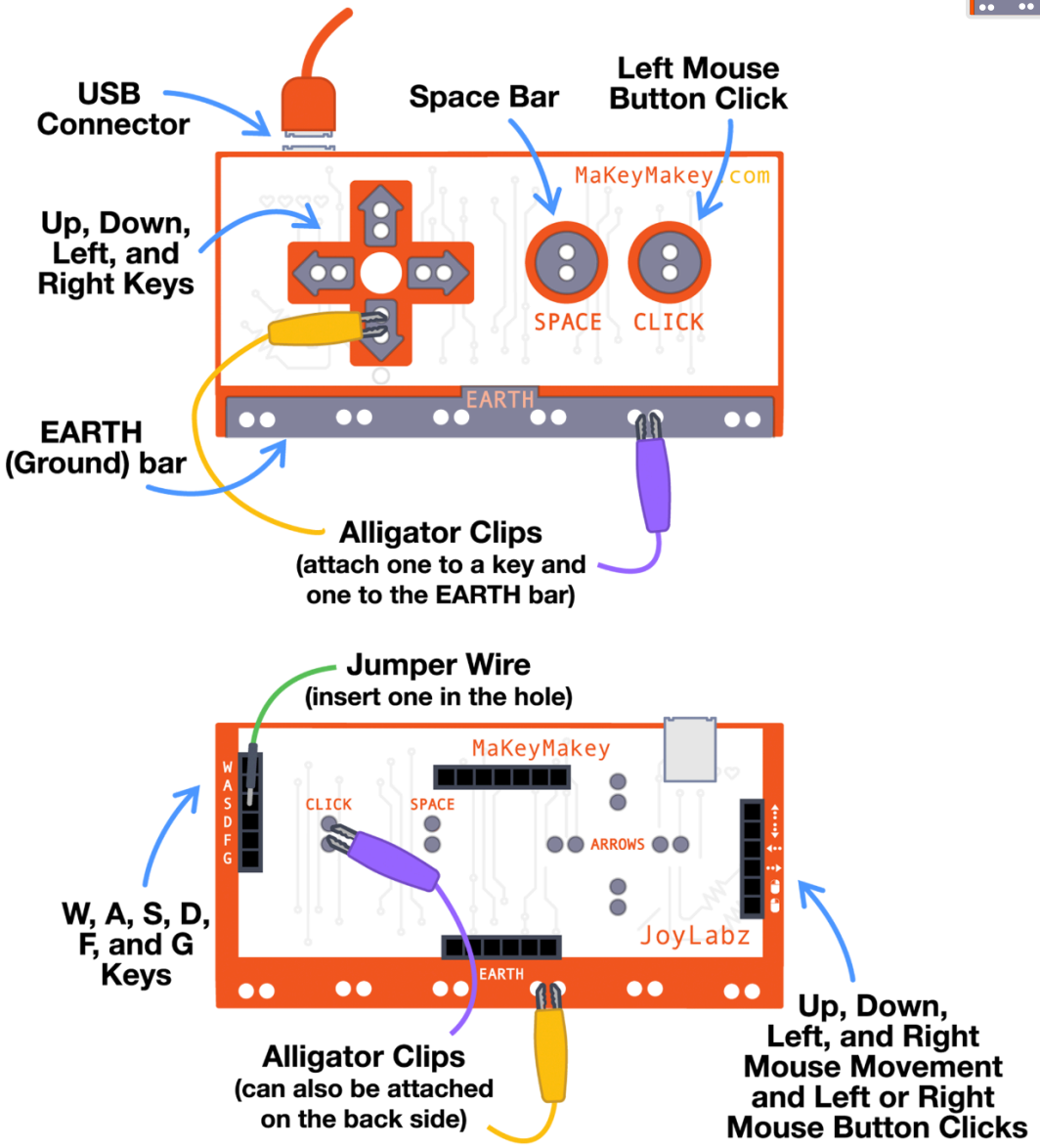
Additional resources provided throughout the guide.

Where to Purchase the Makey Makey

(Website)

Get to Know the Makey Makey Hardware and Blocks





To learn more about the available options on the back of the board, see this page from the Makey Makey blog. And a poster version of the Makey Makey hardware diagrams and blocks is available in the Scratch All Blocks Posters 18x24 set.

Part 1: Setup and Test

Setup (10 minutes)

To add the Makey Makey extension, click on the extension menu in the lower-left corner of the Scratch project editor and choose “Makey Makey.”

