Treasure Island

A Curriculum Unit Focusing on Sensors Through Literature and Robotic Programming

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Introduction to the Curriculum

Based on Robert Louis Stevenson's novel, *Treasure Island*, this curriculum will incorporate literature and robotics. Inspired by the novel, students will learn about the story through specific events and characters through KIWI robotics. The basics of robotics and programming will be expedited in order to accommodate for more thorough lessons on sensors.

The Curriculum

Lesson 1: What is Robotics? What is Programming? What are REPEAT's?
Overview: Students will learn about robotics and programming through exploration and direct instruction through examples. Students will also learn about REPEAT's and its function as well as learn how to detect a situation in which a REPEAT is needed.

Powerful Idea 1: Robotics
Robots have special parts that let them follow instructions. Robots need moving parts, such as motors, to be able to perform behaviors specified by a program. The robotic 'brain' has the programmed instructions that make the robot perform its behaviors.

Powerful Idea 2: Programming- Control Flow by Sequencing and Instructions
A program is a sequence of instructions that the robot acts out in order. Each instruction has a specific meaning, and the order of the instructions affects the robot's overall actions.

Powerful Idea 3: Repeats- Loops & Number Parameters
An instruction or sequence of instructions may be modified to repeat a particular number of times (or forever) using REPEAT, END REPEAT, and NUMBER Parameters.

Knowledge & Objectives
Students Will Understand That:
- Robots need moving parts, such as motors, to be able to perform behaviors specified by a program.
- The robotic 'brain' has the programmed instructions that make the robot perform its behaviors.
- The computer must communicate with the motors for the motors to function.
- Each icon or "block" corresponds to a specific instruction
- A program is a sequence of instructions that is followed by a robot
- An instruction or sequence of instructions may be modified to repeat.
- Some programming instructions, like 'Repeat,' can be qualified with additional information.

Students Will Be Able To:
- Describe the components of a robot, including the 'brain', motors, and wires.
- Upload a program to a robot via the tangible blocks or graphical icons
- Build sturdy robots
- Point out or select the appropriate block corresponding to a planned robot action
- Connect a series of blocks on the computer
- Transmit a program to a robot
- Recognize a situation that requires a looped program.
- Make a program that loops.
- Use number parameters to modify the number of times a loop runs.

Vocabulary
- *Engineer* – someone who invents or improves things
- *Motor* – the part of a robot that makes it move
- *Robot* – a machine that can be programmed to do different things
- *Order* – parts of a group arranged to make sense
- *Program* – a set of instructions for a robot
- *Sequence* – the order of instructions that a robot will follow exactly
- *Parameter* – a limit that a robot will follow
- *Pattern* – a design or sequence that repeats
- *Repeat* – to do something more than once

Materials Needed
- KIWI's
- Blocks: BEGIN, END, ACTION, SOUNDS, REPEATS/END REPEATS, number parameters
- arts and crafts materials

Schedule
1. (10 mins) Introduce ourselves and the theme of the next couple of weeks: *Treasure Island* - use PowerPoint to tell beginning of this story
   a. In the beginning of this story, Jim Hawkins discovers a treasure map from a mysterious man who died at his parents' inn. Jim shows this map to Dr. Livesey and Squire Trelawney, and they sail off with a crew of men to find the buried treasure.
   b. Today, we're going to pretend that we're Jim and his friends to find this hidden treasure!
   c. Our goal is to build a robot ship that will carry supplies safely across the ocean to the island the map tells us! But first, we need to learn some things about our robots.
2. (5 mins) Explore robot parts - let students try to build the robot without instruction from the teachers and then learn the parts of the robot and what they do
3. (10 mins) What is a Program? A set of instructions that tells the robot what to do. For our robots, we're going to use the language CHERP because that's what our robot understands. In every program we create, we must use BEGIN and END, or else the robot won't understand your instructions.
   a. Program the Teacher!
4. (10 mins) Can you build a sturdy robot ship to carry the sailors? Use a program to test the sturdiness.

