Unit 1: Introduction to Robotics

Content Area: **Engineering**
Course(s): **STEM**
Time Period: **Week 1**
Length: **8 Days**
Status: **Published**

Unit Overview

In this unit, students will learn about robotics through the use of the "Hummingbird Robotics Kits". Students will begin this unit by exploring the full capabilities of the "Hummingbird" kits. In order to accomplish this, students will first receive a brief refresher of the "Scratch" program. Students will come up with coding to make the "Scratch" perform the required set of steps. Next, students will create programming language that will allow the "Hummingbird" to perform the required operation. The purpose of this is so students see first hand as to what needs to be done in order for the robot to move, light up, etc. Throughout the course of this mini unit, students will complete basic projects in which they utilize the capabilities of their "Hummingbird" robotics kits. By the end of this unit, it is hopeful that students have a moderate understanding as to the workings of their "Hummingbird" kit.

Standards

SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.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.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
TECH.8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

Essential Questions

1) How can robots assist with everyday tasks?

2) How can a robot provide assistance in a mathematics classroom? Science classroom?

3) How can having superb organizational skills help you to become a better programmer?

Application of Knowledge: Students will know that...

- It is important to have a systematic approach to programming.
- SCRATCH is a computer program used to help understand programming language.
- The Hummingbird controller is the "brain" behind their robot creations.
- They must tell their robot what to think being that they aren't permitted to think on their own.
- When programming a robot it is important to include every detail into the programming code as to not skip anything.

Application of Skills: Students will be able to...

- Create a basic robot utilizing all of the functionalities of the Hummingbird system.
- Research, plan, test, and create a robot to solve a given problem/complete a given task.
- Review and revise programming code that results in the robot not acting the way it was intended to.
- Write programming code to accomplish a small task.

Assessments

- Journal logs: Will be used for students to share anything that worked out well during the design process or anything unexpected they encountered.
- Basic SCRATCH programming rubric: Students will be graded on how they were able to program their SCRATCH to accomplish the problem at hand. (This is a brief review of what is learned in computer programming.)
- Angles with the Hummingbird: Students will be graded on their ability to correctly create a robot used to measure different angles.
- Pythagorean Theorem Robot: Students will be graded on their ability to correctly measure the length of the hypotenuse in a right triangle.

Suggested Activities

- Basic SCRATCH program: Students will work independently to create a program in which their character is asked to perform a given task. This will serve as a brief review of what is covered in the "computer programming" class. This review is imperative to the success in STEM 2.
- Angles with the Hummingbird: In this project, students will be asked to write a program that will allow a robot to show the number of degrees of a given angle. The goal of this project is to get students used to the Hummingbird controller and one of its motors. Students will also learn how to utilize "SCRATCH" when programming these Hummingbirds.
- Pythagorean Theorem Robot: In this project, students will learn how to program their Hummingbird to measure the distance between two given points. This will give students experience not just with utilizing the motor, but also with the distance sensors in their kits.

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
  - Modifications & accommodations as listed in the student's IEP
  - Assign a peer to help keep student on task
  - Modified or reduced assignments
  - Reduce length of assignment for different mode of delivery
  - Increase one-to-one time
  - Prioritize tasks
  - Think in concrete terms and provide hands-on-tasks
  - Position student near helping peer or have quick access to teacher
  - Anticipate where needs will be

- **Content specific modifications may include:**
  - Breaking a project up into attainable goals that can be met each period.
  - Providing students with the beginning (or if necessary the full) programming language to accomplish the programming aspect of the project.
  - For certain projects, show students completed models of projects.

Differentiation for ELL's:

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Graphic organizers
  - Modification plan
  - Collaboration with ELL Teacher
- **Content specific vocabulary important for ELL students to understand include:** STEM, robot, controller, protractor, distance, sensor.

Differentiation to extend learning for gifted students may include:

- For those looking for a different way to program other than SCRATCH, allow students to use Python.
- Incorporate the functionality of the LED lighting for the Hummingbird into the Pythagorean Theorem project in which the would measure the distance between two beacons of light.

Integrated/Cross-Disciplinary Instruction

ELA: Practice formulating complete and grammatically correct responses for the given journal entries.

Mathematics: Correctly create a robot to measure various angles.

Technology: Successfully use distance sensors to correctly measure the distance between two points.

Resources

https://scratch.mit.edu/: (SCRATCH Programming)

http://www.hummingbirdkit.com/teaching/sketches/angles-hummingbird: (Angle Measuring Project)

http://www.hummingbirdkit.com/teaching/sketches/measuring-hypotenuse: (Hypotenuse Project)

Youtube videos: self directed videos that can help students along in the design process

21st Century Skills

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.