Step 1: Plug the Makey Makey board into your computer using the provided cable. You should see a light turn on on the board to know it is connected properly. (There is no need to install any software.)

Step 2: Connect an alligator clip to any set of holes along the “EARTH” strip on the bottom of the board.

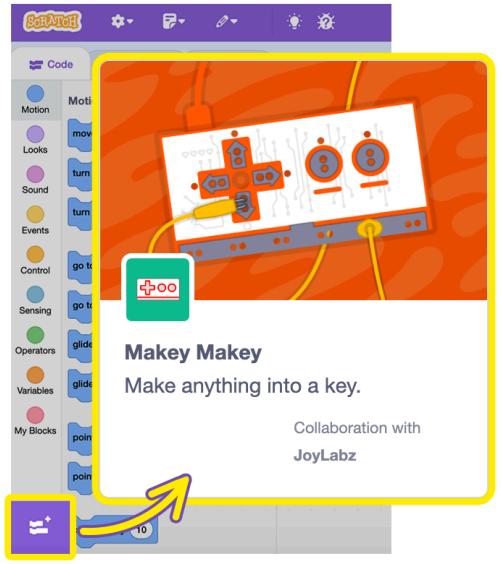
Step 3: Connect an alligator clip to any of the holes aligned with a keyboard key.

Step 4: Create a script to run when that keyboard key is pressed.

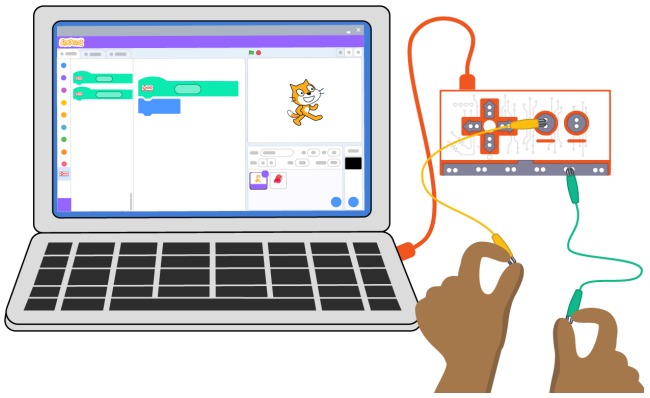
Step 5: Close the circuit to make the program register that keyboard key was pressed by holding the metal part of each alligator clip (key and EARTH).

Resources:

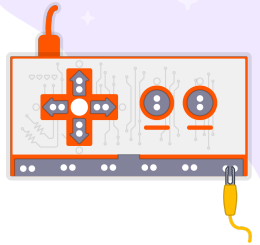
- Makey Makey Coding Cards (Student-Facing)
- Makey Makey: Getting Started with Scratch (Website) - from the makers of the Makey Makey



Scratch Extension Menu and Makey Makey Extension



Connecting the Makey Makey and closing the circuit.



Test the Connection (20 minutes)

Test that the Makey Makey is working and explore closing a circuit by making an “Electric High Five.”

Step 1: Connect one alligator clip to EARTH on the board.

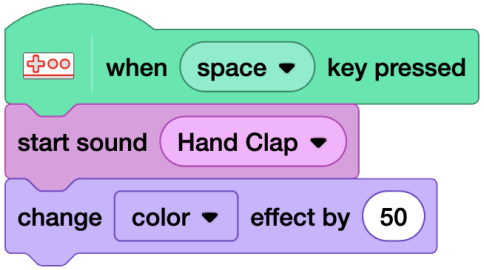
Step 2: Connect a second clip to a keyboard key, like space.

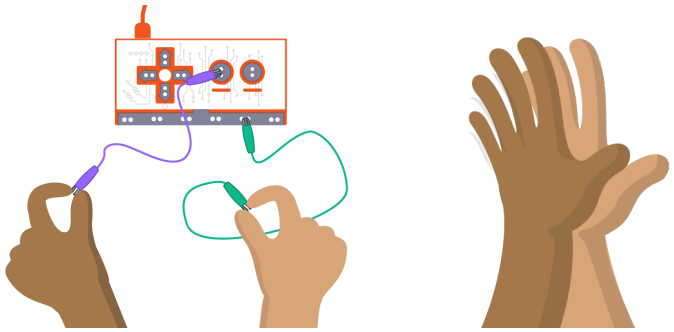
Step 3: Add code to happen when the keyboard key is pressed, like playing a sound or changing the sprite color.

