



EDUCATOR'S GUIDE

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www.makeymakey.com

MAKEY MAKEY EDUCATOR'S GUIDE

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INTRODUCING MAKEY MAKEY

[Makey Makey](#) is an invention kit for the 21st century. We believe that everyone is creative, inventive, and imaginative and that everyone can create a future that changes the world. At Makey Makey, we have dedicated our lives to making easy-to-use invention kits that ignite curiosity, challenge problem-solving ability, and foster creativity.

With Makey Makey everyday objects are transformed into touchpads empowering students to interact with computers as creative tools. The computer becomes an extension of their creativity, fostering imaginative play and discovery. Screen time, so often the bane of parents and teachers, becomes play, discovery, and invention time.

“Makey Makey” is a play on words - students having the ability to Make their own Keyboards (“Ma-Key”). The mundane and boring keyboard is replaced by any object that conducts electricity - pie pans, Play-Doh, bananas, and even potted plants - the list goes on! When students create their own method of interfacing with the computer, barriers to learning and creating give way to a world of exploration that is on their terms. Whether they are coding on [Scratch](#), playing Pacman or jamming with music software, interactive and genuine learning takes place because students are guided by their interests and passion.

Makey Makey is part of a creative and technological downshift in which very smart electronics are simplified to make the world manipulable by ordinary people in ways previously available only to developers. The heart of Makey Makey is its circuit board that connects to a computer via a USB cable. Building circuits that can be used like a joystick or a keyboard key allows users with no coding experience to use Makey Makey to learn, experiment, and invent.

The Makey Makey is used by K12 educators in all 50 states and throughout the world (over 30 countries!) to teach Engineering, Design Thinking, and Making. Teachers in virtually every subject area have successfully used the Makey Makey to enhance and deepen the learning experience in their classroom. Many of these same teachers are [part of a world-wide network](#) of inspired educators sharing their teaching strategies in the moderated Makey Makey educator’s forum.

THE MAKEY MAKEY STORY

Makey Makey began as an academic and artistic project by two students, Jay Silver and Eric Rosenbaum, at MIT Media Lab under the advisorship of Mitch Resnick. Both Jay and Eric have been working with invention kits for the last decade. They are the same people who originated Drawdio and Singing Fingers, and have been on the [Scratch](#) programming language team in the Lifelong Kindergarten group at MIT.

The Makey Makey kit is based on research conducted by Jay and Eric at MIT Media Lab. Now, Makey Makey is both a business and a project with thousands of community collaborators, and more joining the ranks of inventors every day. Makey Makey has created a shared community of users that contribute to an ever-expanding library ([see the LABZ website](#)) of Makey Makey building activities for users of all ages and abilities.

WHY USE MAKEY MAKEY IN THE CLASSROOM?

Makey Makey is a useful, hands-on learning technology tool for learners of all ages, regardless of their academic strengths or weaknesses. Teachers who use the Makey Makey in the classroom will witness collaborative learning that fosters teamwork, problem solving, and multi modal learning. More importantly, teachers will learn and discover with their students, thus, creating a genuine moment of discovery shared by all in the classroom. The Makey Makey gives both teachers and students the opportunity to learn from each other in an environment that fosters risk taking and collaboration. Success is not measured by a single correct answer or technique but rather from the actions of making mistakes and trying different solutions to the tasks at hand.

In addition to being used at the elementary, middle, and high school levels, Makey Makey is utilized at institutes of higher education (IHEs) with college students, in homeschool settings, informal learning environments, maker spaces, and more. Regardless of the learning environment, Makey Makey can help make science, technology, engineering, and mathematics (STEM) learning more available to children while also charging up their learning capabilities.

The Makey Makey is one of the most versatile and yet cost effective educational technology teaching devices in use today. Schools with even the most modest budgets are able to acquire the Makey Makey and, by utilizing the wealth of free online learning resources, begin using it immediately in the classroom. Even though it's extremely easy to use, the Makey Makey can be incorporated into very sophisticated projects, many of which have been featured on the [Makey Makey LABZ website](#).

CLASSROOM EDUCATORS, LIBRARIANS, AND MEDIA SPECIALISTS

The Makey Makey is used by educators in nearly every subject area to enhance the learning experience. Social Studies students are creating interactive dioramas. Students in Biology classes are creating amazing drawings of body systems that utilize coding and art. Physical Education teachers have their students design and build game controllers that require playful physical exertion. Counseling staff challenge students to create an experience that promotes community and connection in the school. A teacher of Design Thinking challenged students to create a device that "gamifies" hand injury recovery.

Makey Makey is perfect for the classroom, library, or media center. Students can invent projects that combine the tactile materials of the classroom with the coding projects they are creating on the computer to bring their creations to life. Makey Makey is used to enhance existing curriculum through problem-based or project-based units or engineering design challenges.

