# ezrobot

EDUCATE • ENGAGE • EMPOWER

# Educators Guide

## SIX Hexapod

Welcome to **EZ-Robot Inc**.

EZ-Robot is an edtech solution that supports teaching and inspires learning. Empowering lifelong learning through real world applications and problem-solving, EZ-Robot provides new opportunities for reinforcing the power of science, technology, engineering, arts, and mathematics (STEAM).

The comprehensive and modular EZ-Robot technology platform grows with students as they learn. EZ-Robot software and hardware innovations provide approachable methods for learning complex robotics skills. From the basics of coding to machine learning, students graduate from beginner to advanced users as they gain the skills and knowledge needed to thrive in future STEAM related careers.
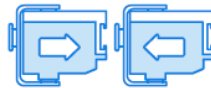
This guide provides important information for getting started with your robot.

| Mobile Play + Programming | 3D Design + Printing | Modular Hardware | Graphical Programming | Easy-to-learn Syntax | Add-Ons + Sensors |
|---|---|---|---|---|---|

The EZ-Robot pedagogical approach builds competency in 21$^{st}$ century learning skills. Through the exploration of technology and robotics, students will build their confidence and capabilities in creativity and innovation, computational thinking, and critical analysis.

| Creativity & Innovation | ✓ Design thinking<br>✓ Algorithmic design<br>✓ Engineering invention |
|---|---|
| Computational Thinking | ✓ Syntax & conditional logic<br>✓ Sequential planning<br>✓ Pattern recognition |
| Critical Analysis | ✓ Problem solving<br>✓ Scientific inquiry<br>✓ Collaboration |

# EZ-Robot in the Classroom

### How do I get started?

1. Download the software from www.ez-robot.com/ez-builder
2. Review the Getting Started Guide for battery and safety information.
3. Visit http://www.ez-robot.com/Tutorials for resources, lessons, and tips.

### How many students can work with a robot at one time?

Based on educator experience, it is recommended to limit two students per robot.

### How can I keep a class set of robots organized when connecting all at once?

Each robot has a unique Wi-Fi identification name. This name can be customized as desired. Designate a number or letter for each robot in a classroom set and mark the robots accordingly.

http://www.ez-robot.com/Tutorials/Lesson/116

### Where can I find learning resources and content?

Visit http://www.ez-robot.com/Tutorials/ to learn more about each robot.

EZ-Robot's The Robot Program is a freely available educational series that teaches technology using robotics. Various aspects of technological literacy are addressed in follow-along lessons, from building robots to coding programs, from using artificial intelligence to implementing computer vision, and more.

Each lesson is available as both a written tutorial and as an educational video. Episodes include a step-by-step lesson with identified learning concepts, as well as a quiz for testing knowledge.

More information and resources can be found at www.TheRobotProgram.com or embedded throughout the Learn section of the website at http://www.ez-robot.com/Tutorials.

### What should I do if something isn't working correctly?

Contact your local reseller for resources and recommendations. If you still need further assistance, please contact us at support@ez-robot.com.

## Suggested Lesson Plan for SIX Hexapod Basics

**Introduction to Teaching and Learning with Robotics**

*Recommended Lessons*

The Robot Program Episode 038: Using The Robot Program

The Robot Program Episode 040: Practical Applications of Robotics

The Robot Program Episode 071: History of Programming

The Robot Program Episode 056: Safe Robot-ing

The Robot Program Episode 005: Battery Charging and Care

**Introduction to SIX Hexapod**

*Recommended Lessons*

The Robot Program Episode 007: Six Hexapod Box Contents

The Robot Program Episode 008: Building Six

The Robot Program Episode 009: Getting Six Hexapod Robot to Move

# The Robot Program Challenge

Encourage, engage, and deepen student learning through creative design challenges. The Robot Program Challenge scaffolds and connects the lessons found in The Robot Program with practical engineering design problems. Each design challenge incorporates technical learning outcomes while developing creativity and innovation, computational thinking, and critical analysis. Five initial challenges are included in this guide.

More challenges can be found at www.ez-robot.com/challenge. Challenge episodes feature teaching and learning experiences from classrooms that have created, adapted, or programmed robots in innovative and fascinating ways. Educators are encouraged to share student achievements related to an active challenge by entering a submission on the website.

Challenges are designed to grow skills and knowledge while promoting interdisciplinary connections between science, technology, engineering, arts, and mathematics (STEAM). As students move through the design and implementation process, they will incorporate core learning outcomes that provide confidence and competency for all stages of learning.

