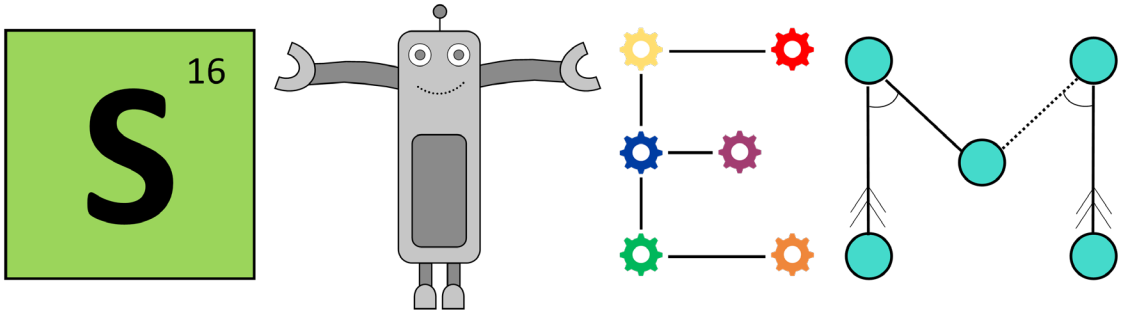
CAL RIPKEN, SR. Foundation

TRANSFORM COMMUNITIES
CHANGE KIDS' LIVES



Ripken Foundation STEM Center

Curriculum Guidebook

INTRODUCTION

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!*

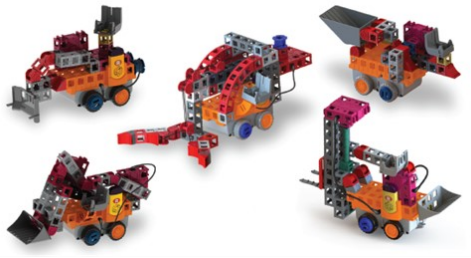
KEEPING KIDS ENGAGED

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**

Ripken Foundation At-Home STEM Kits

Maker ROK Robotics



Congratulations on your new Maker ROK Robotics kit!

The Maker ROK Robotics kit from Kid Spark Education contains 3-D building blocks that combine to create programmable and remote-control robots. This kit will not only teach you how remote-control robots function, but it will allow you to build a variety of robots, each performing a different task. You can use the included construction plans, and there are additional construction guides and activities available through the Kid Spark Education website and on their social media accounts. This requires six AAA batteries and a Phillips-head screwdriver.

https://www.KidSparkEducation.org/

https://KidSparkEducation.org/Curriculum

Facebook: KidSparkEDU ● **Twitter:** @KidSparkEDU ● **Instagram:** @KidSparkEDU

Additional activities and resources are available at:

http://www.RipkenFoundation.org/Ripken-STEM-Kits

LESSONS

ROK BLOCKS CARGO RACER CHALLENGE

OVERALL TIME *60- to 75-minute lesson*

GROUPS *Three to four kids per kit*

Next Generation Science Standards
(4th grade and up)
Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
(3-5-ETS1-3)

OBJECTIVE

Kids will apply the Engineering Design Process to solve a problem.

OVERVIEW

Kids will have the opportunity to work together as a team to solve a problem using the Engineering Design Process. The team will use the engineering design process to guide them as they brainstorm ideas, plan, test, modify, and retest their design. Add collected measurement data to the class chart to see which team's vehicle traveled the farthest.

MATERIALS

- **ROK Block kit**
- **Ramp (optional)**
- **Tape Measure**
- **Paper**
- **Pencils**
- **Masking Tape**
- **Chart Paper**

PREPARATION

- Create a class team chart with a row for each team, and a column to record the distance their vehicle traveled

- Set up an area where kids can complete a test run

- One piece of tape per team labeled with the team's name or number

LAUNCH *5 to 10 minutes*

Introduce the Engineering Design Process with the group. Each child will have a job in the challenge. Share the list of job roles and tasks assigned to each child. Provide teams with two minutes to decide on the different job roles.

Organizer: helps decide roles, holds all kids accountable, and keeps track of time.

Technician: measures, sketches, and makes sure data is recorded.

Programmer: completes tests and the final run; and is in charge of making modifications.

Reporter: takes notes on experiments and reports conclusions.

CHALLENGE

Introduce the challenge to the teams: The objective of this challenge is to have a vehicle that can travel the farthest distance going down a ramp carrying a load of 12 balls (6 red and 6 blue) from the kit. All balls must remain inside of the vehicle while traveling down the ramp. The vehicle that goes the farthest will win the challenge.

EXPLORATION *45 to 50 minutes*

Give teams 30 minutes to design and build a vehicle. Walk around to each group as they are designing and talk with the youth.

Possible questions to ask:

- *What are your ideas for the design?*
- *How did you decide?*
- *Did everyone contribute?*

Give time warnings along the way to keep teams on track. Suggested times: halfway, 10 minutes left, five minutes left, one minute left

Encourage groups to test and modify their design as they go and allow them to use the ramp to practice.