Step 4: One person holds the alligator clip connected to the key. The other holds the clip connected to EARTH.

Step 5: With the free hand, give a high five to close the circuit and see the result!

Step 6: Test the conductivity of materials by attaching alligator clips to various objects and closing the circuit by touching the object and EARTH.





Example Scratch script for the “Electric High Five.”

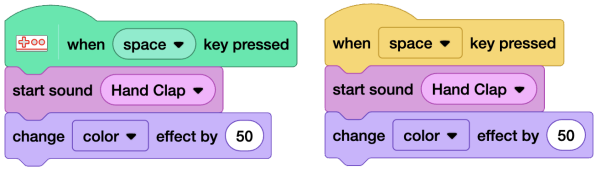
Resources:

- Makey Makey Coding Cards (Student-Facing)

Alternative Options

Technically, you don’t have to use the Makey Makey extension blocks. If you have a Makey Makey attached to your computer, you can use the “when _ key pressed” block as an alternative.

Note: The Makey Makey extension blocks do offer one unique hat block that starts programs with a key sequence.



The same Scratch script for the “Electric High Five” with different hat blocks.

Part 2: Create a Makey Makey Project

Option 1: Makey Secret Code

Use a keyboard combination connected to the Makey Makey to activate a secret code program. Touch the alligator clips or connected conductive objects in the right order to close the circuit and see the result!

Step 1: Select any sprite from the Sprite Library, or create your own. This sprite will react when the secret code is entered correctly.

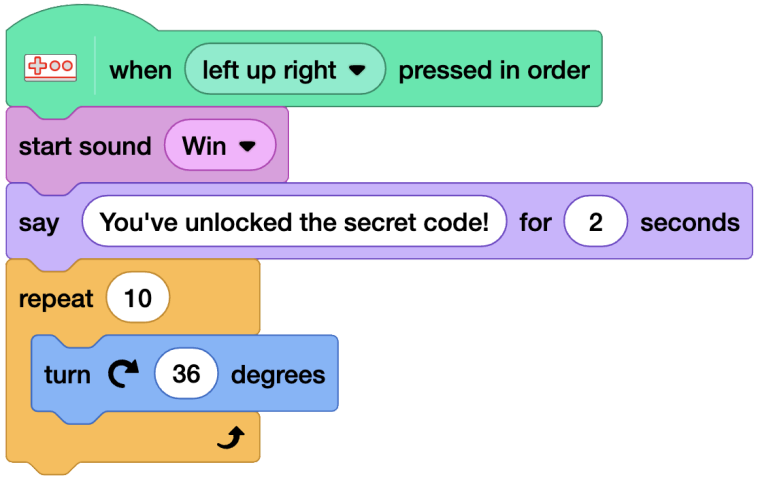
Step 2: Use a unique hat block available under the Makey Makey Extension blocks to choose the block combination to activate your program. Then, write a script to run when received.

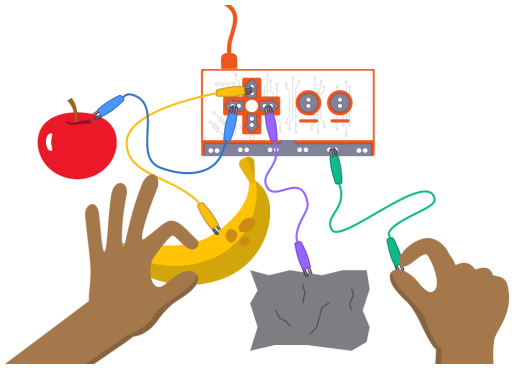
Step 3: Close the circuit to register each keyboard press by touching EARTH and each keyboard input in order.*

Step 4: Debug your code.

Step 5: What else can you add to customize your project? Perhaps add a second secret code!

*For fun, trying pressing the combination on actual keyboard keys versus the Makey Makey.





Example of a secret code script.

Resources:

- Makey Makey Coding Cards (Student-Facing)
- Sprite Creation Cards (Student-Facing)

Option 2: Foil Piano

Connect one alligator clip to EARTH and various alligator clips to multiple keyboard keys, which will represent various musical notes. Code a project so key presses play different notes. Use tin foil, bananas, Play-doh, or other conductive materials as external keys.

Step 1: Select any sprite from the Sprite Library, or create your own. For instance, you might draw piano keys.

Step 2: You can use either the Makey Makey extension hat block or the Event hat block to initiate your script.

