STEAM Academy: Rockin' Robots Camp

Abstract

Many off-the-shelf educational toys are developed to engage kids in STEM-related activities such as coding or programming in hopes of motivating students to engage in STEM practices. However, few of these packaged toys do much in developing an understanding of how the machines actually work. And, while they may promote the use of programming, they do little to build capacity in student creativity and innovation, which often results in kids quickly abandoning these resources.

The goal of Rockin' Robots is to tap into student creativity and empower students to learn new skills as they create their own basic robots, learn how they work, and gain the programming fundamentals to create their own program to create and control both virtual and real-world characters.

The Rockin' Robots STEAM Academy is designed to take the novice maker and programmer through a series of experiences over a five-day course that will result in a basic understanding of both the hardware (circuits) and software (coding) to bring projects to life and leave students with a sense of accomplishment and pride as they leave with their own creations and leave you with the supplies and resources to continue to impact student learning throughout the year.

Target number of camp attendees: 24

Age range target: 9-13yrs

Experience level: None

Host site requirements: Windows or Mac computers with USB port for robotics and Scratch programming.

Duration: Five days, 3 hours per day.

Skill Development

- Ability to disassemble and harvest reusable parts from devices and repurpose for new projects.
- Soldering and circuit-building for simple electronic projects.
- Logic-based programming strategies for operating robotics as well as creating virtual stories.

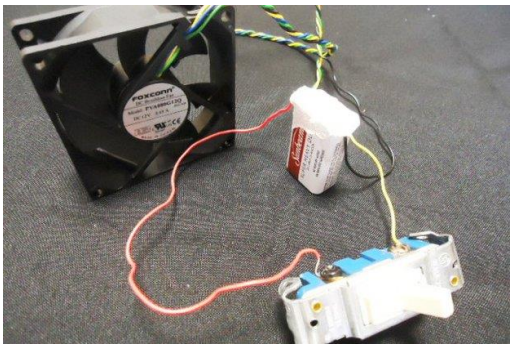
Learning Outcomes

- Understand basic electrical circuits including conductors, insulators, inputs, outputs, the flow of energy in a circuit, and how to modify simple circuits and how these systems are used in everyday technology through reverse engineering practices.
- Understand properties of materials and how those properties make certain materials more or less appropriate for a given task, including the ability to conduct electricity or heat, take advantage of varying melting points, and choose materials for their rigidity or flexibility.

- Understand logic foundations for all programming, including sequence of events, cause and effect, and inputs and outputs to support work in any programming language.
- Apply their own creativity and experiences to a project in bringing a vision from idea to product and the design processes that support successful outcomes.
- Effectively use collaboration and critical thinking process to persevere through challenges and develop a sense of empowerment and confidence in multiple STEM-related fields.

Materials Used

- Discarded technology such as old cassette players, VCRs, desktop computers. These items may be brought by camp attendees, are often donated by computer/technology recyclers, or the key parts harvested can be sourced as new items from electronics suppliers (hobby-sized electric motors, wiring, small electric fans found inside computers)
- Electrical tools including wire cutters, strippers, electrical tape, screwdrivers
- Battery connectors
- Student soldering kits, battery-operated soldering irons, stands, circuit board holders
- mBot robotics kits
- Rechargeable AA batteries and charging stations
- Craftsticks
- Mini hot glue guns and glue
- Cardboard



Instructional Overview

The instructional days are divided into three skill areas of emphasis:

- Reverse engineer and repurpose
- Build and construct from technical directions (soldering)
- Programming basics.

This structure supports engagement and activity with new skills while ensuring that learners benefit from being able to process their learning as they transition to different tasks that utilize different skills and practices.

	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Reverse Engineer & Repurpose	Students set up notebooks and passports, learn their environment, and identify/learn basic tool usage and storage locations. Begin device disassembly.	Continue disassembly of devices. Begin harvesting materials for reuse, including wires, motors, switches. Demonstrate operation of components within devices.	Plan and then utilize harvested parts, for basic robot design. Begin construction from harvested components.	Finish robot construction from harvested components. Identify/modify parts of tech necklace.	Students assemble their take apart necklace. Showcase student robot designs.
Build and Construct (soldering)	Students learn and practice safe soldering iron operation/storage. Begin with basic solder operation and practice.	Continue construction of Rockin' Robots kits, documenting parts used and their purpose in design.	Students continue construction of Rockin' Robots kits.	Students assist and complete Rockin' Robots kits	Students complete post-survey. Update notebook sketches of Rockin'Robots
Coding the program	Students begin their programming in block-based, Scratch environment. Introduction of sequence of events. Learn to manipulate virtual environments.	mBot construction.and connection. Test with first program.	NASA: Programming mBot for sequenced operation. Solving problems in hardware using software.	mBot programming our own controls to enable real-time operation.	Students showcase their robot programming skills through the challenge course!