littleBits

In the Classroom and at the Event
Classroom: Suggested for grades 3-8
At the Event: Suggested for Ages 8 and up

Group Size	Groups size can vary (Recommend group size of 2)
Duration	Determined by activity selected
Materials/ Equipment	littleBits STEAM set including 19 Bits and 40 accessories (16 total sets), littleBits STEAM student set invention guide, inventory list and guide
Resources	**littleBits STEAM set information**: https://littleBits.com/collections/invent-at-school/products/steam-student-set?gclid=CjwKCAiA3abwBRBqEiwAKwICA6O90tq-bHK8C54EueMWvg_aCg3DXOI9xOytudEccp-rlQomI7KRrBoCLo8QAvD_BwE **Getting started with STEAM student set (orientation, curriculum, teacher tools, student handouts, meet the Bits):** https://classroom.littleBits.com/kits/steam-student-set **Lessons (select STEAM student kit):** https://classroom.littleBits.com/explore/search?type=lessons **Educator Quick Start Guide:** https://classroom.littleBits.com/kits/educator-quick-start-guide **STEAM Student Set Invention Guide:** http://www.makerspaceforeducation.com/uploads/4/1/6/4/41640463/steam-student-set-invention-guide.pdf **STEAM Student Set Teacher Guide** http://www.makerspaceforeducation.com/uploads/4/1/6/4/41640463/steam-student-set-teachers-guide-v0.9.pdf **Browse through thousands of projects:** littleBits.cc/projects **Connect with the littleBits community, explore forums and more** littleBits.cc/community
Objective	littleBits are color-coded magnetic Bits that when snapped together create limitless circuit designs. Students will learn about electricity and circuits and develop ways for littleBits to be used in real life. Students will become inventors while using the Bits. The STEAM Student Set makes the engineering design process fun. STEAM Student Set Curricular Crosswalk: Standards Alignment https://lbcommunity.s3.amazonaws.com/uploads/uploaded_file/asset/2010/STEAM_Student_Set_and_Expansion_Packs_Curriculum_Crosswalk.pdf
Preparation	Become familiar with the littleBits by reading the STEAM Student Set Invention Guide. Review STEAM set information, getting started with STEAM student set, review STEAM student kit lessons, review Educator Quick Start Guide, and browse through projects. Gather materials and divide among students. Determine which activity will be used.

	Pages 7-23 in the STEAM Student Set Invention guide provides a great handout for students in the classroom or as guides on the table at the event. If using, have copies printed.
Procedure	Each color-coded Bit has a specific function (ex. lights, sensors, motors, inputs, and outputs) and is modular and reusable for an infinite number of inventions. The kit includes 19 Bits, 40 accessories, and helpful educator resources. Students are prompted to find solutions to real world problems through applying engineering, physics, art, and design thinking in guided activities before leveling up to open challenges. The STEAM set provides flexibility with the activity, whether in a classroom or at an event. In the classroom, a lesson can be selected from the online resources or the Invention Guide. At the event, one can explain what the colors mean, show the students how to snap them together, and then let the creating begin. Now is a good time to establish expectations with the students on how the littleBits should be handled and organized for storage. The Bits need to be handled with care. Wires and parts should not be pulled out of the Bits. Explain to the class that if anything feels stuck or like it isn't fitting right, or if something comes apart on the Bit to immediately let the teacher know. Encourage an atmosphere of openness – if the students are afraid to do something wrong they may not speak up. Once the classroom activity is complete, have the students organize the Bits making sure the pieces match up with the inventory list and picture. If at an event, have the adult organize the containers. Please ensure Bits are returned in the same condition as they were received. While students are using the Bits, ask questions to help students begin thinking like designers and engineers, for example: What do we already know that helps us explain how electronics work? What do electronics need in order to work? Have the students brainstorm ways that we use electronics in our everyday lives. If in the classroom, have the class rank the top 5 electronic devices that they could not live without and discuss how our lives would be different without electricity and thus, electronics. After a brief discussion on the ways in which our lives would be significantly different without electronics, explain to students that they will begin experimenting and investigating electronics with littleBits. While the students will not be able to see electricity, they can observe the interaction of electricity with physical objects such as a lightbulb, radio, or microwave. Explain to the students how littleBits work. If able, print copies of pages 4 and 5 in the Invention Guide and have available for the students to view. Some potential questions to ask while students are creating are: What is electricity? What is electrical current? What is potential energy? What is kinetic energy? What is an electric circuit? **Snap Them Together:** Bits snap together with magnets, so it's impossible to make a mistake. No wiring or device required – just easing and intuitive snapping. They are designed to snap together end to end to create a completely closed circuit. The placement of the magnets on the Bits ensures that the Bit always attaches correctly. The arrows should always point the same direction. Tip: If the Bits won't snap together, try spinning one around. Always check that the arrows point in the same direction. Order is important when snapping