OFFICIAL RUNS *10 minutes*

The ramp should be viewable by all kids. Choose a team to go first and have the Programmer from each team come up to complete the official run for the vehicle. As each vehicle goes down the ramp, have a piece of masking tape ready with the team number and place it where the vehicle stopped. Then, have the Technician measure the distance the vehicle traveled and record data on the class chart. Continue until all teams have had the opportunity to test their vehicle.

**Encourage teams to cheer each other on.*

CLOSING *5 to 10 minutes*

Call on the Reporter from each team to answer the following questions. If they need help, they can call on someone from their team to answer. A variation could be to have each child answer the following questions on an exit slip.

- *How did your design work?*
- *Did your team test the design before the official run?*
- *What changes did you make after the test run?*
- *If you could go back, what would you do differently now?*
- *How did each of your teammates work together?*

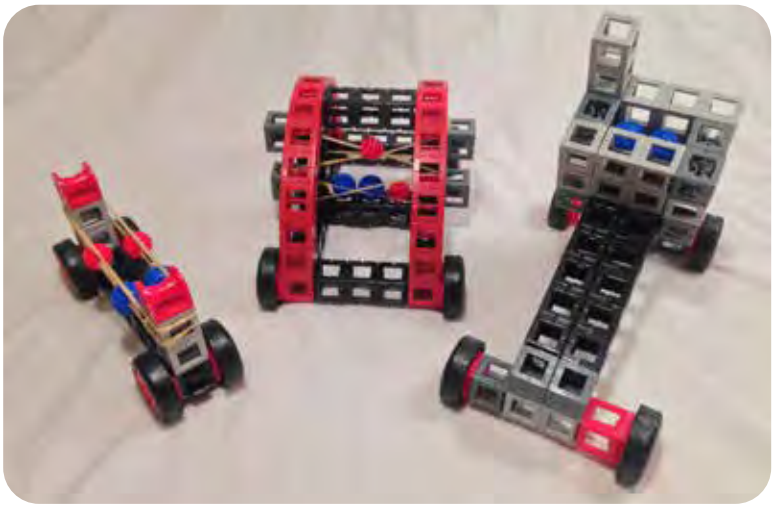
Take time for teams to thank each other for being a part of their learning community.

CLEAN UP *5 minutes*

Have children break apart vehicles and use the ROK Blocks guide to put all the materials back in the box.

ENRICHMENT AND NEXT STEPS

Change the challenge and have teams design vehicles to meet a new standard – which can travel the furthest, carry the heaviest load the furthest, or a vehicle only using two wheels – the possibilities are endless!



OVERALL TIME *60- to 90-minute lesson*

GROUPS *Three to four kids per kit.*

Next Generation Science Standards
(4th grade and up)
Plan and carry out fair tests in which variables are controlled, and failure points are considered to identify aspects of a model or prototype that can be improved.
(3-5-ETS1-3)

OBJECTIVE

Kids will apply the Engineering Design Process to solve a problem.

OVERVIEW

Kids will have the opportunity to work together as a team to solve a problem using the Engineering Design process. The team will engage in the engineering process to guide them as they brainstorm ideas, plan, test, modify, and retest their design. Teams will record data to see which team's structure can hold twelve thin books.

MATERIALS

- **ROK Blocks Kit**
- **Timer**
- **Chart Paper**
- **Markers**
- **Tape**
- **Rulers**
- **12 thin books**

Variation: use a different amount of books or other objects as weights

PREPARATION

- Set up an area where mentees can complete the weight test. Create a Class Data Chart with the headings, "Team," "Height," and "Books." Write down the job roles with task assignments and the challenge on chart paper. Have one Engineering Design Process sheet and a piece of tape per team labeled with the team's name or number.

* Kids will only be able to use the materials from the ROK Blocks kit for the challenge.

LAUNCH *10 to 15 minutes*

Review the Engineering Design Process and the challenge with the group. Each kid will have a job in the challenge. Share the list of job roles and tasks assigned to each one. Provide teams with two minutes to decide on the different job roles.

Organizer: helps decide roles, holds all kids accountable, and keeps track of time.

Technician: measures, sketches, and records data.

Programmer: completes the test, final demonstration, and is in charge of making modifications.

Reporter: takes notes on Engineering Design Process sheet and reports conclusions.

ACTIVITY

A new office building needs to be constructed. The company is requesting the tallest structure possible to allow for maximum office space. However, with the harsh winters in this region, the design needs to support the extra weight of snow and ice during the winter months.

Design the tallest standing structure using ROK Blocks that can support the weight of twelve thin books representing snow and ice.

EXPLORATION *45 to 60 minutes*

Teams will be given 25 minutes to design and build the tallest structure. Walk around to each group.

Possible questions to ask:

- *What are your ideas for the design?*

- *How did you decide?*

- *Did everyone contribute?*

After 20 minutes have gone by, give teams a five-minute warning.

Test *(5 to 10 minutes)*

Have teams test their structures as they are ready.

Modify *(10 to 15 minutes)*

Kids can take this opportunity to make modifications to their structure.