Elementary	Secondary (Middle/High)	IHEs
In PreK-5, educators teaching multi-subjects use Makey Makey across content areas to create cross-curricular units and lessons. Students are excited to explore and create with Makey Makey. Young children can be paired with older students to encourage hands-on learning and invention.	At the secondary level, educators can integrate more complex concepts within their content area or collaborate with other educators to create more in-depth projects across multiple content areas. Students are encouraged to design, invent, and create smart technologies with Makey Makey.	Faculty can introduce college students to more sophisticated designs, product design, engineering processes, and entrepreneurship through Makey Makey. Pre-service teachers are introduced to Makey Makey through teacher education programs in order to inspire the problem solvers of the future.

INFORMAL EDUCATORS

The cultivation of learning outside of traditional school boundaries is essential for today's learners. After-school programs, school libraries, Scouts, 4-H, museums, outdoor educators, government agencies, nonprofits, and many other informal education programs hold the responsibility of opening the world of learning beyond standards, beyond basic objectives, and into the realm of possibility. These exploratory, supportive, flexible settings let children learn in different ways. Makey Makey is a tool that can make that a reality.

No matter the topic, meaningful hands-on, minds-on experiences can be created with a Makey Makey and a handful of everyday materials to attract learners to create and invent. Programs that target underrepresented populations, such as girls and minorities, can use Makey Makey to spark interest in STEM areas. Makey Makey facilitates equitable access and availability to science, technology, engineering, and mathematics learning opportunities for all learners. Using Makey Makey can be an effective strategy for remedial intervention programs, providing learners with opportunities to succeed through open-ended design challenges.

HOMESCHOOL EDUCATORS

Makey Makey is a teaching tool to help students create, invent, and imagine. Makey Makey opens a world of possibilities for open-ended learning and invention in the home learning environment. Through shared collaboration, family learning environments that use Makey Makey can build interest, knowledge, and skills in design thinking and technological literacy. Makey Makey activates learning and helps learners develop their science, technology, engineering, and mathematics fluency by letting them develop, practice, and apply STEM skills in the real world.

Makey Makey homeschool educators:

- Empower Creativity
- Facilitate Innovation
- Foster the Love of Learning (in a safe environment where taking risks and making mistakes are necessary for learning)
- Inspire and Challenge

MAKERSPACES

We are inspired by the Maker Movement and want to help people begin to think of themselves as Makers and agents of change. The shift to "making/tinkering" represents the perfect storm of new technological materials, expanded opportunities, learning through firsthand experience, and the basic human impulse to create. The Maker Movement offers the potential to make classrooms more student-centered: relevant and more sensitive to each learner's remarkable capacity for innovation and creativity. Making is predicated on the desire that we all feel the need to exert agency over our lives and to collaborate in order to solve problems. Making recognizes that knowledge is a consequence of experience, and seeks to democratize access to a vast range of experience and expertise so that each learner can engage in authentic problem solving.

The Maker Mindset encourages people to believe they can change the world.

We believe that the Maker Movement is more than just robots, 3D printing, or even building things. The Maker Movement allows learners to become hardware engineers and solve real-world design challenges by providing a landscape that fosters curiosity and creates vibrant learners. Educators can use Makey Makey as a tool for invention and innovation in a Makerspace. Learners of all ages and level of expertise can use Makey Makey since it is easy to use, challenges the learner to solve real-world scenarios, and does not require prior coding experience.

FOR ADMINISTRATORS: WHY IS MAKEY MAKEY VALUABLE FOR STUDENTS?

MEETING CURRENT TRENDS IN EDUCATION

With a focus on real-world problem solving and the skills our society needs for a complex future, Makey Makey represents a means to help learners become inventors and makers of their world using technological/engineering design practices and processes. Makey Makey supports current trends in education—Integrative STEM Education, problem solving and project based learning, and 21st Century Skills --and enables learners to prepare for work at the frontier.

INTEGRATIVE STEM EDUCATION

Makey Makey instructional activities are consistent with the powerful pedagogy known as “Integrative STEM Education”. In accordance with its original operational definition (Sanders & Wells, 2010) “Integrative STEM education” refers very specifically to instructional approaches that intentionally situate the teaching and learning of science, technology, engineering, and /or mathematics concepts and practices in the context of hands-on engineering, designing, and making. In other words, Integrative STEM instruction purposefully engages students in robust hands-on designing and making activities that effectively teach science, technology engineering, and mathematics concepts and practices... and Makey Makey instruction exemplifies that pedagogical approach (Mark Sanders, 2017).

By definition, I-STEM Ed is a pedagogical approach for supporting knowledge construction through student engagement in technological/engineering design-based learning. The pedagogical premise is that of connecting hands-on with minds-on, where hands-on experiences are intentionally utilized to achieve minds-on learning outcomes; i.e., experiential learning intentionally used to promote knowledge construction (Kolb, 1984*). Integrative STEM education includes approaches that explore teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other content area. Just as technological endeavor, for example, cannot be separated from social and aesthetic contexts; neither should the study of technology be disconnected from the study of the social studies, arts, and humanities.