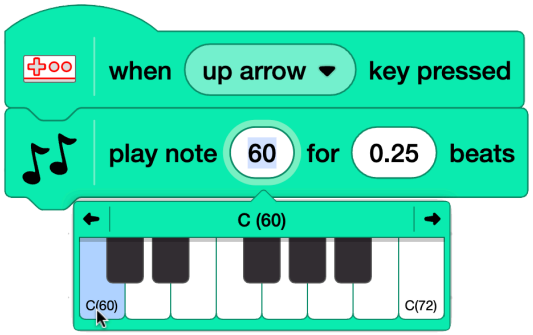
Step 3: Select note sounds in the Sound library to play when different keyboard keys are pressed.

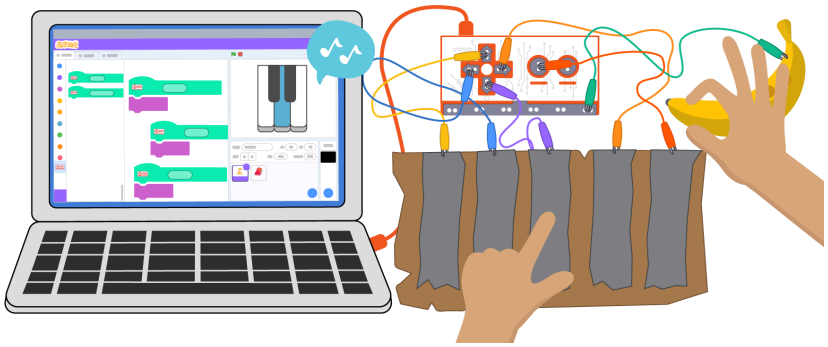
Or add the Music Extension and select notes to play when different keyboard keys are pressed. Notes can be customized for beat count and instrument.

Step 4: Close the circuit to register each keyboard press by touching EARTH and a keyboard input.

Resources:

- Makey Makey Coding Cards (Student-Facing)
- Sprite Creation Cards (Student-Facing)
- Makey Makey Musical Instruments (Studio) - project examples to explore
- Sound and Music Cards (Student-Facing)





Example of a foil piano script.

Option 3: Art Comes Alive

Create a drawing, informational sheet, poem, or poster you want to connect to the digital space. Use a graphite pencil, foil, conductive tape, or conductive paint to create connection points with pieces. Use Makey Makey and Scratch to provide additional information when participants interact with your work.

Step 1: Select any sprite from the Sprite Library.

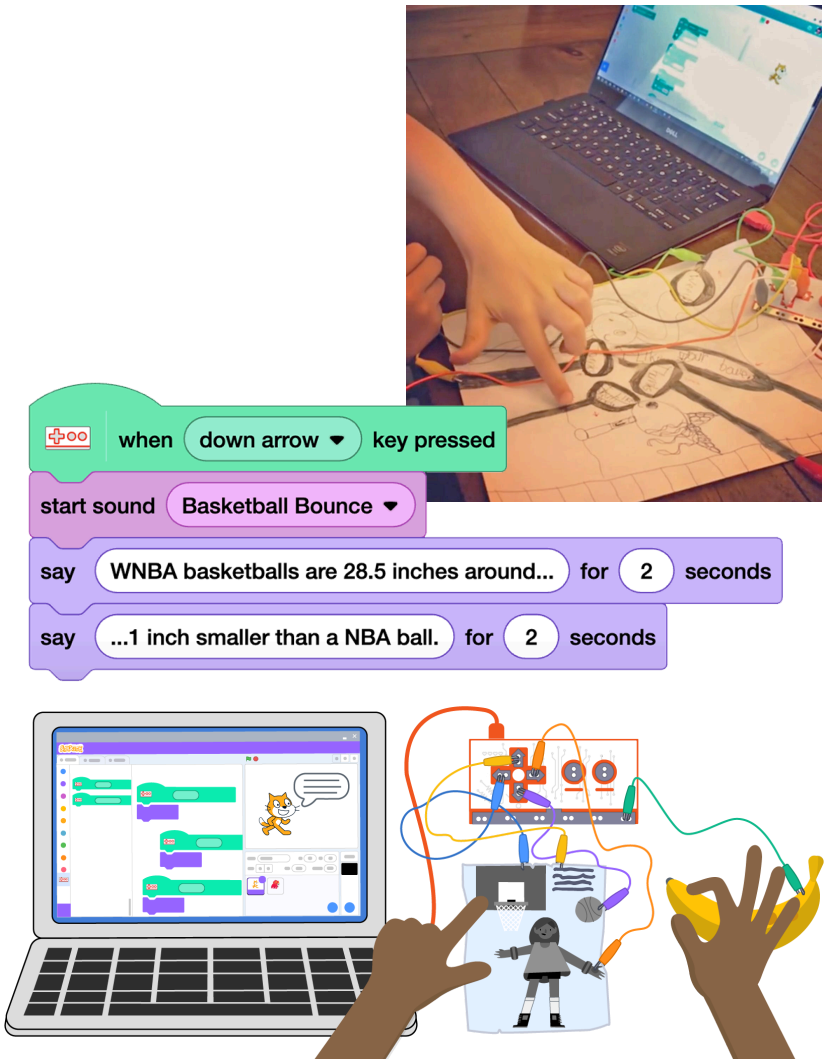
Step 2: Create your drawing using a graphite pencil, tin foil, conductive tape, or conductive paint to create connection points with pieces.

