STEAM

STEAM Is the New STEM
How You Can Bring It to Your School
FROM STEM TO STEAM
BRINGING STEAM TO YOUR SCHOOL OR DISTRICT

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littleBits
AGENDA

• CURRENT SITUATION
• INTRODUCTION TO LITTLEBITS
• WHY STEAM?
• 6 WAYS TO SUPERCHARGE YOUR STEAM PROGRAM
CURRENT SITUATION

- High tech use, low tech understanding among youth
- Barrier of entry to technical fields (STEM) too high
- Girls, students of color and low-income students have persistent achievement gaps in STEM
- The jobs of tomorrow will require creativity and innovation
OUR MISSION

TO EMPOWER EVERYONE TO CREATE INVENTIONS, LARGE AND SMALL, WITH OUR PLATFORM OF EASY-TO-USE ELECTRONIC BUILDING BLOCKS.
AN EVER-GROWING LIBRARY
**HOW IT WORKS**

**BLUE = POWER**
Power Bits, plus a power supply, run power through your circuit.

**PINK = INPUT**
Input Bits accept input from you or the environment and send signals that affect the Bits that follow.

**ORANGE = WIRE/LOGIC**
Wire Bits connect to other systems and let you build circuits in new directions.

**GREEN = OUTPUTS**
Output Bits do something—light up, buzz, move...

**ORDER IS IMPORTANT**
Power Bits always come first and input Bits only affect the Bits that come after them.
A GROWING ECOSYSTEM

littleBits

IFTTT

MINECRAFT

ARDUINO

SCRATCH

LEGO

Makey Makey
LITTLEBITS GROWS WITH YOU

- LIGHTS, SOUNDS + SWITCHES
- MOTION
- ENVIRONMENT SENSORS
- BASIC LOGIC + PROGRAMMING
- CODING
- CLOUD
- HARDWARE DEVELOPMENT
& WORKS ACROSS CURRICULUM

WIDE WALLS

SCIENCE
In a lesson on the electromagnetic spectrum, students use littleBits to learn about the visible light spectrum and understand how our eyes and brains interpret light.

HUMANITIES
In a Social Studies unit on Inventors and Inventions, students use littleBits to create an invention to improve the standard of living for people living today.

ART
In this project, students collaborate to create an autonomous drawing machine while also learning about energy and engineering.

MATH
In this advanced level lesson, students use the Bits to learn about the binary number system and the process of counting in binary.
WHY STEAM?

STEAM adds Art (and Design) to STEM

“Sometimes people think STEAM just means adding paint to science projects; it’s not. It’s about mixing the left brain and the right brain, making the study of math and science more visual and creative, and seeing things more openly.”

– Lesa Wang, Marymount School of New York
BRINGING STEAM TO YOUR SCHOOL OR DISTRICT
1. **INSTILL A GROWTH MINDSET IN STUDENTS**

The biggest hurdle students face in a maker/STEAM environment can be failing at a project, so it’s essential that they be encouraged to adopt a “growth mindset” – the belief that they can build and strengthen their abilities through hard work.

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**YOUR STUDENTS’ JOURNEY WITH LITTLEBITS**

- Introducing LittleBits
- LittleBits Invention Cycle
- Guided Challenges
- Open Challenges
- Your Own Challenges
2. CREATE A CULTURE WHERE STEAM CAN THRIVE

Administrators willing to innovate and shake up the system...
Librarians willing to create magical maker spaces...
Teachers willing to learn alongside students...

Find your key group that can make an amazing STEAM Team.
3. PROVIDE SCAFFOLDING FOR TEACHERS AND STUDENTS

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Complexity vs. Time
**i13 LIGHT SENSOR**

**MEET THE BIT**

Use this Bit to control your circuits with light! The amount of light shining on the sensor will change how your circuit behaves. It's a great way to activate your circuit without hands and is perfect for alarms!

**MINI-CHALLENGE**

Can you invent something that moves when the lights go out?

**SAMPLE CIRCUIT**

**HOW IT WORKS**

The light sensor measures how much light is shining on it. It has two modes.

In **LIGHT** mode, as the light shining on the sensor gets brighter, more signal passes through it (making lights brighter or motors turn faster). In **DARK** mode, the signal increases as it gets darker.