	together the Bits. Power Bits always come first and input Bits only affect the output Bits that come after them. For example, with no output Bit after it, the input Bit has nowhere to send its signal. Some Bits are adjustable such as switches, buttons, and dials on the board which allow you to change how the Bit functions. **Color-Coded by Function:** Each Bit is color-coded by its function and are grouped into four different categories: **Power with BLUE**: The blue Bits are the power and always come first. Connect a power Bit to a battery so that electricity can run through your circuit. **Input Bits- PINK**: Maybe you do not want your circuit to just be "on" all the time. Simply add a pink between your power and output Bits to add a control. Inputs can be buttons, dimmers, sensors – things that receive direction from you or the environment. **Wire Bits – Orange :** Orange Bits let you build your circuits in new directions with a wire or a fork connected to other systems (like coding on a computer). **Output Bits- GREEN**: The green Bits are outputs, which do something like light up, buzz, move, etc. The index is found in page 6 of the STEAM Student Set Invention Guide. Pages 7-23 show various examples of sample circuits including information on the Bit, how it works, and real-world analogies. These pages would make great classroom handouts to guide the students in exploring or as guides on the table at the event. To conclude the activity, ask students what they have learned about how littleBits work. Discuss the circuits they created and ask how they are used in real-life scenarios. Ask them to think about how they could use these circuits creatively in their own life (for example, creating a phone charger, inventing a game show buzzer, or creating a thermostat). If time, ask students to explain a circuit they created. Review the clean-up procedure that you will find below. Please return the littleBits in the same condition in which they came to your classroom. Please make a note of any littleBits that did not work properly and tape to the top of the kit lid.
Potential Questions	What is electricity? What is electrical current? What is potential energy? What is kinetic energy? What is an electric circuit? (Please see page 2 for answers).
Air Force Connection	Every Air Force base and installation around the world requires electricity to operate successfully. Responsible for installing, repairing and maintaining this electrical network, Electrical Systems specialists ensure that our primary source of energy is always available. From space command communicating with our satellites to hospitals operating lifesaving equipment, every Air Force function depends on this crucial service provided by these experts: https://www.airforce.com/careers/detail/electrical-systems

littleBits

Potential Questions to Ask:

What is electricity?
Electricity is a type of energy that can build up in one place or flow from one place to another. When electricity gathers in one place it is known as static electricity (the word static means something that does not move); electricity that moves from one place to another is called current electricity. Electricity is a form of energy that is produced by the flow of electrons. Electricity provides power for lighting, appliances, and other electric devices in our homes and businesses.

What is electrical current?
When electrons move, they carry electrical energy from one place to another. This is called an electric current. A lightning bolt is one example of an electric current, although it does not last very long. Electric currents are also involved in powering all the electrical appliances that we use, from washing machines to flashlights and from telephones to iPads. These electric currents last much longer.

What is potential energy and kinetic energy?
Potential energy means energy that is stored for use in the future. An example is wheels on a roller skate before someone begins to skate or a stretched rubber band. When the wheel begins to move, the potential energy is converted into kinetic energy (the energy something has because it is moving). When the rubber band is released, the potential energy of the stretched rubber band transfers into kinetic energy in the process.

What is an electric current?
For an electric current to happen, there must be a circuit. A circuit is a closed path or loop that electric current flows around. A circuit is usually made by linking electrical components together with pieces of wire. Thinking about a flashlight for a moment. In a flashlight, there is a simple circuit with a switch, a lamp, and a battery linked together by a few short pieces of copper wire. When you turn the switch on, electricity flows around the circuit. If there is a break anywhere in the circuit, electricity cannot flow. If one of the wires is broken, the lamp will not light. If the switch is turned off, electricity cannot flow. Wire is not always needed to make a circuit. For example, a circuit is formed between a storm cloud and the Earth by the air in between. Normally, air does not conduct electricity. However, if there is a big enough electrical charge in the cloud, it can create charged particles in the air called ions (atoms that have lost or gained some electrons). The ions work like an invisible cable linking the cloud above and the air below. Lightning flows through the air between the ions.

littleBits

Activities

The activity plan has been written to provide flexibility and options in the activities that students can do with the littleBits. A few sample activities are found below with many more lessons can be found on the littleBits website to fit the needs of your classroom or event.