5. (10 mins) What are REPEAT's? When we're sailing on the ocean, how can we program our robot ships to keep moving FORWARD without using so many blocks? REPEATS! Create a program that will bring our robot ships closer to the island.
6. (10 mins) Let's share! Circle everyone around and show their robots and their programs.

Lesson 2: What are REPEAT's? What Are Sensors (DISTANCE)?

Overview: Students will review REPEAT before learning about sensors in general. Lesson 2 will only focus on the DISTANCE sensor. After using both through REPEAT and if there is time, students will learn how to use IF blocks to create more complicated programs and scenarios.

Powerful Idea 1: Repeats - Loops & Number Parameters
An instruction or sequence of instructions may be modified to repeat a particular number of times (or forever) using REPEAT, END REPEAT, and NUMBER Parameters.

Powerful Idea 2: Sensors
A robot can feel and see its surroundings with a sensor. A robot can react to information it collects by changing its behavior. The DISTANCE sensor is like our eyes. Our eyes can tell if we are NEAR or FAR from an object or person. And just like our eyes, the DISTANCE sensor can tell our robots if they are NEAR or FAR from something.

Knowledge & Objectives
Students Will Understand That:
- An instruction or sequence of instructions may be modified to repeat.
- Some programming instructions, like 'Repeat,' can be qualified with additional information.
- A robot can feel and see its surroundings with a sensor.
- A robot can react to collected data by changing its behavior.
- Certain instructions (like "Repeat") can be modified with sensor data.
- *A robot can 'choose' between two sequences of instructions depending on the state of a sensor.*

Students Will Be Able To:
- Recognize a situation that requires a looped program.
- Make a program that loops.
- Use number parameters to modify the number of times a loop runs.
- To use a sensor appropriately with their robots.
- Compare and contrast human sense and robot sensors
- *Identify a situation that needs a branched program.*
- *Make a program that uses a branch.*

Materials Needed:
- KIWI's, DISTANCE sensor, LIGHT ACTUATOR
- Blocks: BEGIN, END, ACTION, SOUNDS, REPEAT/END REPEAT, number parameters, NEAR/FAR parameters, LIGHT ON/LIGHT OFF

Schedule
1. (5 mins) Review what a program is, what we need in our programs (BEGIN and END).
2. (5 mins) TREASURE ISLAND
   a. Remember that last week, Jim and the crew had set sail to the island? Well now they are really close to the island but they need to steer the ship to avoid the big rocks and drop the anchor! They successfully steer the ship through the rocks, drop the anchor, and row to the island.
   b. Our goal today is to bring our robot ships safely to the shore!
3. (5 mins) Learn about REPEAT's. We can use repeats when we want the robot to do a command or a group of commands a certain number of times. We can make the robot REPEAT: 2 times, 3 times, 4 times, and 5 times
4. (10 mins) Learn about sensors, specifically DISTANCE. But wait! What if we want to make our robots do something when it is NEAR or FAR from another object? Our robots need to use a part called the DISTANCE sensor. The DISTANCE sensor is like our eyes - our eyes can tell us how NEAR or FAR away we are from something. Well, the DISTANCE sensor can do the same for our robots!
5. (20 mins) Let's explore with the DISTANCE sensor, using REPEAT and NEAR/FAR parameters. Can you get your robot ship to the island? Make sure you don't run into the rocks!
6. (10 mins) Let's share!

Lesson 3: What Are Sensors (SOUND)?
Overview: Students will review of REPEAT and DISTANCE before starting a new sensor. Students will learn about the SOUND sensor and how we can use the WAIT FOR CLAP block to tell our robots to do something.