Too many students lose interest in STEM areas at an early age, and thus make an early exit from the so-called “STEM pipeline.” I-STEM Ed uses design thinking, a prototype-driven process for innovation with a human-centered approach. Design thinking fosters creativity, empathy, infinite ideas, and can be applied to all areas of our world. By introducing Makey Makey into I-STEM Ed, the world of design is placed at the learner’s fingertips. Makey Makey facilitates the kind of open-ended, hands-on learning of I-STEM Ed that engages students of all learning modalities.

We support innovators and entrepreneurs to design products and services with real social impact. Learners can use Makey Makey when challenged to create better solutions to society’s most complicated problems. A design challenge is an open-ended project that encourages learners to ask questions, take initiative, and think creatively. Example design challenges can be found on the [Makey Makey Labz website](#) and in the section, Beyond the Banana Piano: Innovation Through Design Challenges, later in this document.

* Kolb, D.A. (1984). *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

PROBLEM SOLVING AND PROJECT BASED LEARNING

Project based learning engages students in the investigation and solutions of real-world problems. Makey Makey is a valuable tool that students can use to solve problems and demonstrate their solutions to problems. With the help of Makey Makey, students can work together or on their own to make real change in the world.

According to the [Buck Institute for Education \(BIE\)](#) (2017), students engaged in high-quality project-based learning with a facilitating educator are actively involved in the learning process. Makey Makey encourages students to experiment, constructing their own knowledge that can be applied to a real-world problem. As students work on projects using Makey Makey, they can use Makey Makey to create a solution for a project resulting in a product that demonstrates the culmination of their learning. Students are encouraged to communicate their learning with peers and experts through demonstration of their product and their experience inventing with Makey Makey.

One such project involved a high school teacher who inspired students to design Assistive Technology solutions using the Makey Makey. Students were challenged to design appropriate Assistive Technology solutions for elementary students with physical and cognitive disabilities. Working in teams, the Asheville School students designed and built prototypes of their solutions for use by the students enrolled at Hall Fletcher Elementary School (HFE) located in Asheville, NC.

The design solutions were intended to help students interact with computer programs (games) in new ways. The Assistive Technology prototypes created did utilize Makey Makeys allowing for quick prototyping by turning everyday objects into touchpads. Students traveled to HFE to meet with the students to test their prototypes. The HFE special education teachers were both delighted to have high school students interacting with their students and they were intrigued to see how effective the designs were at providing assistive solutions for their students. [View a video of this project HERE.](#)

21ST CENTURY SKILLS

[The Partnership for 21st Century Learning](#) cites problem solving, creativity, collaboration, communication, innovation, critical and analytical thinking as vital and necessary skills for engagement and success in our rapidly changing world. In this age of information, rote memorization and testing of facts will not prepare students for developing these skills or for a career.

Makey Makey provides learners with the tools to help them develop into the risk-taking, critical thinking, problem-solving collaborators that will create the future. Learning and innovation skills increasingly are being recognized as the skills that separate students who are prepared for increasingly complex life and work environments in the 21st century, and those who are not. The skills that children learn in STEM programs that use Makey Makey can be woven together and strengthened in order to develop the critical skills needed throughout life. A focus on creativity, communication, and collaboration is essential to prepare students for the future. Makey Makey offers learners infinite ways to invent, solve, collaborate, and innovate.

MEETING STANDARDS HANDS-ON WITH MAKEY MAKEY

Units and/or lessons that incorporate Makey Makey align effectively with national standards — [Next Generation Science Standards](#), [Common Core State Standards for English/Language Arts](#), [21st Century Learning and Innovation Skills](#), the [International Society for Technology in Education \(ISTE\)](#) and the [International Technology and Engineering Educators Association \(ITEEA\) Standards for Technological Literacy](#). In addition to being a useful learning tool, Makey Makey can also serve as an authentic assessment of student understanding and performance on key objectives of those standards.

Below are examples of Makey Makey standard alignment to the Next Generation Science Standards, Common Core State Standards for English/Language Arts, 21st Century Learning and Innovation Skills, ISTE Standards for Students, and ITEEA's Standards for Technological Literacy. There are certainly more standards addressed by Makey Makey, but these are too numerous to mention here.

NEXT GENERATION SCIENCE STANDARDS (NGSS)

Within the [NGSS](#), there are three distinct and equally important dimensions to learning science. These dimensions are combined to form each standard and each dimension works with the other two to help students build a cohesive understanding of science over time. Makey Makey provides a hands-on, minds-on approach to assist with addressing these three dimensions of learning science.

Physical Science (Grades 3 and 4)

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.

Engineering, Technology, and Applications of Science (Middle School)

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Physical Science (High School)

HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

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.

HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

COMMON CORE STATE STANDARDS

While working on projects with Makey Makey, students can communicate their ideas and understanding orally, through writing, and through multi-media demonstrations. Here are some examples of [Common Core State Standards \(CCSS\)](#) English/Language Arts (ELA) writing and communication standards for Grade 6 addressed through Makey Makey projects:

CCSS.ELA-LITERACY.SL.6.1

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly

CCSS.ELA-LITERACY.SL.6.2

Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

CCSS.ELA-LITERACY.SL.6.5

Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

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.

21ST CENTURY LEARNING AND INNOVATION SKILLS

These are skills that separate students who are prepared for increasingly complex life and work environments in the 21st century, and those who are not. Creativity, critical thinking, communication and collaboration are critical to prepare students for the future ([P21.org](#)).

Creativity and Innovation

- Think Creatively (ex. Create new and worthwhile ideas).
- Work Creatively with Others (ex. Demonstrate originality and inventiveness in work and understand real world limits to adopting new ideas).
- Implement Innovations.

Critical Thinking and Problem Solving

- Reason Effectively.
- Use Systems Thinking (ex. Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems).
- Make Judgements and Decisions.
- Solve Problems (ex. Solve different kinds of non-familiar problems in both conventional and innovative ways).

Communication and Collaboration

- Communicate Clearly (ex. Utilize multiple media and technologies, and know how to judge effectiveness a priority as well as assess their impact).
- Collaborate with Others (ex. Assume shared responsibility for collaborative work, and value the individual contributions made by each team member).

INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION ([ISTE](#))

Innovative Designer

4a: Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts, or solving authentic problems.

4b: Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

4c: Students develop, test, and refine prototypes as part of a cyclical design process.

INTERNATIONAL TECHNOLOGY AND ENGINEERING EDUCATORS ASSOCIATION

Standards for Technological Literacy (STL)

The STLs specify what students should “know and be able to do” in order to be considered technologically literate and provide standards that prescribe what the outcomes of the study of technology in grades K-12 should be. Here are few examples of STLs that students may develop while working with Makey Makey:

Design

- Std. 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Abilities for a Technological World

- Std. 11: Students will develop the abilities to apply the design process.
- Std. 12: Students will develop the abilities to use and maintain technological products and systems.

The Designed World

- Std. 17: Students will develop an understanding of and be able to select and use information and communication technologies.

BECOMING FAMILIAR WITH MAKEY MAKEY

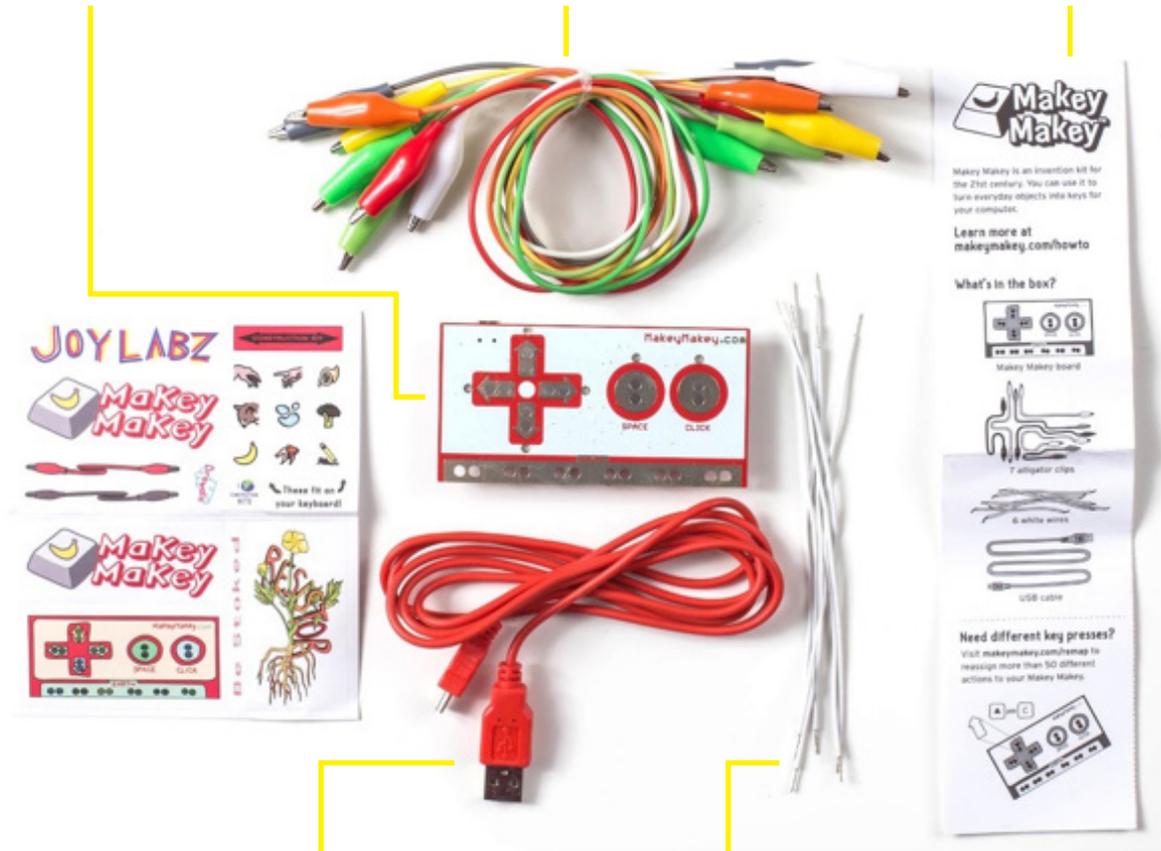
Makey Makey is designed for quick connections between a computer and a variety of objects. Learners can experiment with various configurations to create a complete circuit.