## Lifelong STEAM Learning Outcomes

| Science | Technology | Engineering | Arts | Mathematics |
|---|---|---|---|---|
| Formulate hypotheses | Abstract complex systems | Examine problem constraints | Create original works | Predict outcomes |
| Explore theories & ideas | Develop a sequential process | Generate multiple ideas | Interpret & express theories | Determine & describe patterns |
| Record observations & data | Design comprehensive tests | Analyze & compare ideas | Connect interdisciplinary ideas | Measure angles & movement |
| Identify & analyze trends | Model & visualize information | Develop & manage a plan | Engage responsible citizenship | Analyze position & motion |
| Collaborate on solutions | Verify outcomes | Design prototypes & testing | Communicate data & results | Apply spatial transformations |
| Discover through inquiry | Apply knowledge & skills | Reflect & refine solutions | Innovate authentic applications | Represent expressions & data |

| Challenges for SIX Hexapod | Learning Goals | Recommended Lessons |
|---|---|---|
| Challenge – Recipes for Robots | *Create a program in RoboScratch using actions, movements and sounds.*<br><br>Technical Skills:<br>• Code linear, sequential programs using RoboScratch<br>• Differentiate between immediate and delayed actions<br>• Control robot movement<br>• Activate and use peripheral information | Episode 071<br>Episode 020 |
| Challenge – Laughs and Limericks | *Program the robot to tell a joke or recite a poem.*<br><br>Technical Skills:<br>• Code linear, sequential programs using Blockly<br>• Analyze and predict speech patterns<br>• Trigger and time audio output<br>• Adjust speech recognition confidence intervals | Episode 043<br>Episode 044<br>Episode 045 |
| Challenge – Obstacle Mission | *Navigate a course within a specified time limit using speech recognition and then by creating a Blockly program.*<br><br>Technical Skills:<br>• Calculate, plan and analyze robot movements<br>• Code sequential programs using Blockly<br>• Adjust speech recognition confidence intervals<br>• Trigger and navigate movement | Episode 045<br>Episode 059 |
| Challenge – Secret Message Delivery | *Generate and decode secret messages using QR codes and the camera.*<br><br>Technical Skills:<br>• Encode QR information<br>• Analyze variable data<br>• Append text to a string<br>• Output audio | Episode 052 |
| Challenge – So You Think Your Robot Can Dance | *Design and share a custom choreography timed to a favorite piece of music.*<br><br>Technical Skills:<br>• Synchronize servo movements to audio<br>• Calculate servo angles and positioning<br>• Create a mobile app interface<br>• Share projects across robots | Episode 034<br>Episode 037<br>Episode 053 |

# Implementing a STEAM Classroom Challenge

## Understanding the Problem

Provide the goal of the challenge to the students. Have them identify the requirements as they breakdown the overall outcome into smaller objectives. At this stage of the process, students should be focused on defining and examining the problem, rather than focusing on how they will solve the problem.

An engineering log book is a great way to record student thoughts, ideas, and collaborations. Encourage both individuals and teams to express their design process through written, visual, and oral communication. This may include presentations, reports, tables, charts, discussions, predictions, or models.

## Generating and Comparing Solutions

Encourage students to ideate individually before coming together as a team or large group. Each student should have the opportunity to share their potential solutions without judgement or criticism. Empower student collaboration by connecting a strong element or thought from each student to grow a group solution. Students can assess and critically analyze multiple potential solutions by weighing criteria such as time constraints, material restrictions, feasibility, and adherence to the requirements. Once a solution has been determined, students can then begin to develop a design plan.

## Developing a Plan

Whether students are working as a team or individually, they will benefit from creating a design plan. This allows them to identify and schedule specific software or hardware tasks that need to be completed. Students should also predict anticipated areas of difficulty and identify any gaps in their knowledge that will require extra research or learning.

As they begin development, students should rotate roles to practice the various skills involved, from coding to connecting the hardware to recording design progress.

## Prototyping a Solution

As students begin to develop their solution, they may benefit from first mapping out their proposed program on paper or by talking through the logic with another person or team. This will help them to develop their computational thinking skills as they gradually increase the complexity of their

implementation. Rather than implement multiple controls or commands at once, students should build their project modularly, iteratively developing and testing each component. Remind students to focus achieving the challenge outcomes as they innovate.

## Testing and Refining the Result

Testing provides students with the opportunity to break and improve their designs. Verifying the outcomes of their work allows students to take responsibility for their own learning while considering practical scenarios that could impact their original plan. As students debug their designs, they will learn to recognize patterns in their code and the corresponding implications for robot movement or response.

