iRobot Create STEM Lesson Plan

Created by Bedford, MA Public Schools
Grade Level/Class Size: Upper Elementary, Middle, or High School in groups of 2 or 3.
**Tasks can be modified for experienced users and/or high grade levels*

Duration: approx. 180 min *(multiple days depending on school period scheduling)*

Essential Question: How can we modify technology so that it can serve other purposes besides its original intent?

Objectives: *Students will be able to*

1) Develop an efficient program in Scratch to control the Create Robot
2) Design a modification to the Create so that it can transport different types of materials
3) Display and use computational thinking skills through the engineering design process

Standards:

Next Generation Science Standards *(click on links to see connection to Common Core)*

Grades 3-5

3-5-ETS1-3

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.

Grades 6-8

MS-ETS1-4.

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.

Grades 9-12

HS-ETS1-4.

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Materials:

- Computers (preferably laptops) with internet connection
- Create Robot - see http://irobotstem.github.io/CreateScratchX/
- Simple Building Materials (ie rulers, velcro, tape, styrofoam or plastic cups, etc.)
- An object for Create to carry, push or pull. *Tennis balls work well because they are not as stable as more rigid materials*

Evaluation Criteria:
Assessment should be based on how well students work together and problem solve to accomplish the tasks. The goal should be focused on the process and not necessarily the end result. Click the following link to see examples of Project Based Learning Rubrics.

The Lesson

**Students should have some familiarity with how to create simple programs in Scratch before they begin to program the Create with Scratch. If more background knowledge needs to be developed students can visit the MIT Scratch site and run through some of the helpful tutorials on the homepage.*

Activator:
(5-10 min) Ask students to brainstorm what types of technologies make everyday tasks easier. Also, ask them if they have ever had to modify a technology or change something so that it served a different purpose. For upper grades, you may want reference the following article from *How Stuff Works,* 10 New Uses for Old Inventions.

Activities:
(10-15min) Introduce the students to the Create robot and some of its functionality. Explain how it can be connected and programmed via Scratch. Allow for students to ask questions and even observe or play with the Create. Model how the Scratch blocks work to control the Create using some simple commands. Explain that it is designed to be changed and modified or "hacked."

The Challenge:
(60 min or more) Present the following challenge to the students:

> *A large internet company is receiving thousands of orders online everyday for different products. In order to efficiently get the products out for delivery, the company decides they are going to use robots to get the materials in the warehouse back and forth from the shelves to the delivery platform. The company is looking for engineers to modify and program the Create Robot to accomplish this task. You are the engineer!*

**If you have access to youtube there are several videos on how the Kiva Robot works in the Amazon Warehouse. See A Day in the Life of a Kiva Robot.*

Explain to students that they have to modify the Create robot using only the "building" materials that you have provided. The Create must successfully drive a given distance (end of room, hallway, etc) and bring back the product (in our example we are using tennis balls) successfully. The ball can be pushed, dragged or somehow placed on top of the Create.

Students should be given ample time to design and test out different programs they create with Scratch in conjunction with their design modification to the Create. The culminating activity should allow students to present their design and Scratch program to the class.

You may choose to have students keep track of their designs using a design worksheet similar to this iRobot Create Worksheet .

Wrap Up:
(10-15min) Ask students to think about their thinking. They can share their answers orally within small groups, as part of a whole class discussion, through journal entries and/or through the creation of a video or other multi-media project.

- How did they go about trying to accomplish the challenge?
- What problems did they run into?
- How did they try to solve the problems?
- If they could change something about the challenge what would it be?
- If they could try something else what that be?
- How did the engineering design process help you accomplish your task?

Possible Lesson Modifications:

- Have students keep a journal of their lesson design, sketches and ideas
- Change the route Create has to take or add obstacles to Create's path.
- Make the challenge into a competition and have students vote on best design and/or best Scratch Code.
- Have each group try out another group's Scratch code, checking for "bugs" or efficiencies.
- Give specific parameters on what the design can and can not include.
- Try using different "building" materials. For older students, allow them to physically change the Create by taking it apart and adding different materials using a 3d printer or materials you may find in a traditional "shop" class.
- This suggested lesson plan could easily incorporate content from other disciplines. (i.e. Math Connections: measurement, angles, data collection, graphing; Science Connections: developing and using models, cause and effect, scale and proportion, motion and energy, systems; ELA Connections: informational writing, persuasive writing, research to build and present knowledge, presenting findings, create a business plan for a developer)