The Makey Makey kit (see fig. 1) includes the Makey Makey board, a USB cable, seven alligator clips, six connector wires, and an instruction sheet.

MAKEY MAKEY BOARD

7 ALLIGATOR CLIPS

INSTRUCTIONS

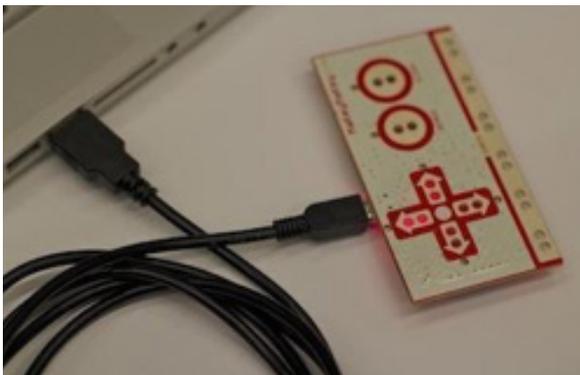


USB CABLE

6 CONNECTOR WIRES

Figure 1. Makey Makey Kit

HOW MAKEY MAKEY WORKS

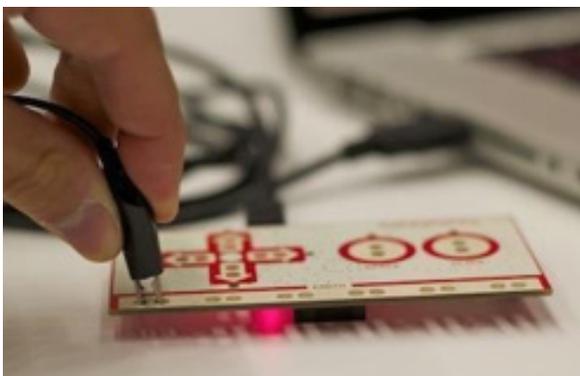


1. Plug in USB

The smaller side of USB cable plugs into Makey Makey, and the larger side plugs into the computer.

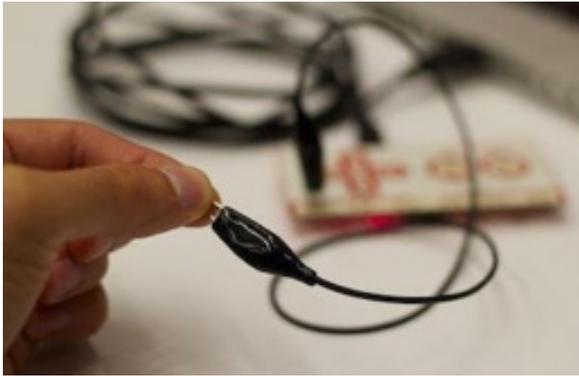
2. Close Pop-Up window

The computer may ask to install drivers or complete another setup. Click cancel or close the window.



3. Connect to Earth

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

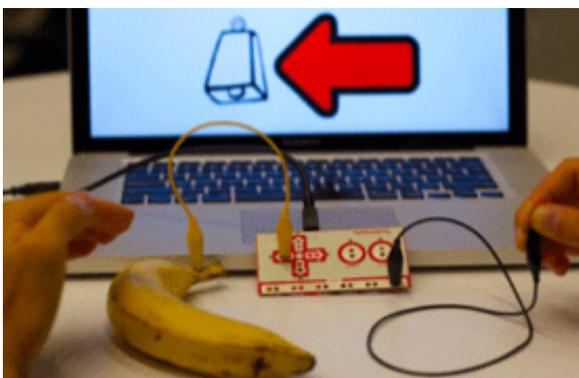
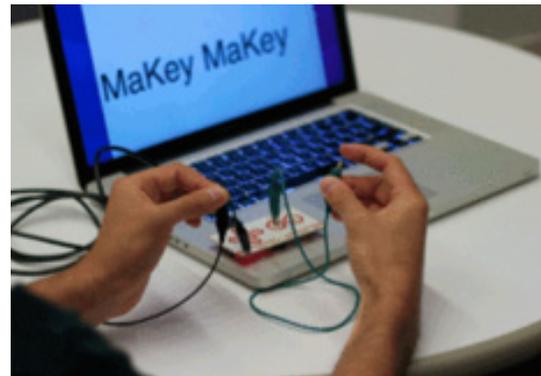


4. **Connect to Yourself**

Hold the metal part of the other end of the alligator clip between your fingers. You are now “grounded.”

