

Ripken Foundation STEM Center

Curriculum Guidebook



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ABOUT THE CAL RIPKEN, SR. FOUNDATION

During his 37-year career with the Baltimore Orioles organization, Cal Ripken, Sr. taught the basics of the game and life to players big and small. After he passed away, his sons Cal and Bill recognized that not every child is lucky enough to have such a great mentor and role model. In this spirit, the Ripken family started the Cal Ripken, Sr. Foundation, a national 501(c)(3) nonprofit organization, in 2001.

By teaching kids how to make positive choices no matter what life throws at them, the Cal Ripken, Sr. Foundation strives to help underserved youth fulfill their promise and become healthy, self-sufficient, and successful adults.

ABOUT THE CAL RIPKEN, SR. FOUNDATION STEM PROGRAM

The Cal Ripken, Sr. Foundation provides programs, resources, training, and support to community-based youth organizations across the country that directly impact the lives of underserved kids. When it comes to the fields of Science, Technology, Engineering, and Math (otherwise known as STEM), we have created a program that makes STEM activities and learning easy for mentors at community-based youth organizations to implement.

We have developed Ripken Foundation STEM Centers to facilitate STEM learning with youth partners nationwide. Each Ripken Foundation STEM Center is equipped with this STEM curriculum guidebook paired with STEM Center products and activity kits which provide a comprehensive, experiential learning environment for kids. The activities in the guidebook are designed to offer mentors many ways to teach critical thinking and problem-solving skills, all while having fun.



GUIDING PRINCIPLES OF THE CAL RIPKEN, SR. FOUNDATION

Cal Ripken, Sr. was a player, coach, and manager in the Baltimore Orioles organization for nearly four decades. He developed great players and, more importantly, great people through his style of coaching which we use as our guiding principles at the Foundation. No matter what you are teaching, you can use these four key ideas as your guide:

Keep It Simple

Lessons on the field and in life are best learned when presented in a simple manner. Teach the basics and keep standards high.

Explain Why

By helping kids understand the connections between everyday decisions and real-life outcomes, we can help them make smarter choices for brighter futures.

Celebrate The Individual

When kids are encouraged to be themselves, respected for their opinion, and are encouraged to share it, they are more likely to have a higher self-esteem and feelings of self-worth.

Make It Fun

If kids aren't paying attention or participating, how much are they learning? Whether it's using a game to teach a concept or motivating kids with a little friendly competition, keeping kids engaged is essential.

Want to hear Bill Ripken explain the guiding principles of the Foundation? Go to http://www.RipkenFoundation.org and sign up for a free account today!



Ripken Foundation STEM Center Curriculum Guidebook

KEEPING KIDS ENGAGED

Here are some tips to help you structure activities that keep kids engaged, excited, and coming back:

- Have a plan
- Keep activities structured
- Provide feedback
- Encourage, encourage, encourage
- Allow kids opportunities to collaborate and learn from each other
- Set achievable goals
- Let kids be silly they're kids!
- Use short time increments and reminders
- Rotate activities frequently
- Let kids have input in the activities they like best
- Stay consistent and create routine
- Affirm kids when they do well



EDUCATIONAL PRINCIPLES BEHIND STEM EDUCATION

Ripken Foundation STEM Centers allow kids to learn and explore their curiosities without the confines of standardized lesson plans and testing. This curriculum guidebook is designed to give you background on the supplies we have provided, along with a set of lessons to enrich your mentoring program.

To help you curate a successful STEM program, we have provided a selection of tools that will strengthen your skills as a STEM mentor. Having these tools in your back pocket will enrich your understanding of the best practices which will enable you to teach important principles while having fun! Remember, some of these tools youth have already encountered in the classroom, so using them in afterschool mentoring programs will reinforce the skills and instill the confidence kids need to excel in STEM subjects, leading to careers in related fields.

HANDS-ON LEARNING

Hands-on learning is a key component of the Ripken Foundation STEM Centers. By having kids actively participating in a hands-on learning experience, you foster skills of inquiry, self-discovery, and problem solving, all while learning science, technology, engineering, and mathematics concepts.