Use the purple screwdriver to turn the dial and adjust how much light it takes to change the signal. Clockwise increases sensitivity, counterclockwise decreases it.

**REAL WORLD ANALOGIES**

- **NIGHT LIGHT SENSOR**
- **PHOTOGRAPHER’S LIGHT METER**
- **FINGER PULSE METER**
THE LITTLEBITS INVENTION CYCLE

CREATE

SHARE

REMIX

PLAY
CREATE

BUILD YOUR CIRCUIT.

CHALLENGE 03

INVENT A THROWING ARM

START BY BUILDING A LAUNCHER THAT FLINGS PROJECTILES WITH A SERVO AT THE PRESS OF A BUTTON. Set up a tower of cups and try to knock them over. Then modify your launcher to make it even more accurate, powerful, or speedy. Challenge your friends to see who can knock over the most cups.

BITS™ + MATERIALS

- battery & cable
- pl: power
- l3 button
- a11 servo & servo hub
- a24 servo mount
- a23 mechanical arm
- screws (>3)
- a9 mounting board
- Phillips head screwdriver
- scissors
- rubber band
- paper cups
- masking tape

(not included)
HOW IT WORKS

p1 POWER sends a signal to the button.
When pressed, the [13 BUTTON] lets the signal through to the servo.
When the [a11 SERVO] gets the signal, it turns, rotating the arm and throwing the projectile.

a23 MECHANICAL ARM
The farther you place your cup from the servo hub, the faster it will swing. You can experiment with extending the mechanical arm with other materials, but you’ll have to pay attention to weight.
As the cup gets farther from the hub, it also takes more force to move it. If your arm gets too long it will overpower the servo motor and will be hard to move. This relationship between distance and force is called torque.

a11 SERVO
When it’s in TURN mode, the position of the servo is determined by the incoming signal. At 0 volts, the servo is all the way to the left. If the incoming signal is at full power (5 volts), the servo arm is all the way to the right. When the button makes the signal go from 0 to 5 volts quickly, the arm swings quickly. This speed helps your ball fly farther.
Today's engineering challenge: make the fastest robot inchworm. LunchInTheLibrary @BerkeleyPublic littlebits
**A**  
Try experimenting with the mechanics of your catapult.
- How does changing the length of the mechanical arm change the throwing distance?
- Try different objects for balls. What gets thrown the farthest? How does the size and shape affect the distance traveled?
- What happens when you change the bucket size or shape? How does it affect the throw?

**B**  
How could using other bits make it better?
- Switch the button with a pulse Bit for automatic firing.
- Add a number Bit to count the number of shots taken.
- Creating a moving target with one of the motors and the other mechanical arm.

**C**  
What other games can you play? Could you invent your own?
- Try miniature golf, baseball, or bowling!

**SHARE**  
What new game did you invent? Make it official. Give it a name. Write the official rules and share what you created.

GATHER YOUR FRIENDS AND START A TOURNAMENT. What do they think of the game? Is it too easy? Too hard? Just right?

SHARE YOUR INVENTION ON THE LITTLEBITS APP OR WEBSITE.
4. BUILD STEAM PROJECTS AROUND REAL WORLD ISSUES
Every year over 1 million cats are euthanized in shelters across the United States. One of the main reasons a cat doesn't get adopted is because it is scared of humans and not friendly.

Max, a 6th grader, invented a machine that would play human sounds whenever the cat approached the feeder. The cat learns to associate human voices with the positive experience of eating.

And the invention won the science fair!
Students at the Colonial District in PA were challenged to design ways to improve standards of living for Americans with disabilities.

Sawyer, a 5th grader, invented an enlarged keyboard for a fellow student born with limited hand movement.
Daelyn, age 14, is a Cystic Fibrosis patient who uses littleBits in a children’s hospital makerspace in Tennessee. She invented a device using a timer and fans to dry her nebulizers.
INVENT YOUR WORLD

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OPEN CHALLENGES

Up the difficulty by creating invention-based solutions to 4 open-ended problems.