5. **Connect to “Space” and Try It**

While you are still grounded, touch the round “Space” pad on the Makey Makey. A green light should appear on the Makey Makey, and the computer will “think” the spacebar was pressed. Also, complete the circuit by connecting another alligator clip to “Space.”



6. **Experiment, Innovate, and Invent**

Experiment by turning various items, objects, or substances into a computer key. A connection can be made through anything that is even slightly conductive of an electrical current, so be innovative. Create inventions that combine conductive and non-conductive parts to solve real-world challenges.

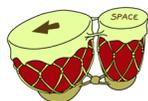
SUGGESTIONS FOR USING AND TESTING CONDUCTIVE MATERIALS

When inventing, anything goes! Below is a list of materials with which learners can experiment, investigate, and innovate. Also important to have available are some tools for cutting, like scissors and craft knives, and ways to attach things together, like hot glue, super glue, various kinds of tape, and clips or clamps.

- Most fruits and vegetables are able to conduct an electrical current as well as many other foods. Learners should experiment with a variety such as marshmallows, gummy candies, macaroni and cheese, cupcakes, and shrimp.
- Try experimenting with some plant leaves or flowers, but nothing too dry.
- Play-Doh™, Model Magic™ and other clays work very well if the clays stay moist.
- Since people are conductive, connect one person to a ground, and another to an input. A sound can be triggered when they touch hands (e.g., high-five).
- Graphite from a pencil is conductive. Draw thick, dark lines, on a smooth surface and touch the end of the alligator clip to the lines.
- Foil and other metal objects work well. Try coins, magnets, nuts and bolts, forks and knives, or pots and pans.
- Try testing everyday items such as inflatable beach balls, paper plates, cardboard boxes, various types of soft and rigid foam, Lego™ bricks, plastic storage boxes, stuffed animals and other toys, hats and other pieces of clothing, sheets of fabric, string, yarn, elastic, and paper.

MAKEY MAKEY SOFTWARE www.makeymakey.com/apps

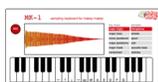
Makey Makey works with any software that uses the keyboard, mouse, and/or arrow keys. Try Makey Makey out by using the device with any web page or computer application where a keyboard and/or mouse is required. Below are just a few of the computer applications that can be used with Makey Makey.



Bongos - Play some bongo drums with the spacebar and left arrow.
Turn anything into a drum!



Piano - A piano designed for Makey Makey. Play a melody with the arrow keys and spacebar (and click, too).



MK-1 - A sampling synth for Makey Makey. Record a sound, use preset scales, and set the keys to play just the notes wanted.

USING MAKEY MAKEY WITH SCRATCH

[Scratch](https://scratch.mit.edu/) is a free education programming language and online community developed at the MIT Media Lab where interactive stories, games, and animations can be created. The Scratch Piano is an example of a program made using the Makey Makey.



Scratch Piano - This piano is played with the arrow keys and the notes can be remixed for an array of versions.

MAKEY MAKEY IN THE CLASSROOM

CLASSROOM MANAGEMENT WITH MAKEY MAKEY

Students can work on Makey Makey projects individually, in pairs, or small groups (3-4 students). Pairs or very small groups are preferable as students build confidence and communication skills through collaborating and problem-solving with peers. Since each group usually works on one computer, students in larger groups may become disengaged or frustrated with limited computer access.

Groups can be determined by interest or project, or through mixed grouping by ability level, gender, or special needs.

CARE AND MAINTENANCE

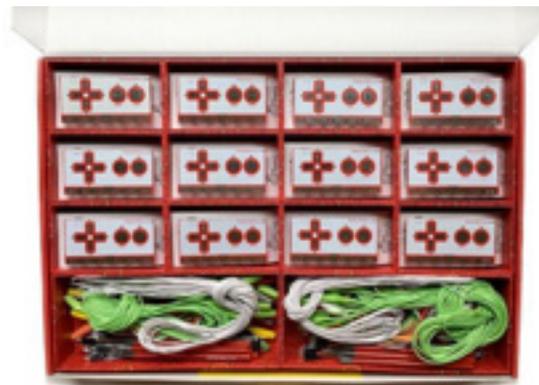
The Makey Makey devices are quite resilient, but teaching students how to care for them is important to maintain proper usage. Students should handle the Makey Makey with care (throwing and dropping are not recommended), and wires should not be twisted, crimped, or bent at extreme angles. For Troubleshooting Tips, see Appendix A later in this document.

STORAGE AND ORGANIZATION

Makey Makey offers a giant box of Makey Makeys, the Makey Makey STEM Pack, that is perfect for classrooms, museums, homeschools, makerspaces, and anyone else who wants a distillation of 12 Makey Makeys and 12 booster packs with some extra parts in a nicely organized briefcase.