Powerful Idea 1: Sensors A robot can feel and see its surroundings with a sensor. A robot can react to information it collects by changing its behavior. The SOUND sensor can tell the robot what to do when the "hears" some loud noise, like clapping. When using this sensor and the WAIT FOR CLAP block, robot will only move when the SOUND sensor "hears" the clapping.
Knowledge & Objectives *Students Will Understand That:* ● A robot can feel and see its surroundings with a sensor. ● A robot can react to collected data by changing its behavior. ● Certain instructions (like "Repeat") can be modified with sensor data. *Students Will Be Able To:* ● To use a sensor appropriately with their robots. ● Compare and contrast human sense and robot sensors
Materials Needed: ● KIWI's, DISTANCE sensor, LIGHT ACTUATOR, SOUND sensor ● Blocks: BEGIN, END, ACTION, SOUNDS, REPEAT/END REPEAT, number parameters, NEAR/FAR parameters, LIGHT ON/LIGHT OFF, WAIT FOR CLAP

> **Vocab:**
> - *Loop* – something that repeats over and over again
> - *Parameter* – a limit that a robot will follow
> - *Pattern* – a design or sequence that repeats
> - *Repeat* – to do something more than once

Schedule

1. (5 mins) Review REPEAT and DISTANCE.
   a. Last week, our robots weren't ready to work but I think they're more awake this morning! Let's review the DISTANCE sensor and parameters with the REPEAT blocks.
   b. Let's have a volunteer: BEGIN - REPEAT [UNTIL NEAR] - FORWARD - END REPEAT - END
2. (5 mins) Treasure Island
   a. The ship's crew get onto the island except for Squire Trelawney and Dr. Livesey. Jim snuck onto one of the boats that the crew rowed out on but it turns out that Jim discovers that these sailors are actually pirates! And they're planning on taking over the ship after they find the treasure!
   b. Help Jim escape into the island! We need to let Jim move only when there he is NEAR the pirates OR when there is a loud noise.
3. (10 mins) Learn SOUND sensor.
   a. This sensor is shaped like what? An ear, right! This will let the robot move or not move when there is a sound, like clapping. But oh wait, I don't think we can use our REPEAT blocks. We have to use another block called WAIT FOR CLAP.
   b. Let's practice: BEGIN - WAIT FOR CLAP - FORWARD - END
4. (20 mins) Let's practice using our DISTANCE and SOUND sensors and WAIT FOR CLAP. Can you make a program that will help Jim escape from the pirates?

Lesson 4: What is the Light Actuator? What are IF's?
Overview: Students will get a review of REPEAT and IF, DISTANCE, and SOUND before starting a new sensor. Students will learn about the LIGHT sensor and how we can use the BRIGHT/DARK parameters to tell our robots to do something.

> **Powerful Idea 1: Light Actuator**
> A robot can feel and see its surroundings with a sensor. A robot can react to information it collects by changing its behavior. The Light sensor
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> **Powerful Idea 2: IF's, Sensors**
> A robot can 'choose' between two sequences of instructions depending on the state of a sensor by using IF's.
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> **Knowledge & Objectives**
> *Students Will Understand That:*

- A robot can feel and see its surroundings with a sensor.
- A robot can react to collected data by changing its behavior.
- Certain instructions (like "Repeat") can be modified with sensor data.
- A robot can 'choose' between two sequences of instructions depending on the state o
  a sensor.

Students Will Be Able To:
- To use a sensor appropriately with their robots.
- Compare and contrast human sense and robot sensors
- Identify a situation that needs a branched program.
- Make a program that uses a branch.

Materials Needed:
- KIWI's, DISTANCE sensor, LIGHT ACTUATOR, SOUND sensor
- Blocks: BEGIN, END, ACTION, SOUNDS, REPEAT/END REPEAT, number parameters, NEAR/FAR parameters, LIGHT ON/LIGHT OFF, WAIT FOR CLAP