The Experiential Learning Model shows how learning occurs with hands-on experiences. This model, based on the work of D.A. Kolb (1984), works on three basic principles: Do, Reflect, Apply.

Do:

Instruct the kids to conduct an activity. Kids are directly involved in the process by conducting experiments, designing solutions, and testing out ways to answer questions.



Reflect:

Ask questions to help the kids process the experience they just had. The questions offer a chance to delve deeper into the activity and understand concepts they can take away from the experience.

Apply:

Discuss other ways they can use the skills learned with other activities and experiences. The skills developed with one activity transfer to many different applications.

For example – you want your kids to build a garden. They learn how to sow seeds and care for plants, but they also learn how to plan ahead and use resources wisely. These skills developed in the garden will apply on their next project building birdhouses and beyond.

INQUIRY-BASED LEARNING

The Inquiry-based learning process allows kids to learn and grow in a supportive environment that gives them the opportunity to explore their curiosities through facilitated activities that incorporate "free play." Lessons usually begin with an introduction of concepts providing the educational background for activities. You can provide parameters and limitations such as time, budget, limited supplies, real world applications, etc. to give a context for the activities they are about to complete. After providing constructs, task kids with an open-ended challenge that allows them to explore and learn as needed within the constructs. Inquiry-based learning provides some structure for the kids on the front end, while allowing for the kids to arrive at a solution on their own or as a group.

For example – you task the kids with building the tallest tower they can in 10 minutes using only a limited number of index cards and straws. You provided the time and materials constraints, as well as gave them a goal, but left the design, use of materials, and actual construction up to the kids.

ENGINEERING DESIGN PROCESS

The Engineering Design Process (EDP) is a tool to assist with facilitation of problem solving. Children are presented with a scenario or problem, and they follow the steps of the engineering design process to imagine, create, and improve upon a solution to the issue at hand.

To help put this in context of classroom facilitation, we have created an example problem: Ellie and Henry are trying to grow three tomato plants. All three plants need to get water at the same time, but they only have one watering can. The six steps to the Engineering Design Process are as follows:

Ask:

Define the problem to address.

Scenario: We need to water three plants with one watering can.

Imagine:

Conceptualize and brainstorm ideas of possible solutions.

Scenario: How can we have the water come from one can but go three different places?

Plan:

Draw out sketches to visualize ideas including notes for assembly and constructing a model.

Scenario: Henry sketched out a picture of possible contraptions to add to the watering can. Ellie then built a working model based off Henry's drawing.

Test:

Conduct testing to determine if the plan meets the needs and solves the problem. Testing can identify improvements that need to be made and kids can go through the EDP until they are happy with a solution.

Scenario: Henry and Ellie tested their design to see if it worked. It didn't work, so they looked at the drawing and modified their model until it did what they wanted!

Share:

Engineering is a collaborative process. Kids can work in groups to create plans together, or they can offer feedback at the end.

Scenario: Ellie and Henry shared their design with their classmates, so everyone could use it and got feedback on how to make it better.



SCIENTIFIC METHOD

The Scientific Method is a process used to conduct science experiments through a logical process of problem solving and observation to help answer a question. The questions can be as simple or as complicated as you would like. Some experiments solve problems while others simply exist to satisfy a curiosity. The scientific method helps us with these questions through a step-by-step process to gather facts and arrive at an answer.

To help explain, we will follow up with Ellie and Henry's plants. They water them every day, but their plants are wilting and not growing. Ellie wants Henry's help to figure out why their plants are not growing.

Purpose

- State the problem or what you want to discover.
 - What is the question the experiment will address?
 - The plants are wilting even though Ellie and Henry water them every day, why is this happening?

Research

- Make observations about an issue or situation.
 - What is already known? What are you observing?
 - What potential causes of the problem can you rule out?
 - Ellie thought, "My plants get water and sunshine, but what if I am watering them too much?"

Hypothesis

- Predict the outcome to the problem in a testable statement.
 - Create a statement that predicts the solution usually written as an "if...then" statement.
 - Use the research and observations to make an educated guess as to what will happen.
 - Henry poses "If we only water our plants once a week, then they will grow?"