Final demonstration *(10 to 15 minutes)*

Choose a team to go first. The **Organizer** will keep track of time. Each team will have two to three minutes to perform the demonstration. Have the **Programmer** from the team come up to complete the test. Then, have the **Technician** record the team number, and the number of books the structure can hold on the class chart. Continue until all teams have had the opportunity to complete the weight test.

**Encourage teams to cheer each other on.*

CLOSING *10 to 15 minutes*

Call on the **Reporter** from each team to answer the following questions. If they need help, they can call on someone from their team to respond. *A variation could be to have each kid answer the following questions on an exit slip.*

- *What changes did you make after the practice test?*

- *Why do you think your design met or didn't meet the challenge?*

- *If you could go back, what would you do differently now?*

- *How did each of your teammates work together?*

Take time for teams to thank each other for being a part of their learning community.

CLEAN-UP *5 minutes*

Have groups break apart the structures and use the ROK Blocks guide to put all the materials back in the box.

NEXT STEPS OR TAKE HOME CHALLENGE

Allow kids to complete a similar challenge by exploring other materials, such as blocks, paper, or cards, to build a tall structure. Weights could be dice or pencils. Be creative!

EDUCATIONAL PRINCIPLES BEHIND STEM EDUCATION

EDUCATIONAL PRINCIPLES BEHIND STEM EDUCATION

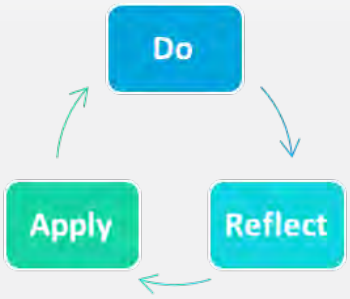
Ripken Foundation STEM Centers allow kids to learn and explore their curiosities without the confines of standardized lesson plans and testing. This curriculum guidebook is designed to give you background on the supplies we have provided, along with a set of lessons to enrich your mentoring program.

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:

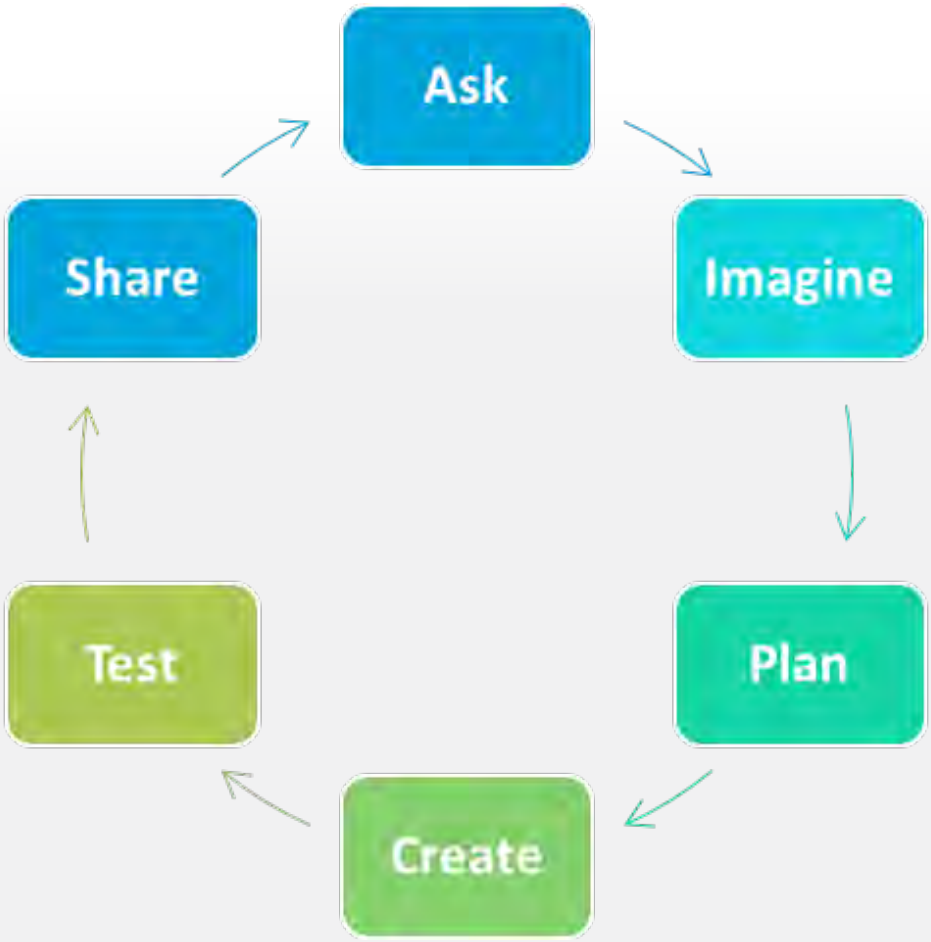
Conduct testing to determine if the plan meets the needs and solves the problem. Testing can identify improvements that need to be made and kids can go through the EDP until they are happy with a solution.

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.

STEM RESOURCES

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

STEM RESOURCES

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/**

STEM RESOURCES

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**

STEM RESOURCES

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/**

STEM RESOURCES

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**

ACKNOWLEDGEMENTS

We would like to thank all of our sponsors for their support.