Robotics

Science Elective

Grades 6-8

Elective Overview

Department of Equity, Curriculum and Instruction

Revised: July 2019

Approved by the Montclair Board of Education: August 2019

Montclair Public School Elective Overview

Instructional Plan

Course: Introduction to Robotics

Marking Period or Trimester: Full Year

Pacing: 30 Weeks

Next-Generation Science Standards
Engineering Design 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. MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. 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. 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.

Framing the Learning			
Timeframe	**Big Ideas**	**Essential Questions**	**Enduring Understandings**
1 Week	**<u>EV3 Kits Basics</u>** Navigating the EV3 brick Wires and Sensors App use on the Chromebook	• What are the components of the EV3 Kit? • How can the EV3 app be accessed on the Chromebook? • What are the four menus on the main screen of the EV3 block? • What are the proper techniques for handling the equipment?	• Any student using the EV3 kit should follow all procedure while using the equipment. • The components of each kit are essential and should be stored correctly. • The students will understand that robots are complex devices.
4 Weeks	**<u>Basic Movement</u>** Forward/Backward Motion Control Speed of Robot Stopping	• What are the different methods for moving the bot forward/backward from a starting position? • How can kinetic and potential energy be demonstrated using the EV3 brick? • What are the different methods for stopping the bot?	• Demonstrate a working knowledge of the laws of physics as they apply to self-designed engineering solutions for a real-world problem.

4 Weeks	**Turning** Turning in Motion Gyro Sensor	• What are the different methods for turning the EV3 bot? • How can the gyro sensor be used to navigate through a course?	• Robot systems require troubleshooting and maintenance to ensure safe and proper function • Sensors allow robots to interact with the world. • Energy can be converted from one form to another. • Components of a robot can be changed to produce motion, speed, torque, and acceleration. • Engineering design is an interactive process with a defined cycle of steps. • Safety is everyone's responsibility. • Design and programming are processes that must consider all the systems within a robot and the required task. • Failure is an important and valuable part of the engineering process. • Engineers work cooperatively in teams to accomplish a task.
4 Weeks	**Using Sensors** Touch Sensor Ultrasonic Sensor Programming with Sensors	• Program the robot to stop by using the touch sensor, and sensing the distance to an object. • How do the ports on the EV3 brick allow multiple sensors to be used for a program?	
4 Weeks	**Switch Blocks** Switches/Switch Loops Line Follower Multitasking	• Demonstrate how the bot is able to make decisions while traveling through a course. • Program the bot to follow a black line for a specific distance.	
4 Weeks	**Data Wire** Compare Function Logic Block	• Describe the advantage of using logic to control loops. Explain the operation of the "Compare" function in a Sensor Block's data wire node. • Demonstrate the role of each parameter in a Logic Block	
N/A	**Advanced Skills**	• Engineer a robot that is able to demonstrate the basics of the EV3 bot by achieving a set of objectives on a robotics mat**.**	

Evidence of Learning
Throughout the course of the semester, students will complete activities and projects that demonstrate their knowledge on how to use the EV3 block for basic movement, navigating an unknown area, collecting data, and other objectives specific to the LEGO EV3 sets. Robotic Mat with Objectives Engineering Lab Robots Lab Worksheets Student Presentations Observations of Individual Student Behavior Teamwork Abilities

Activities

Students will engage in various team-based engineering challenges that have specific objectives for the EV3 bot to complete.

EV3 First Lego League Competition: Students will compete in the regional FLL competition.
Robotic Mat Project: Students create a robotics mat that has a clear objectives that need to be accomplished.
Designing Robots for Engineering Challenges: Teams will design and engineer a bot to complete specific objectives. These will take part at various points throughout the class
Team Work Challenges: Students will work as team to complete specific objectives. These will take part at various points throughout the class.
Recycle Bots: Students will use recyclable materials to create robots.
Obstacle Course Mayhem: Student design an obstacle course that requires the robot to be interactive in order to complete the course.

DIFFERENTIATION			
Special Education	**ELL**	**Intervention**	**Acceleration**
• Modify and accommodate as listed in student's IEP or 504 plan • Prioritize instruction • Utilize wait-time • Ensure directions are clear and concise • Utilize probing and clarifying questions • Support instruction with scaffolding • Model (provide step by step instructions) use of learning strategies • Provide extended time for practice and review of learning strategies • Identify, categorize, and teach words critical to understanding instructional texts • Utilize multiple approaches to monitor student understanding • Create rubrics to develop assessments • Vary assessments • Assign peer assisted reading and tutoring • Provide individual help to all students • Create opportunities for/Monitor peer collaboration • Monitor student progress frequently • Utilize flexible/cooperative grouping based on instructional goals • Prioritize and chunk lengthy assignments • Utilize assistive technology, when appropriate • Provide ongoing, effective, specific feedback • Model/Utilize graphic organizers • Provide leveled reading materials • Utilize visual aids and props (flashcards, pictures, symbols) when possible • Utilize a multi-sensory approach to new topics	• Get to know student • Set high expectations • Learn/Utilize/Display some words in student's heritage language • Allow electronic translator • Reword, repeat, and clarify directions • Determine student knowledge and level of understanding • Research instruction that best matches student need • Utilize ongoing informal assessments • Refer to NJDOE Resources: https://www.state.nj.us/education/bilingual/resources/ • NJDOE ELL Support Descriptions: https://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf ***Review Special Education list for additional recommendations.***	• Tiered Interventions following RtI framework • RtI Intervention Bank • Fundations Double-Dose (Tier II) • LLI (Tier III) • FFI Skill Report: DRA On-Line • enVision intervention supports NJDOE resources	• Process should be modified: higher order thinking skills, open-ended thinking, discovery • Utilize project-based learning for greater depth of knowledge • Utilize exploratory connections to higher grade concepts • Contents should be modified: abstraction, complexity, variety, organization • Products should be modified: real world problems, audiences, deadlines, evaluation, transformations • Learning environment should be modified: student-centered learning, independence, openness, complexity, groups varied