Experiment

- Develop a procedure to test the hypothesis.
 - Define a step-by-step plan to follow to ensure consistency in carrying out the testing.
 - Henry and Ellie plan to use their three tomato plants. For one month, they will water one every day, one three times a week, and one, once a week. Ellie and Henry observed their plants twice a day and measured the height of each plant.

Analysis

- Record the results of the experiment.
 - Keep track of the testing results and interpret them.
 - At the end of the month, Ellie and Henry saw the plant that was watered every day did not grow, the plant watered three times a week grew one inch but was still somewhat wilted, and the plant watered once a week grew three inches and was standing tall.

Conclusion

- Compare hypothesis to the results of the experiment.
- Did the results of the experiment support the hypothesis? Why or why not?
- Ellie and Henry changed their plans and now only water their plants once per week as the experiment supported their hypothesis that watering the plants less than once per day would make their plants grow.

WHAT IS IN A RIPKEN FOUNDATION STEM CENTER?

We at the Cal Ripken, Sr. Foundation continue to help underserved kids through developing new and relevant programs. In keeping with that goal, we have created the Cal Ripken, Sr. Foundation STEM Program. According to a 2011 Harvard study, "there is widespread recognition of the need for literacy and proficiency in Science, Technology, Engineering, and Mathematics (STEM) to navigate the modern world. Furthermore, there is an urgent national priority to



transform STEM learning and engagement in order to meet the nation's need for a STEM-skilled workforce." One of our priorities is giving underserved youth in disadvantaged neighborhoods the opportunity to participate in STEM programs.

Ripken Foundation STEM packages include:

PRODUCTS

Organizations that implement the Ripken Foundation STEM program will receive a selection of materials to enhance STEM learning with their kids in the form of STEM Center products and STEM Kits.

RIPKEN FOUNDATION STEM CURRICULUM

This curriculum accompanies the Ripken Foundation STEM Center products, providing guidance on use of the products provided, as well as offering lessons to use with the kids and products.

RIPKEN FOUNDATION PORTAL

Our online portal offers digital copies of our curriculum as well as other resources for mentoring youth.

To download additional copies of the Ripken Foundation STEM curriculum, supporting files, and other educational materials, register for a FREE account at http://www.RipkenFoundation.org

STEM RESOURCES

These resources listed are websites and products that exist which could assist with facilitation of STEM programming.

CODING AND COMPUTER SCIENCE

Code Academy – learn coding for free

http://www.CodeAcademy.com

Code.org - learn coding and programming with popular characters and games

http://www.Code.org

Scratch Visual, Block-based programming language

http://scratch.MIT.edu

Khan Academy Computer Science Courses

http://www.KhanAcademy.org/CS

CodeCombat.com - game using coding principles, free and paid versions

http://www.CodeCombat.com

Mozilla Thimble - online code editor teaching HTML, CSS, and JavaScript

http://https://thimble.mozilla.org/en-US

AppInventor.org - learn to build Android apps

http://www.AppInventor.org

GameBlox - create and edit games with code

http://gameblox.org

MIT App Inventor

http://appinventor.mit.edu/explore

ROBOTICS

Robotics activities come in all shapes and sizes. Here are a few resources to research if interested in starting a robotics program!

LEGO Mindstorms

SeaPerch

NASA Robotics

http://nasa.gov/audience/foreducators/robotics http://robotics.nasa.gov

Sphero

VEX Robotics

3-D PRINTING

TinkerCAD - online 3D design program. Offers free lessons and design tools

http://www.TinkerCAD.com

Thingverse - website with 3D design files to download and print on your own

http://www.Thingiverse.com

Tinkerine U - online lessons to introduce 3D printing. Has challenges and ideas for kids to design

http://www.u.tinkerine.com

SketchUp - 3D design software, has both a free and paid version

http://www.SketchUp.com

Biological and Earth Sciences

Howard Hughes Medical Institute

www.hhmi.org/biointeractive

EarthWatch Institute

http://earthwatch.org/Education

Earth Science Activities & Experiments

http://www.Education.com/activity/earth-science

MATH

MathChip - math games and activities

http://www.MathChimp.com

STEMCollaborative.org - math games

http://www.STEMCollaborative.org

Adventures in Math

http://www.scholastic.com/regions

Math Playground - math games and activities

http://www.MathPlayground.com

MathSnacks.com - math games and videos

http://mathsnacks.com/

TECHNOLOGY AND ENGINEERING

Engineering.com - news and articles related to engineering

http://www.Engineering.com

Rube Goldberg Challenges - create elaborate inventions to accomplish a simple task!