Student Activity #1: Classroom or At the Event

In the classroom, organize students into groups and pass out one STEM kit per group. At the event, place kits on the table so that multiple students can invent at once.

Have the students pull out only a single input Bit (pink) and an output Bit (green) and encourage them to explore how the Bits connect. After a few moments, ask students to share what they have observed and learned about the Bits (for example, they may say they have magnets and snap together). During this discussion, introduce and define the following items:

Bit, Circuit, Power, Input, Output

Next, have the students pull out a power Bit (blue), battery, and cable.

Allow the students a few minutes to explore the Bits. Through trial and error, students will naturally learn how to assemble little Bits. It is important to allow students the opportunity to experiment with the Bits. As they are connecting just these few Bits they should recognize a difference in the top and bottom of the Bit and the front and the back of the Bit.

Guided Lesson #1: Classroom

Students will begin to notice if they are connecting the Bits the right way and if the order of the Bits matter. After the students have explored for a few moments, ask them to share what they have observed and learned about assembling the Bits. For example, does the Bit color effect their design?
Use the guiding questions to promote deeper understanding and engage students in active inquiry, for example:

How can you tell the top/front of the Bit from the bottom/back?
How does the bottom/back of the Bit look different than the top?
How do you know that you are connecting the littleBits the right way?
Does the order of assembly matter?
How do the Bit colors inform or affect your design?

littleBits

Student Activity #2: Classroom
(If doing after Student Activity #1, have the students disconnect the Bits and place back into the correct containers before moving on)
Allow students to learn through discovery. Students can be placed into small groups and share, swap, and combine the Bits to create at least one circuit with power, input, and output. Remind students of the proper care to take when using the Bits. Walk around the room and ask the groups if they can think of a real-life application for the circuit (such as a nightlight sensor or an illuminated object)? Ask where have they seen something similar?

Student Activity #2: At the Event
(If doing after At the Event #1, have the students disconnect the Bits and place back into the correct contains before moving on)
Have pages 7-23 in the STEAM Student Set Invention Guide printed and on the table for students to use as guides when building.

Student Activity #3: In the Classroom
(If doing after Student Activity #2, have the students disconnect the Bits and place back into the correct contains before moving on)

Have pages 7-23 in the STEAM Student Set Invention Guide printed and available for students to use as guides when building.

As a reminder, this is just a small sample of activities that can be done with the Bits. Additional activities can be found using the online resources or the Invention Guide.

Clean Up Procedure:

Please have students make sure the battery is disconnected from the cable and the power Bit.

Help students notice:

1. Each Bit has a name on it
2. Coordinate the Bits with the inventory label on the lid of the small kits.
3. Ensure that all Bits are back in the correct small kits and make note of any Bits that are not working or are missing a piece or part.

littleBits

Some helpful tips:

Snap Them Together:
Bits snap together with magnets, so it's impossible to make a mistake. No wiring or device required – just easing and intuitive snapping. They are designed to snap together end to end to create a completely closed circuit. The placement of the magnets on the Bits ensures that the Bit always attached correctly. Arrows should always point in the same direction.

Power Bits always come first and input Bits only affect the output Bits that come after them.

Color-Coded by Function:
Each Bit is color-coded by its function. There are 4 colors:
It all starts with BLUE: The blue Bits are the power. Connect a power Bit to a battery so that electricity can run through your circuit.

Input Bits- PINK: Maybe you do not want your circuit to just be "on" all the time. Simply add a pink between your power and output Bits to add a control. Inputs can be buttons, dimmers, sensors – things that receive direction from you or the environment.

Wire Bits – Orange : Orange Bits let you build your circuits in new directions (like with a wire or a fork) or connect to other systems (like coding on a computer).

Output Bits- GREEN: The green Bits are outputs, which do something like light up, buzz, move, etc.