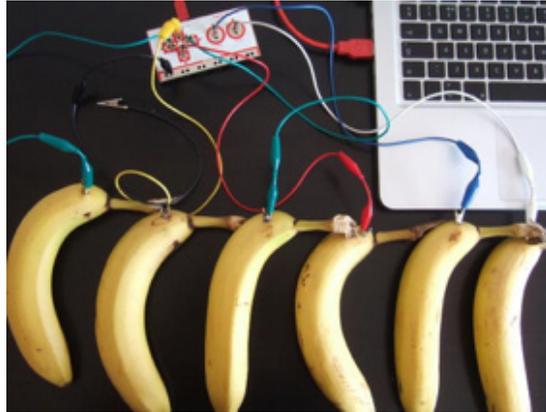
The Makey Makey STEM Pack contains 12 Makey Makey Classics, 12 alligator clips 6ft, 12 connector wires 6ft, 72 extra alligator clips, 144 connector wires for the back, 12 conductive writing utensils, and a super cool case to keep it all tidy. Each of the 12 Makey Makeys has its own box that comes out of the case containing the Makey Makey, USB cable, 7 alligator clips, 6 connector wires, and how-to booklet.

Teach students to return Makey Makeys with all of the components to their individual boxes after work is finished. This way, each Makey Makey kit will be ready to go for the next project!



BEYOND THE BANANA PIANO: INNOVATION THROUGH DESIGN CHALLENGES

The Banana Piano has become synonymous with Makey Makey. In this unique set up, bananas become the piano keys when connected to the Makey Makey with the help of alligator clips. Novice Makey Makey users are astonished when they realize they can make music just by tapping on a row of bananas.

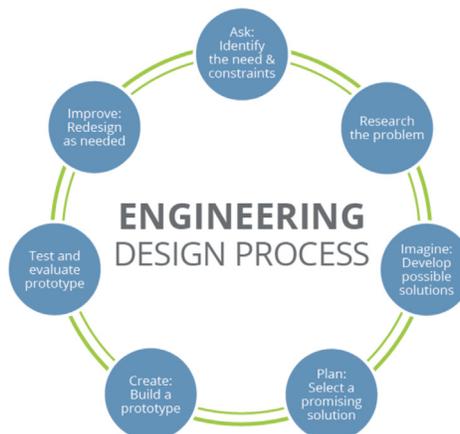


Makey Makey users can move beyond the Banana Piano by experimenting, investigating, innovating, and inventing products that can meet the challenges of real-world needs. Makey Makey provides design and maker experiences that help learners become more engaged with the designed dimension of their world. One such experience is providing design challenges through Integrative STEM Education.

INTEGRATIVE STEM EDUCATION DESIGN CHALLENGES

Integrative STEM education refers very specifically to instructional approaches that intentionally situate the the teaching and learning of science, technology, engineering, and /or mathematics concepts and practices in the context of hands-on engineering, designing, and making. Using Makey Makey as part of these instructional approaches enables amazing creative student design challenges.

Guide your students through the design process:



(Source: <https://www.teachengineering.org/k12engineering/designprocess>)

Give your students a scenario based on a human need (real-world and/or based on the topic of study). Provide them with criteria and constraints (what they can and cannot do), materials, and a small group or partner, and watch the problem solving unfold!

Here are some sample scenarios that challenge your students to think creatively to solve a problem:

- A climber on Everest can't take her mittens off to type a message to basecamp. Create a device to allow her to type using only supplies she would have in her pack.
- An astronaut on Mars must re-program his Rover after a malfunction. Design a device that allows him to complete a program with limited dexterity due to space gloves and hostile conditions (e.g., gravity differences).
- Design a device that would allow a dolphin to communicate a simple message to humans by using its nose to select basic pictures or words.

For more information on the design process, design challenges and standards alignment, here are some great resources:

- International Technology and Engineering Educators Associates, <http://iteea.org>
- Link Engineering, <http://linkengineering.org>
- Teach Engineering: Curriculum for K12 Educators, <http://teachengineering.org>

THE MAKEY MAKEY COMMUNITY: MORE SUPPORT AND AWESOME IDEAS

We love seeing the innovations and inventions educators and their students develop - they bring us closer to a world built by everyone exploring their ideas and reinventing the things around us while orienting people to the collective, societal benefits of science, technology, engineering, and mathematical learning.

Set up a class in the Makey Makey Labz and assign step-by-step guides to students. Choose from a plethora of pre-written lesson plans, create a new lesson plan, or modify pre-existing projects to work for the classroom.