http://www.RubeGoldberg.com

Engineering is Elementary - lessons and activities for educators available for purchase

http://www.eie.org

TryEngineering.org - information and lesson plans related to engineering

http://www.TryEngineering.org

TeachEngineering.org - lesson plans and activities that tie into the Next Generation Science Standards

http://www.TeachEngineering.org

PHYSICAL AND CHEMICAL SCIENCES

PhysicsGames.net - games related to physics

http://www.Physicsgames.net

Science Kids - simple experiments and activities

http://www.ScienceKids.co.nz/physics.html

myPhysicsLab.com - interactive online physics simulations

http://www.MyPhysicsLab.com

Algodoo - free physics simulation software

http://www.algodoo.com

ChemCollective.org - online simulations and experiments related to chemistry

http://www.chemcollective.org/

GENERAL STEM RESOURCES

STEM Works - articles, activities, and information about all things STEM!

http://www.STEM-works.com

New Mexico State University Learning Games Lab- fun and educational games on a variety of topics

http://www.LearningGamesLab.org

4-H National Youth Science Experiment - a new experiment released annually related to various STEM concepts

http://www.4-h.org/NYSD

Magic School Bus - games, activities, and stories on a wide variety of topics

http://www.Scholastic.com/MagicSchoolBus

National Geographic Kid's Website

http://Kids.NationalGeographic.com

IXL.com – quizzes and activities to reinforce concepts and skills across disciplines. A preview is free but full site use requires subscription

http://www.ixl.com

PBS - The Public Broadcasting Service has several pages related to education and learning

- http://www.PBSLearningMedia.org
- http://www.PBSKids.org/DesignSquad
- http://www.PBSKids.org/

BrainPOP - online educational videos and games. Some videos and games are free, but most require a subscripton

- http://www.BrainPOP.com
- http://www.brainpop.com/games/

Makerspace.com – Online community for the Maker movement of invention and creativity. Get and share ideas of what to create and make next!

http://www.MakerSpace.com

SEA Research's STEM Mentoring Program

http://stemmentoringprogram.org/

Common Sense Media - resource with ratings and information on various technology media such as games, cyber safety, and other web resources

https://www.commonsensemedia.org/



PRODUCT GUIDE

Each Ripken Foundation STEM Center will receive a set of STEM equipment, along with a STEM Kit.

RIPKEN FOUNDATION STEM CENTER EQUIPMENT

The Ripken Foundation provides a variety of products to foster STEM learning in our Ripken Foundation STEM Centers. We work with our program partners to select products for their specific needs. Here is a list of some of the products available to each center:

3D Printer:

Centers receive a 3D printer capable of bringing digital, 3-dimensional models to life! Several spools of printing filament and a replacement nozzle are also included.

Computers:

Each Center has a choice of computers to meet their needs. Some of the models include: Notebooks, Chromebooks, or laptops.

The Ripken Foundation STEM Kit includes fun and captivating activities that teach STEM

concepts that cater to a variety of ages. The Ripken Foundation STEM Kits could include:

- Bee-Bot
- LEGO[®] Coding Express
- littleBits
- Makey Makey
- Ozobot
- Rok Blocks
- Snap Circuits
- Squish Circuits
- LEGO[®] WeDo 2.0



BEE-BOT

OVERVIEW

Bee-Bot is a programmable robot designed for young children to teach counting, sequencing, coding, and problem-solving. Kids use the buttons to input commands telling Bee-Bot a sequence of actions to perform. Bee-Bot is rechargeable and comes ready to use right out of the box so with a little bit of exploration, kids can use Bee-Bot right away. Bee-Bot plays built-in sounds, but these can be muted with a switch on the bottom of the device. Kids can enter up to 40 commands, then press "go" and watch Bee-Bot in action!

