

Berrien Springs Partnership Syllabus and Instructor Qualifications

CLASS TITLE: Robotics I

GRADE OR AGE LEVELS: 3rd - 8th

START DATE: contact instructor for class dates **END DATE:**

WEEKS TOTAL: 17

WEEKS OFF: 3

DAY/TIME REQUIRED: Wednesday 2-3pm **ADD'L DAYS/WK AVAILABLE:**

HOURS (REQUIRED): 17

HOURS (OPTIONAL): 73 (approx.)

TOTAL SEMESTER HOURS POSSIBLE: 90

LOCATION/ADDRESS: STEAMWORKS: 606 Carrol St, Suite B, Buchanan MI 49107

MAIN INSTRUCTOR: Rob Kerr

CONTACT INFORMATION:

phone: 269-362-5046

email: rob@funlearningcompany.com

website: <https://FunLearningCompany.com/>

ADDITIONAL REGISTRATION AT SITE REQUIRED? NO

MAIN INSTRUCTOR QUALIFICATIONS:

I am passionate about helping students to explore new things and express their creativity. I have been teaching myself for the last eight years. For the last six of those, I've been partnering with different schools through the Fun Learning Company to teach critical thinking and STEAM courses. I enjoy tinkering and making things myself, and seek to encourage the entrepreneurial spirit in others as well. I have published my own card game, as well as writing and producing an album. One of my favorite things is when I can combine multiple interests together, like when I wrote a ukulele song for my Drone Building students to help them remember yaw, pitch & roll. I love hearing about my students' interests and seeing how we can bring those into our classroom as well. I hope to continue learning from, and with, young people for years to come.

COURSE DESCRIPTION (complete overview shown on website):

Students will learn the fundamentals of building and programming using LEGO robots! We will use multiple types of motors and a variety of sensors to help our robots interact with the world around them. We will cover how robots are used in the real-world, as well as the scientific principles behind our builds. We'll learn about robots in factories as we create a robotic crane and a color-sorting assembly-line. Students will learn about different types of gears and their

uses and understand the trade-offs between power and speed as they design their own race cars and battle bots. After they understand the basic principles, we encourage students to follow their curiosity to test and create whatever they dream up!

SYLLABUS/OUTLINE: weekly breakdown of Project-Based Learning activities

Semester 1

- **Weeks 1-2:** Real-world robots, building, moving, loops & motors
- **Weeks 3-6:** Sensor intro (ultrasonic, Touch, color & gyro sensors) + switches
- **Weeks 7-8:** Sensor review and sensors in sequence (maze)
- **Weeks 9-11:** Combining multiple sensors (in parallel -- consider sensor precedence)
- **Weeks 12-14:** EV3 turtle (intro to multithreading)
- **Weeks 15-17:** Robot claw/crane (intro to variables and boolean operators)

Semester 2

- **Weeks 1-3:** Battle bots
- **Weeks 4-7:** Color sorter (intro to arrays)
- **Weeks 8-10:** Racer (intro to MyBlocks and measurements)
- **Weeks 11-14:** Error Control and gyrobot v1 (optional: gyrobot v2)
- **Weeks 15-17:** Create your own robot

COURSE OBJECTIVES AND APPROXIMATE TARGET DATES:

1. Students will learn about building, problem-solving, and programming through immersive work on challenges, which gradually increase in difficulty in both building and programming.
2. Some projects can be completed autonomously by following the instructions in the software, and on the video lessons (and, of course, asking for help when needed). Students are encouraged to come up with creative solutions to challenges and design their own projects.
3. Logic/problem-solving, including Trial and error and debugging programs, as well as design concepts.
4. Programming concepts:
 - Loops/Repeating
 - Waiting (for time, sensors, etc.)
 - Controlling motor power, direction, and braking/coasting
 - Generating/Using random numbers
 - Variables – storage, accessing, and uses
 - Switches with one or multiple conditions
 - Loop interrupts/breaks
 - Error control and using mathematics to automate things within a program
5. Reading and following instructions, as well as imitating conceptual ideas without specific instructions.
6. Sensors – building with, and programming using: color, touch, gyro, and ultrasonic sensors. This includes using sensors individually as well as learning to combine multiple sensors to complete more complex tasks. Students will also learn how each sensor works and how they are used in everyday life.
7. Building concepts, including:

- Gear ratios, gear trains, and the tradeoff between speed and power – including how to combine gears to obtain a particular desired gear ratio in a functional Lego clock
- Motors and movement, including using motors to operate a conveyor belt, open and close a claw, etc.
- Levers, Pulleys, conveyor belts, and other mechanical systems
- Gyroscopes and how they can be used to balance – including examining position and velocity and programming a robot to respond to both in order to stay upright.

After the first 8 weeks, students should have a solid understanding of the input and output capabilities of their robot, including how to use each of the sensors and motors in multiple different ways, as well as the general function of robots in society. They should understand basic programming concepts like loops and if-statements and be able to apply them to solve relatively simple problems involving a single sensor.

At the end of the first semester, students should be able to combine 2-3 sensors to solve more complex problems with minimal assistance. They should be able to build attachments for their sensors and modify their robots to optimally perform specific tasks (making adjustments to increase power, speed, reach a desired gear ratio, etc.) as well as finer motor controls (adjusting for limited range-of-motion or adapting individual motor power based on environment feedback to follow a line).

Mid-way through the second semester, students should have a deeper understanding of robotic systems and which tasks robots can perform efficiently. They should be able to create multi-axis movement, in projects like a robotic crane and assembly line, with some assistance. At this point, students can understand and apply programming concepts like variables easily - understanding the various types of data and basic Boolean operators.

By the end of the year, students should be able to create their own robots to perform meaningful, small-scale, tasks. They should be comfortable with creating and using arrays in their programs and able to replicate natural behaviors or create very basic AIs using random numbers.

STUDENT ASSESSMENT - what will be used to evaluate student progress and/or end of semester pass/fail status?

All classes abide by the following:

1. Student agrees to attend at least 80% of class sessions/lessons offered. Attendance is kept online and tracked by Partnership staff. Failure to meet 80% or be on track to meet 80% may result in program discontinuation.

2. The Partnership Student Assessment or Performance Form is filled out by the teacher and turned in to Partnership staff. The link to this form is found on the web page for this class. Failing marks for lack of participation, behavior issues, practice time, etc. may result in program discontinuation.

Class-specific assessment:

Our instructor will evaluate each student using Berrien's evaluation form and passing criteria will be based solely on students attending and actively participating in the class sessions.

Additionally, students will take our course pre/post assessment in Moodle. (We can provide your teachers with non-editing accounts to see our virtual Moodle courses upon request).

ADDITIONAL RESOURCES: (online, books, video, etc.):

Each student will have their own login with access to our virtual Moodle course in Drone Building.

CLASS POLICIES: ATTENDANCE, BEHAVIOR, WEATHER, ETC.

Attendance: attendance is required, and students should notify the instructor in advance of any absence.

Behavior: any behavior issues will first be privately brought to the attention of the parent and, should the behavior persist, to the partnership staff.

Weather: the classes will be canceled on any days when Berrien Springs Public Schools are closed. We will also contact families to remind them of this in the event of a weather-related cancellation. We will make up any canceled class meetings at a later date.