Schedule

1. (5 mins) Review DISTANCE, SOUND, REPEAT, WAIT FOR CLAP.
2. (5 mins) Treasure Island
   a. Great! So you've helped Jim escape into the island but whoa! There's a man named Ben Gunn, who's been stranded on the island for many years. Ben makes a deal with Jim, saying that he'll bring Jim to the treasure if he promises to let Ben come home with him… IF they escape!
   b. Ben and Jim are now in the cave but they can't see! They need to use a lantern to help them look in the cave.
3. (10 mins) Learn how to use IF's.
   a. The IF blocks lets us make programs for our robots where the robot can do some command only IF something else happens.
   b. So let's practice: IF you're in school, you do what? [math, reading, recess]. IF you're at home, you do what? [play, homework, more reading]. IF you're happy, you do what? [laugh, smile, jump around]
   c. Let's try this with our robot: IF the robot is NEAR something, it should do what? [move away, spin, turn, beep]
   d. So you can use the DISTANCE sensor with IF and REPEAT blocks!
4. (5 mins) LIGHT Actuator
   a. use the LIGHT ON and LIGHT OFF blocks to use the LANTERN.
5. (20 mins) Start using the IF and LIGHT ON/OFF blocks in your programs. Try to help Jim and Ben look for the treasure in the dark cave!
6. (10 mins) Let's share!

Lesson 5: LIGHT Sensor & Final Projects

Overview: Students will review REPEAT and IF, DISTANCE, SOUND, and Light Actuator before starting LIGHT sensor. Students will learn about the LIGHT sensor and how we can use the BRIGHT/DARK parameters to tell our robots to do something.

Powerful Idea 1: Sensors
A robot can feel and see its surroundings with a sensor. A robot can react to information it collects by changing its behavior. The LIGHT sensor can "see" whether it is BRIGHT or DARK

Knowledge & Objectives
Students Will Understand That:
- A robot can feel and see its surroundings with a sensor.
- A robot can react to collected data by changing its behavior.
- Certain instructions (like "Repeat") can be modified with sensor data.
- A robot can 'choose' between two sequences of instructions depending on the state of a sensor.

Students Will Be Able To:
- To use a sensor appropriately with their robots.
- Compare and contrast human sense and robot sensors
- Identify a situation that needs a branched program.
- Make a program that uses a branch.

Materials Needed:
- KIWI's, DISTANCE sensor, LIGHT ACTUATOR, SOUND sensor, LIGHT sensor
- Blocks: ALL

Schedule
1. (3mins) Review DISTANCE, SOUND, and Light Actuator. Review IF blocks.
2. (2mins) Treasure Island
   a. Do you remember where we left off? Jim escapes from the pirates and he meets Ben Gunn, who has been stranded on the island for many years. They make a deal: Ben shows Jim where the treasure is and Jim brings Ben back.
   b. But first, they have to make it across the island and back to the ship without getting caught by the pirates! They should move when it is DARK and hide when it is BRIGHT outside.
   c. GOAL: Make a program that will help Jim and Ben escape to the ship! But first, we'll need something to help our robots escape from the pirates.
3. (5mins) LIGHT SENSOR
   a. The LIGHT sensor is like our eyes too. We can see when it is BRIGHT or DARK out. Our robots can use their LIGHT sensors to see when it is BRIGHT or DARK too!
   b. Example with REPEAT.
   c. Example with IF.
4. (10mins) Help Jim and Ben escape! Use the LIGHT sensor and any other sensors to help your robot escape.
5. (5mins) TRANSITION TO FINAL PROJECT. Bring everyone back to the rug. Have helpers pass out paper for kids to plan their programs, the design of their robot, etc.

a. So Jim and Ben are now back on the beach and they see the ship in the ocean. But oh no! The pirates see them and are running towards them! What will happen to Jim and Ben?

b. For the rest of the time we have, we're going to start our FINAL PROJECTS. We'll use today and next Monday to make our FINAL PROJECTS.

c. First, you need to decide with your partner(s) what or who your robot is going to be. It can be Jim or Ben or Squire Trelawney or Dr. Livesey. Or it can be the ship or the pirates. But you and your partner(s) need to decide and draw out ship on the piece of paper before you can start programming. Next week, you'll have time to decorate your robot.

d. Second, once your drawing plans are done, start planning what your program is going to be. What's going to happen with the characters? Are they going to get back on the ship? Will they escape the pirates? Will the pirates stop them? Write your program on another sheet of paper.

e. Third, once your program is done, come grab the blocks you need and program your robot.

6. (25mins) FINAL PROJECT