PRODUCT SPECIFICS

Bee-Bot kits include:

- Bee-Bot Robots
- Charging Station

MENTOR NOTES

To enhance cross-curricular programming, Bee-Bot can be used in conjunction with mats with pictures of the alphabet, numbers, coins, or other objects to have kids



spell words, add up coins to a target amount, or navigate a town from one store to another. Bee-Bot offers mats for sale on their website, as well as accessories and curriculum.

Bee-Bot moves in 6-inch steps and 90-degree turns and works on a variety of surfaces, so the official mats are not required for use. Groups can construct their own versions of the mats using masking tape on the floor, or other items that create a physical or visual barrier for kids to program Bee-Bot to avoid.

Command cards are another way to enhance the use of Bee-Bot. These cards have directional arrows that kids can place in a specific order to enter as a sequence for Bee-Bot. These cards help visualize the coding, and kids can easily troubleshoot if they encounter an issue.

- https://www.bee-bot.us/ Bee-Bot main website
- https://www.bee-bot.us/bee-bot/beebot-curriculum.html Bee-Bot Curriculum available for purchase (not required)

LEGO® CODING EXPRESS

OVERVIEW

Taking the train set to the next level, the LEGO[®] Coding Express uses large, colorful bricks to teach STEM concepts such as cause and effect and basic coding principles like sequencing and looping. Special bricks are placed along the train tracks to prompt the train to perform a specific action such as play a sound, turn on a light, or change direction. In order to introduce STEM at an early age, the LEGO[®] Coding Express is a kit aimed at kids two to five years old.

PRODUCT SPECIFICS

LEGO® Coding Express kits include:

- LEGO[®] DUPLO[®] bricks
- Battery-powered train
- Getting started guide
- Access to online lessons

MENTOR NOTES

The LEGO[®] Coding Express can be used on its own, or you can deepen and enhance



the experience using the LEGO[®] Coding Express app. The app is available on Android and Apple iOS operating systems. LEGO[®] Education has lesson plans available to facilitate learning.

LEGO® Coding Express requires four AA batteries for each train chassis.

- https://education.lego.com/en-us/support/preschool/coding%20express
 Overview of LEGO[®] Coding Express resources including lesson plans, teachers guide, and building instructions
- https://education.lego.com/en-us/lessons
 LEGO[®] Education lesson plans
- https://education.lego.com/en-us/downloads/early%20learning/software
 LEGO® Coding Express App Downloads available for Android and Apple iOS platforms

LITTLEBITS

OVERVIEW

Often described as electronic building blocks, littleBits are easy to use educational tools that teach critical thinking and problem-solving through engineering and design. The kits are comprised of multiple electronic components (called bits) that each serve a specific function. The bits are color-coded and snap together using magnets making it fun and easy to use for kids and adults alike! littleBits comes with directions for assembling several projects which are easy to follow. The STEAM (Science, Technology, Engineering, Art + Design, and Math) Education Class Pack comes with lesson plans and resources to use in an educational setting.

PRODUCT SPECIFICS

Littlebits Kits includes:

- littleBits and accessories
- Teacher's Guide
- Introduction and littleBits Basics Guides
- Invention Guidebook tied to the Next Generation Science Standards (NGSS) and Common Core Standards
- Online resources

MENTOR NOTES

The materials are easy enough for elementary-aged children to use, but complex enough to allow high schoolers to create and explore. There are activities provided in the Teacher's and Student's Guides that come with the STEAM Class Pack, but there are many other lessons found on the littleBits educator's community website. You can sign up for a free account and gain access to many resources and ideas for using littleBits with your kids.

A great introductory lesson to using littleBits is included in the littleBits Educator's Guide that is available for a free download at http://littlebits.cc/education

- http://littlebits.com/
- http://littlebits.com/education
- http://littlebits.com/education/resources



MAKEY MAKEY

OVERVIEW

Makey Makey is a computer chip that you can affix to any computer, and it will act as a keyboard, game controller, or other controlling device. Kids can play games, play a banana piano, and other neat activities, all while learning basic circuitry. Kids can also go as deep as applying it to coding and programming lessons. Makey Makey is ready to use right out of the box, so just plug it in and start the fun!