Need more ideas or support for creative exploring? Check out these excellent resources:

- Discover Makey Makey <http://makeymakey.com/>
- Makey Makey LABZ website <https://labz.makeymakey.com/>
- Makey Makey Education <http://makeymakey.com/education/>
- [Makey Makey Education Facebook Group](#)

MAKEY MAKEY INVENTION LITERACY WORKSHOP

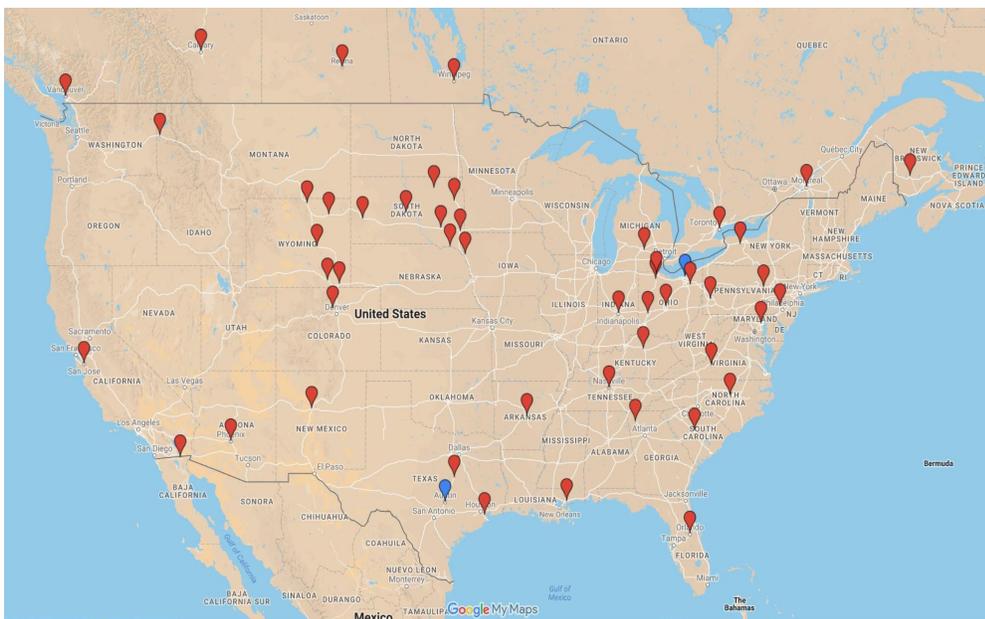
Get ready for a fun hands-on workshop where you'll learn how to teach Invention Literacy, Making, and Design Thinking using the award winning Makey Makey invention kit used by educators in all 50 states and around the world and featured in TED talks. This workshop is new and being delivered throughout the US and in locations around the world. You'll learn best practices and gain access to a multimedia training website that you can use later when you train others or teach the students you serve.

WORKSHOP DETAILS <https://makeymakey.com/education/#enroll>



TRAINING SITES LOCATED THROUGHOUT THE UNITED STATES & AROUND THE WORLD

New training locations added regularly. Visit the Makey Makey website to view an interactive map that includes workshop locations and contact information.



DISTANCE LEARNING PROGRAM

New! The Makey Makey distance learning program for educators! Visit the Makey Makey website to learn more. www.MakeyMakey.com

TESTIMONIALS FROM TEACHERS WHO'VE ATTENDED THE WORKSHOP:

Staff continue to talk about what an incredible training the Makey Makey workshop was. You ignited the spark that has carried our staff from the workshop to the children. I have already had request for more Makey Makey and a couple folks who were unable to attend want to know when the next Makey Makey workshop will be held.

- San Jose, workshop participant

Incredible hands-on learning experience while also getting tons of the "science behind the magic" information.

- Orlando workshop participant

Greatly appreciated the scaffolding of instruction and the opportunity to apply the skills to actual inventive creative design and engineering practice.

- Roanoke workshop participant

The website used in the workshop is super valuable. I loved seeing how engaged all participants were as adults. I know K-12 students will be just as engaged if not more so. I also know that they will have much more creative ideas than I did! It was valuable to see all of the different uses of the Makey Makey, especially those that helped others and made a difference in the world!

- Pittsburgh workshop participant

VIDEO DESCRIBING THE WORKSHOP:

<https://youtu.be/PouWbbb9Geg>



Teaching Invention Literacy With Makey Makey

APPENDIX A: TROUBLESHOOTING TIPS

Problem: 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 make 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.

Problem: I can't get a key to press.

- 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 the 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.
- 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 is 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.

Problem: It works sometimes, but not at 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 your fingertip.
- 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 above.

This document written by:

Anita S. Deck, Ed.D.
Director of Innovation, Assessment, and Research
International Technology and Engineering Educators Association
STEM Center for Teaching and Learning
Reston, VA
www.iteea.org

Lisa A. Moyer, Ph.D.
Postdoctoral Associate
Department of Engineering Education
Virginia Tech
Blacksburg, VA



The International Technology and Engineering Educators Association (ITEEA) is the largest professional organization for technology, innovation, design, and engineering educators. Our mission is to promote technological literacy for all by supporting the teaching of technology and engineering and promoting the professionalism of those engaged in these pursuits. ITEEA strengthens the profession through leadership, professional development, membership services, publications, and classroom activities.