Step 3: Connect different pieces of your drawing to alligator clips. Make sure the conductive pieces don't overlap, so only one key is registered as pressed at a time. Don't forget to connect an alligator clip to EARTH.

Step 4: Add code to play a sound (like a recording of your voice) or have your sprite say something when different pieces of the drawing are touched. You can use either the Makey Makey extension hat block or the Event hat block to initiate your script.

Resources:

- Makey Makey Coding Cards (Student-Facing)
- Sprite Creation Cards (Student-Facing)
- Sound and Music Cards (Student-Facing)
- Sounds in Scratch: Add, Record, and Use Text to Speech Blocks (Video Tutorial and Written Guide)



Example of an "Art Comes Alive" script.

Option 4: Create Your Own Unique Project

Try creating your own unique project or remix projects to use the Makey Makey to control sprites.

See our Starter Projects page for projects you might remix. Such as:

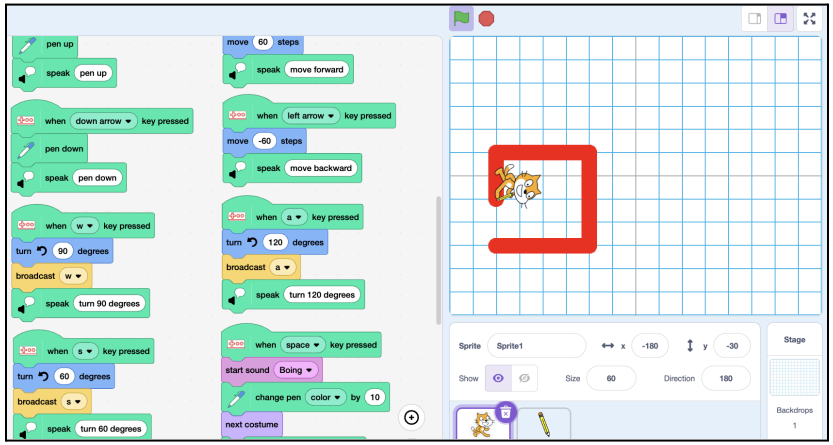
- Make It Fly
- Maze Starter
- Pong Starter
- Piano
- DJ Scratch Cat

Or see our Paper Planes, Turtle Graphics, and Computational Concepts Lesson Plan. How might you code different angles and movements to keyboard keys and challenge learners to draw shapes by touching different conductive objects? See an example Makey Drawing project here by codified concepts.

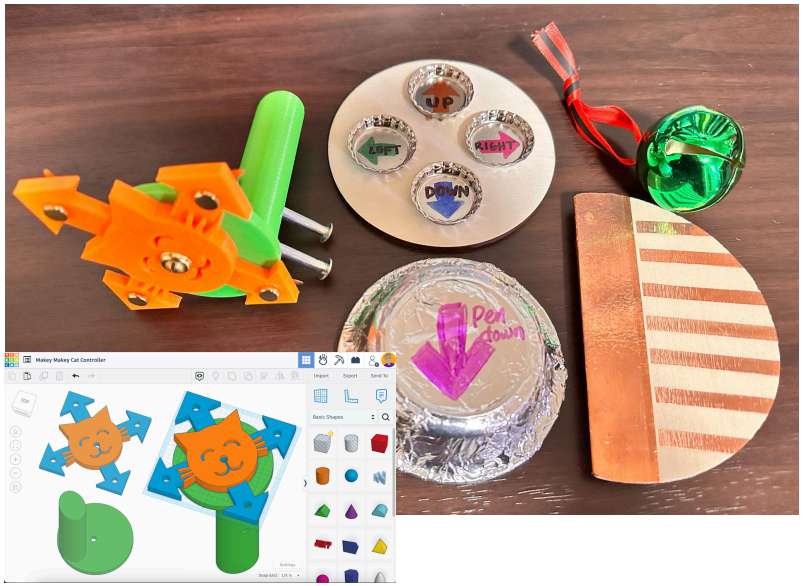
Try creating a variety of controllers that can interface with Scratch via the Makey Makey. For example, 3D controllers could be designed and printed. Then, conductive tape, metal screws, or other objects could be attached to make connection points.