PRODUCT SPECIFICS

Makey Makey Kit includes:

- Makey Makey Classic boards
- Connecting wires
- USB computer connecting wires
- Graphite pencils optimized for use with Makey Makey
- Organizing carrying case
- Basic instruction guides

MENTOR NOTES



Makey Makey has a wide offering of online resources available to mentors. The Makey Makey website has instructions for some of the more popular projects such as banana bongos or play dough game controller. Makey Makey has also created an educational website where mentors from around the world can contribute and share ideas and lesson plans. There is also an online forum to ask questions and get ideas and insight on ways to use Makey Makey with your kids. Makey Makey pairs well with Scratch, a visual-based programming language. Using Scratch kids can create colorful games and animations to use with their Makey Makey.

- http://makeymakey.com/
- http://makeymakey.com/how-to/classic/
- http://makeymakey.com/education/
- https://labz.makeymakey.com/dashboard
- http://www.makeymakey.com/forums/
- http://makeymakey.com/lessons/
- http://makeymakey.com/guides/
 - https://scratch.mit.edu/

OZOBOT

OVERVIEW

Ozobot is a programmable robot that uses simple concepts to teach coding and programming basics. Using markers, kids can simply draw a course and the robot will follow! By placing specific sets of colors along the course, the robot will read the colors and behave in a predetermined way. The robots can also be programmed on a computer using Blockly, a visual-based computer programming language.

PRODUCT SPECIFICS

Ozobot Kit includes:

- Ozobot robots
- Multi-port chargers
- Sets of markers
- Tip sheets
- Teacher's guide
- Storage boxes
- Online resources

MENTOR NOTES



Ozobot's Classroom Kit comes with some lessons and classroom resources. Ozobot has on online website that provides mentors access to additional resources such as lesson plans and activities. Mentors can also submit materials to share with others on how they use Ozobot with their kids.

- http://ozobot.com
- http://ozobot.com/stem-education/

ROK BLOCKS

OVERVIEW

ROK Blocks is a reusable set of prototyping tools that allow kids to build and create 3D models of almost anything they can imagine. This kit is a new approach to building blocks, which allows for building things in three dimensions. The variety of the pieces and their durability make this a versatile product that meets many different programmatic needs.

PRODUCT SPECIFICS

ROK Block Kits includes:

- Stackable modules (cases) which hold various pieces and parts
- Base with wheels
- Access to online lesson plans

MENTOR NOTES

Kidspark Education has an online resource center with many different lessons available for download at no cost. These lessons cover a variety of different STEM topics, and even include 3D Printing. The lessons and resources are available for different age and grade levels.

- https://kidsparkededucation.org/
- https://kidsparkeducation.org/curriculum



SNAP CIRCUITS

OVERVIEW

Snap Circuits from Elenco are a fun learning kit that teaches the basics of circuitry and electronics. The kit is comprised of different pieces that can be snapped together (like buttons) to create circuits which turn on lights, fans, radios, and other fun components! The kits are easy to use and assemble, and each comes with directions on how to put together different circuits. The kits can be combined to make larger circuits.

PRODUCT SPECIFICS

Snap Circuits kits include:

- Snap circuit pieces such as:
 - Wire
 - Resistor
 - Speaker
 - Motor
 - LED
 - Switch
- Snap Circuits platform board
- Project instruction guide

MENTOR NOTES



Snap Circuits allow kids to learn the concepts of electronics through easy-to-use components. The activities in the guide provided offer different projects that range in complexity from simply turning on a light to complex circuits using resistors and switches. One realistic feature of Snap Circuits is the use of actual electrical symbols on the products themselves as they would be seen in a schematic drawing or circuit diagram. Also, some of the pieces are made with clear plastic, so the internal wiring can be seen.

- http://www.snapcircuits.net/
- http://www.snapcircuits.net/learning_center

SQUISHY CIRCUITS

OVERVIEW

Squishy Circuits teach circuitry and electronics by using conductive dough, LEDs, and other components using a fun and easy-to-grasp product. Using conductive and insulating dough, Squishy Circuits can create any shape imaginable while still teaching circuitry and electronics.