HACK YOUR CLASSROOM

INVENT FOR GOOD

CHAIN REACTION CONTRAPTION

HACK YOUR HABITS
HACK YOUR HABITS

CREATE

1. CREATE A LIST OF THINGS YOU OR YOUR CLASSMATES DO THAT YOU WANT TO KNOW MORE ABOUT. Maybe it’s a habit you’d like to improve on (how can I make fewer trips to my locker?), something you’re curious about (how many high fives can I get in a day?), or an issue you’d like to help other people understand (why don’t your classmates recycle?). Try to list as many different habits as possible.

2. SELECT THE HABIT YOU WANT TO LEARN MORE ABOUT. Is there one that makes you the most happy, passionate, or upset? It’s always good to work on something that means a lot to you.

   option A
   pros
   -
   -
   cons
   -
   -

3. LOOK THROUGH YOUR BITS™ AND MATERIALS AND THINK ABOUT HOW EACH ONE COULD MEASURE OR TRACK THAT HABIT. Could the button help you know when something is moved? Could the light sensor detect when something is opened?

4. SKETCH OUT IDEAS, PICK YOUR FAVORITE, AND CREATE A PROTOTYPE OF A DATA-COLLECTION MACHINE. Don’t worry about getting everything right on the first try. The important thing is to just get started and experiment. Building a physical model of your idea will help you figure out the best way to track habits.

PRO TIP: PAIRING AN INPUT BIT™ WITH THE NUMBER [IN COUNT MODE] CAN BE A REALLY HELPFUL COUNTER IN THIS PROJECT.
5. CONNECT WITH CURRICULUM

NEXT GENERATION SCIENCE STANDARDS

CREATE
PLAY
REMIX
SHARE

NGSS PRACTICE STANDARDS (K-12)

DEVELOPING & USING MODELS

ASKING QUESTIONS AND DEFINING PROBLEMS

PLANNING & CARRYING OUT INVESTIGATIONS

ANALYZING & INTERPRETING DATA

CONSTRUCTING EXPLANATIONS & DESIGNING SOLUTIONS

ENGAGING IN AN ARGUMENT FROM EVIDENCE

OBTAINING, EVALUATING, & COMMUNICATING INFORMATION
THE INVENTION LOG

CREATE

When challenges are no working yet
It's going to be working on the treat for a
team challenge. It'll be working at a
to the classroom or we can work on things.
6. ENSURE THAT TEACHERS HAVE SUPPORT & TRAINING

- GIVE TEACHERS TIME TO TINKER
- OFFER STEAM TRAINING
- EMPOWER THE POLLINATORS
LITTLEBITS STEAM PD

Learn the skills to bring STEAM teaching to the classroom.

Engage in 6 hours of online instruction at your own pace.

Gain an in-depth understanding of littleBits by getting hands-on with inventions.

Receive a PDU certificate upon completion.

HTTP://LITTLEBITS.CC/STEAMPD
LITTLEBITS AT SCALE

DISTRICT-WIDE MAKERSPACES
KILLEEN ISD
TEXAS
Outfitted 24 elementary schools with littleBits makerspaces and now expanding to all middle schools.

DISTRICT-WIDE INTEGRATION
COLONIAL SCHOOL DISTRICT
PENNSYLVANIA
STEAM projects integrated into humanities classes in 3rd-5th grades, and used in high school makerspace.

DISTRICT-WIDE STEM COMPETITION
COLLIER COUNTY PUBLIC SCHOOLS
FLORIDA
Annual STEM competition across all 4th-grade classrooms, with winners from schools attending district-wide competition.
The New York City Department of Education will feature the littleBits STEAM Student Set as one of the primary learning tools for grades 2-5 in its new STEM-enriched programming for summer school students.
ALL RESOURCES AVAILABLE AT:
littlebits.cc/steam-student-set
littlebits.cc/education
Bit by Bit

Making Makerspaces Work in Killeen ISD
Anna Adam & Helen Mowers
What would you do if you had $1,000,000?
Makerspaces in Schools: Creating STEAM Connections


http://www.mbusd.net/makerspace

https://sites.google.com/a/ugcloud.ca/makerspace-bins-at-terry-james/
CONTEXT THROUGH CREATION, COLLABORATION, AND COMMUNICATION.
Thank you for joining us!

QUESTIONS?
CONTACT: education@littlebits.cc
OR VISIT: littlebits.cc/education

For large scale solutions call: (917) 464-4577