Resources:

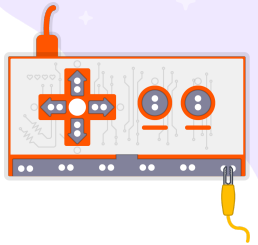
- Scratch Coding Cards (Student-Facing) - individual coding cards are also available
- 3D controller design (Website) - Scratch Learning Resource Designer Maren has shared her Scratchy design
- Tinkercad's guide to making accessible buttons (Website)
- Makey Makey How To (Website) - see Accessibility Guides



Makey Drawing project example.



3D-printed controller design inspired by the Scratch Cat, bottle caps, a foil-wrapped object, conductive tape on wood, and a jingle bell as examples of possible controllers.



Part 3: Reflect and Share

Reflect (15 minutes)

Learners can reflect on their project creation and process as they complete the Show-and-Tell Sharing Sheet. Next, their peers are encouraged to leave feedback or comments on the sheet for the creator as they view the projects in a studio or participate in the gallery walk.

Resources:

- Show-and-Tell Sharing Sheet or Project Gallery Walk Self-Reflection and Peer Feedback Sheet (Worksheet)

Share Option #1: Create a Class Studio to Gather Shared Projects

Studios are a space on Scratch where users can come together to make, share, and collect projects related to a particular theme, idea, or prompt. Set up a class studio* for your learners and add their original asset projects. Learners are encouraged to take time to look at projects and read/listen/interact with them to learn more about their peers.

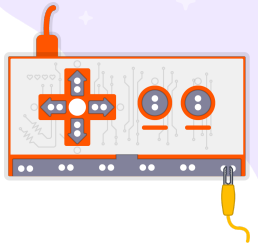
Resources:

- Teacher Account Guide (Written Guide) - This resource contains information on setting up teacher accounts and student accounts, managing classes, and class studios.
- Scratch Studios Guide (Written Guide) - General information on setting up and managing.

**Note: Learners need a Scratch account and access to the online editor to participate in this option.*

Share Option #2: Gallery Walk

Have each participant's project open on their computer or other device. Participants can walk around a room, or take turns sharing their screen in a virtual space, to experience each other's creations. Or display one project at a time on a large screen. Learners are encouraged to take time to look at projects and read/listen/interact with them to learn more about their peers.



More Things to Try

- Lessons and Activity Ideas from Makey Makey (Website)
- Makey Makey: Getting Started with Scratch (Website)
- Scratch Design Journal (Worksheet) - imagine, plan, iterate, and reflect throughout all of the phases of your project's development
- Debugging Strategies Posters (Printable Posters)

Standards Aligned

CSTA Standards	ISTE Standards	CASEL Framework	RITEC Indicators
Link to full standards	Link to full standards	Link to full standards	Link to full standards
• 1B-AP-08 Compare & refine algorithms • 1B-AP-10 Create programs • 1B-AP-11 Decompose problems • 1B-AP-12 Modify, remix, or incorporate • 1B-AP-15 Test and debug • 1B-AP-17 Describe choices made • 1B-CS-02 Model how computer hardware and software work together • 2-CS-02 Design projects that combine hardware and software	• 1.1a Learning Goals • 1.1d Technology Fundamentals • 1.5.b Data Sets • 1.5.c Decompose Problems • 1.5.d Algorithmic Thinking • 1.6.b Creative Communicator • 1.6.c Communicate Complex Ideas	• Self-awareness • Self-management	• Autonomy • Competence • Creativity • Diversity, equity and inclusion

This lesson also fulfills all three of the ISB Indicators of Playful Learning (Choice, Delight, Wonder), developed by the Pedagogy of Play (PoP) research project at Harvard University.

Tip: If you'd like to translate this guide, **click here to make a copy** of this Google doc.