## Sharing the Final Solution

Challenges encourage creativity and innovation, leading to multiple solutions and varied results for every design problem. Students should have the opportunity to share their work while learning about the solutions of others. Whether this is done through a formal showcase or an informal discussion, students should be encouraged to consider how their final solution could be applied ethically and responsibly to a practical, real-world scenario.

## Reflecting on the Challenge

Before ending the challenge, encourage students to reflect on the design process and the implications of their work. As they develop their technical skills, students will also benefit from growing their ability to self-assess and analyze. Identifying both positive and negative aspects of the challenge experience will help students to connect ideas in the future while building their confidence and competencies.

# Challenge Descriptions

# Challenges for SIX Hexapod

### Challenge – Recipes for Robots

A program allows humans to give specific instructions to robots. Create a program in RoboScratch that uses the following elements:

- At least ten actions or movements
- A mix of "wait" and regular actions or sounds
- The robot must not remain in the same starting location
- The robot must take two different photos

*Students will learn to...*

- Program linear sequences
- Implement immediate commands
- Implement delayed commands
- Move the robot
- Reposition the robot
- Output audio
- Activate the camera

*Recommended Lessons*

The Robot Program Episode 071: History of Programming

The Robot Program Episode 020: Detect Face and Wave – RoboScratch

## Challenge – Laughs and Limericks

Robots can be programmed to speak with a similar cadence and sound to humans. This allows for better quality interactions between humans and robots.

Program the robot to recite a family-friendly joke or poem. The chosen words should involve at least three lines of spoken text. Consider how a human would pause while reciting the text. For an advanced challenge, trigger the recitation using a speech command.

*Students will learn to…*

- Code linear, sequential programs using Blockly
- Analyze and predict speech patterns
- Trigger and time audio output
- Integrate pause commands where necessary in the code design
- Adjust speech recognition confidence intervals

*Recommended Lessons*

The Robot Program Episode 043: Create a Scene Using RoboScratch

The Robot Program Episode 044: Create a Scene Using Blockly

The Robot Program Episode 045: Control Robot with Speech Recognition

## Challenge – Obstacle Mission

Robots can enter situations that might be too dangerous or difficult for humans. They can navigate over rough terrain and around obstacles.

Travel through an obstacle course or through a maze within a specified time limit first using speech recognition to control movement, and then by creating a Blockly program.

*Tip:* Remember to calculate how many seconds it takes the robot to complete a 90-degree turn to the right or left.

*Tip:* Make a note of how far the robot moves forward in a single second.

*Students will learn to…*

- Adjust speech recognition confidence intervals
- Trigger movement through audio input
- Calculate and analyze robot movements
- Build a series of movement commands
- Navigate turns and obstacles

*Recommended Lessons*

The Robot Program Episode 045: Control Robot with Speech Recognition

The Robot Program Episode 059: Navigating Using Blockly

## Challenge – Secret Message Delivery

Robots can process complex information such as QR codes and react to the provided information.

Generate a secret message in a QR code and swap with someone else. Program your robot to decode the new message and then read it out loud, starting with the phrase "The secret code is…"


*Students will learn to…*

- Store information in a QR code
- Detect a QR code
- Read information from a variable
- Append text to a string
- Output audio


*Recommended Lessons*

The Robot Program Episode 052: Using QR Codes

## Challenge – So You Think Your Robot Can Dance

Robotics are used in fine arts as a part of performance, animation, and theatrics.

Design a custom robot dance routine to a favorite piece of music. The choreography must be at least one minute in length and use a minimum of five different positions. For an advanced challenge, create one custom action that can be incorporated into the choreography.

One your dance is complete, create and share a mobile interface that allows anyone to showcase the dance routine.

*Tip:* Search for free music using www.ninety9lives.com.

*Tip:* Start with an existing mobile interface to see how buttons can be used to execute routines.

*Students will learn to…*

- Synchronize servo movements to music
- Save a new routine in the Soundboard control
- Transition between servo positions
- Advanced: build actions through still frames
- Advanced: calculate servo angles and positioning
- Modify or build a mobile app interface
- Save and export a mobile app to the EZ-Cloud
- Access apps from the EZ-Cloud community

*Recommended Lessons*

The Robot Program Episode 034: Teaching JD Humanoid to Dance

The Robot Program Episode 037: Teaching JD Humanoid to Dab!

The Robot Program Episode 053: Creating a Mobile App