PRODUCT SPECIFICS

Squishy Circuits Kits include:

- Conductive dough
- Insulating dough
- Battery Holder
- LEDs (various colors)
- *Note: The dough is a consumable product will need replacing periodically. You can purchase more dough from the Squishy Circuits store, or make it using recipes included with the kit or found online.



MENTOR NOTES

Kids love how easy this product is to use. The dough provided works well, but there are alternatives as it is a consumable product and will need occasional replenishing. One option is to use commercial play dough as a conductive dough with modeling clay as the insulating dough. There are also recipes found online as well as in the kit to make your own doughs.

There are no official lessons provided from Squishy Circuits. You can find project ideas in the quick start guide and on the Squishy Circuits website.

ONLINE RESOURCES

https://squishycircuits.com/
 Official site with store to purchase additional supplies.

LEGO[®] WEDO 2.0

OVERVIEW

LEGO[®] WeDo 2.0 combines the standard LEGO[®] brick with motors and sensors for kids to build creations and code them to move and react to their environment. Using a visual-based coding app, kids program a sequence of events and build a structure that carries out the code. WeDo 2.0 comes with several sensors that react to movement as well as a motor and power hub.

PRODUCT SPECIFICS

LEGO® WeDo 2.0 kits include:

- LEGO[®] bricks
- Organizing tray
- Motors and sensors
- Access to online lessons

MENTOR NOTES

LEGO[®] WeDo 2.0 requires the use of an app to program and use the motors and sensors.

This app is available for multiple devices and operating systems. The LEGO[®] Education website has links to download the app for each platform.

LEGO® WeDo 2.0 requires two AA batteries per kit.

- https://education.lego.com/en-us/support/wedo-2
 Overview of LEGO[®] WeDo 2.0 resources including lesson plans, teachers guide, and building instructions
- https://education.lego.com/en-us/lessons
 LEGO[®] Education lesson plans
- https://education.lego.com/en-us/downloads/wedo-2/software
 LEGO[®] WeDo 2.0 App Downloads available for multiple devices including tablets and computers
- https://education.lego.com/en-us/support/3rd-party-support
 Third-Party Software that is compatible with LEGO® WeDo 2.0



LESSONS

We have put together several lessons that utilize the Ripken Foundation STEM Kit. The lessons will rely heavily on the equipment provided, but may call for some additional resources. These lessons are designed for primary or intermediate elementary and middle school range.

All of our lessons were developed to meet the Next Generation Science Standards. The Next Generation Science Standards is a national set of educational standards for STEM fields. These standards align with in-school plans of study creating a cohesive learning experience for kids during mentoring programs. The Next Generation Science Standards were developed to establish skills and concepts crucial to STEM learning. By basing our curriculum on these standards, we are making sure that the activities and lessons create a meaningful experience for all children that attend Ripken Foundation STEM Center programs. This also places your organization ahead of other who do not align their programs to national standards showing a dedication to education and youth development. For more information, visit https://www.nextgenscience.org/

*Note: Several of the products teach circuitry. The skills and knowledge learned from one product can transfer to others creating a deeper learning experience. A recommended "plan of study" for electronics would have kids start with Squishy Circuits, progress to Snap Circuits, then Makey Makey, and concluding by using littleBits.



INTRODUCTION TO 3D PRINTING CONCEPTS

*Note: This is an introductory lesson to 3D printing where kids will be observing the 3D printer in action, while their team is creating an object using the Design Process that could later be designed and printed.

OVERALL TIME 60-minute lesson

GROUPS Three to four kids per group

Next Generation Science Standards

Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

OBJECTIVE

- Gain a better understanding of how 3D printing works.
- Design and sketch an object that solves a problem.

OVERVIEW

Kids will learn how a 3D printer works, and what a 3D printer is capable of printing. Kids will design and sketch an object that would be useful to solve a problem in their school, capable of using 3D printing to make. Kids will also observe a 3D object being printed using Matter Control software.

MATERIALS

- 3D Printer
- Downloaded .stl file to print
- Matter Control

- PREPARATION
- Matter Control is the software used to upload files to the Robo3D Printer. Be sure to install Matter Control and the 3D Printer drivers on the computer before beginning. When you are ready to print, download an object file compatible with your 3D printer.
- Warm up the printer. Place a blank sheet on the base of the printer and tape the ends down, so it doesn't move while it prints. Then after the printing is complete, the object should easily come off the paper.

LAUNCH 10 to 15 minutes

Bring kids together in a large group. Have them choose a partner and share what they know about 3D printing. After a minute of discussion, have a few pairs share aloud in a large group. Then have the kids choose a different partner and ask where do we see 3D printing in real life? Give a minute for discussion, and then ask a few pairs to share with the group. Some examples might be: prosthetic limbs, toys, vases, replacement parts, prototypes, etc.

Have the kids pair up with a third partner. To begin exploration into 3D printing, have kids take 5 to 10 minutes using the STEM Lab computers to research what can be printed using a 3D printer.

We have several .stl files located on the materials page of the portal. To download, visit: http://www.ripkenfoundation.org

Playdoh

Paper

EXPLORATION 35 to 40 minutes

Kids will partner up in groups of 3 to 4, to brainstorm and create a useful object that would be helpful in school such as a door stop, sign holder, or picture frame. Then kids will sketch the design on paper noting different angles of the object (top, bottom, side, etc.). After making the sketches, kids will use Playdoh to create the 3D object.

While kids are working on their design, print an object using the 3D printer. Many of the .stl files found on CRSFPortal.org only take about 15 minutes.

Have groups come up one at a time to observe the 3D printer in action.



POSSIBLE YOUTUBE VIDEOS

What is 3D printing and how does it work?

https://www.youtube.com/watch?v=Llgko_GpXbl

3D Printing in the Elementary School

https://www.youtube.com/watch?v=QTW4r4qfHys

3D Printing in the Middle School Science Classroom

https://www.youtube.com/watch?v=1jp-RemY-_4

Kids Learn 3D Design and Printing

https://www.youtube.com/watch?v=nHgY947uCbU

CLOSING 5 to 10 minutes

Bring everyone back together. Have groups share their 3D design and how it would be helpful in school.

Pass around the object that was printed. Have kids share any interesting observations. Take time for teams to thank each other for being a part of their learning community.

ENRICHMENT AND NEXT STEPS

For kids interested in creating their own 3D designs, TinkerCAD is a great website for beginners. TinkerCAD is a free website that allows anyone to learn how to design and print simple or intricate 3D objects. TinkerCAD offers lessons on how to use the controls for the website, as well as how to create designs and objects! Visit http://www.tinkercad. com for more information and to access the lessons and design tools.

This is just a preview of the Ripken Foundation STEM Center Curriculum Guidebook. Contact info@ripkenfoundation.org for more information on becoming a STEM Center.

FINAL THOUGHTS

You are on the front lines, empowering kids in your community each and every day. You're there through life's challenges, just as Cal Ripken, Sr. was for his kids and his players: teaching them how to make the best of every situation, leading by example, and encouraging them to swing for the fences.

At the Cal Ripken, Sr. Foundation, we see our role as supporting you in this shared mission. This guidebook is just a stepping-stone to start your STEM program! We hope you find ways to expand and keep your program going in perpetuity. Here are some resources to encourage program growth.

ADDITIONAL CAL RIPKEN, SR. FOUNDATION RESOURCES

For more information about the Cal Ripken Sr. Foundation, visit our website at

http://www.ripkenfoundation.org

Follow us on twitter at http://www.twitter.com/CalRipkenSrFdn

Find us on Facebook at http://www.facebook.com/CalRipkenSrFdn

Check out our YouTube Channel at http://www.youtube.com/CalRipkenSrFdn

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We would also like to thank our sponsor, Battelle who provided support making Ripken Foundation STEM Centers a reality.





Ripken Foundation STEM Center Curriculum Guidebook



The Cal Ripken, Sr. Foundation helps to build character and teach critical life lessons to at-risk young people living in America's most distressed communities.



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