Robotics Programming - Grade 8

Course Information

Grade(s):	8
Discipline/Course:	Technology Education/ Robotic Programming
Course Title:	Robotics Programming
Prerequisite(s):	NA
Course Description: *Program of Studies*	This is an introduction to Robotics Programming utilizing VEX IQ. The course is structured around iterative, engineering processes, real-world applications, and opportunities for students to build teamwork and collaboration skills. Students will gain experience with building, as well as explore concepts such as mechanical advantage and gear ratios. Once the students have experience with basic building techniques, they will build the autopilot robot and explore the vision sensor and its capabilities while programming the autopilot to drive forward, in reverse, turn left, and turn right all at different velocities. Students will then build the clawbot which allows for more manipulation with the addition of the arm and claw. Students will learn important programming concepts such as loops and conditionals.
Course Essential Questions:	● How do robots work? ● How do robots interact with the world around them? ● How do robots and programming work together? ● How can robots and programming be used to solve problems?
Course Enduring Understandings:	● Computational thinking is a systematic approach to planning, problem solving, and creating. ● Automation is the operation and control of equipment and processes through programmable systems to facilitate faster, easier, and more precise completion of tasks. ● Coding is a language that can be used to create instructions for computers to follow. ● Robotics programming can be used to solve real-world problems.
Duration: **Credit:**	10 weeks 0 Credit(s) (Middle School Course)

Course Materials/Resources:	VEX IQ Class Kit
FPS Course Academic Expectation(s):	EU - Exploring and Understanding CC - Creating and Constructing
Year at a Glance (Units)	Unit 1 - Intro to Robotics Engineering (2 weeks) Unit 2 - Basic Programming (3 weeks) Unit 3 - Intermediate Programming (5 weeks)

Unit Number and Title:	Unit 1 - Intro to Robotics Engineering
Duration:	2 weeks
Resource(s):	VEX IQ Class Kit VEXcode https://codeiq.vex.com/ (works on Chromebooks) VEX IQ STEM Labs: M.A.D Box, Testbed - VEX IQ Sensors
Unit Overview:	Students will build the M.A.D. Box (Mechanical Advantage Device) to gain experience with building, as well as explore mechanical advantage. Students explore how the mechanical advantages of torque and speed are related to gear ratios, where gear ratios can be found in daily life, and how they can be applied to their builds. There is a full investigation of calculating different gear ratios. Students will then gain experience with VEX IQ Sensors by building the Testbed and competing in the Sense It Challenge.
Learning Goals	
Standard(s):	ITEEA (International Technology and Engineering Educators Association) Standards for Technological and Engineering Literacy (STEL) STEL-2M. Differentiate between inputs, processes, outputs, and feedback in technological systems. STEL-2N. Illustrate how systems thinking involves considering relationships between every part, as well as how the system interacts with the environment in which it is used. STEL-2O. Create an open-loop system that has no feedback path and requires human intervention. STEL-8J. Use devices to control technological systems.
Essential Question(s):	● How do robots work? ● How do robots interact with the world around them? ● How do robots and programming work together?
Enduring Understanding(s):	● Computational thinking is a systematic approach to planning, problem solving, and creating. ● Automation is the operation and control of equipment and processes through programmable systems to facilitate faster, easier, and more precise completion of tasks.

	● Coding is a language that can be used to create instructions for computers to follow. ● Robotics programming can be used to solve real-world problems.
Learning Goal(s): *Students will be able to use their learning to:* (Content/ Skills)	**Content:** (Students will know…) ● how the mechanical advantages of torque and speed are related to gear ratios. ● where gear ratios can be found in daily life, and how they can be applied to their builds. **Skills:** (Students will be able to…) ● create torque and/or speed advantages in designs ● calculate gear ratios yielding torque or speed advantages ● analyze situations to know which advantage (torque or speed) is needed in a design ● design and create devices with mechanical advantages from VEX IQ parts ● follow building instructions to assemble the VEX IQ Testbed. ● identify the correct output and associated coding blocks for each sensor.

Unit Number and Title:	**Unit 2 - Basic Programming**
Duration:	3 weeks
Resource(s):	VEX IQ Class Kit VEXcode https://codeiq.vex.com/ (works on Chromeboooks) VEX IQ STEM Labs: Drive Forward and Reverse, Turning, Vision Sensor
Unit Overview:	Once the students have experience with Engineering and basic building techniques, the students will build the Autopilot robot. Students will then explore robot behaviors and create a project to drive the Autopilot robot forward and in reverse, turn left, and turn right to navigate certain obstacles using VEXcode IQ Blocks. Students will also engage in configuring, tuning, and programming the Vision Sensor so the Autopilot robot will detect objects.
Learning Goals	
Standard(s):	ITEEA (International Technology and Engineering Educators Association) Standards for Technological and Engineering Literacy (STEL) STEL-2M. Differentiate between inputs, processes, outputs, and feedback in technological systems. STEL-2N. Illustrate how systems thinking involves considering relationships between every part, as well as how the system interacts with the environment in which it is used STEL-2O. Create an open-loop system that has no feedback path and requires human intervention. STEL-2P: Create a closed loop system that has a feedback path and requires no human intervention STEL-8J. Use devices to control technological systems.
Essential Question(s):	● How do robots work? ● How do robots interact with the world around them? ● How do robots and programming work together? ● How can robots and programming be used to solve problems?
Enduring Understanding(s):	● Computational thinking is a systematic approach to planning, problem solving, and creating. ● Automation is the operation and control of equipment and processes through programmable

	systems to facilitate faster, easier, and more precise completion of tasks. ● Coding is a language that can be used to create instructions for computers to follow. ● Robotics programming can be used to solve real-world problems.
Learning Goal(s): *Students will know and will be able to use their learning to:* (Content/ Skills)	**Content:** (Students will know…) ● criteria and constraints of a solution for a design problem. ● steps needed to configure a solution and develop an algorithm. ● programming behaviors, including conditionals. **Skills:** (Students will be able to…) ● analyze building directions and create a robot to complete a specific task..

Unit Number and Title:	Unit 3 - Intermediate Programming
Duration:	5 weeks
Resource(s):	VEX IQ Class Kit VEXcode https://codeiq.vex.com/ (works on Chromeboooks) VEX IQ STEM Labs: Speedy Delivery, Loop - There It Is!, To Do, or Not To Do
Unit Overview:	Students will build a robot to navigate a warehouse by programming the Claw and Arm of a Clawbot to grab and move packages to a loading dock for delivery. Students will then complete several mini-challenges to experiment with using loops within their projects. This information will be used in the "Groove Machine Challenge," where students will program robot movements to repeat, causing their robot to "dance." Students will explore conditional statements and how button presses can provide input for a program to decide if a conditional is true or false. They will also explore how a conditional statement can be looped, repeating a decision or executing a behavior.
Learning Goals	
Standard(s):	ITEEA (International Technology and Engineering Educators Association) Standards for Technological and Engineering Literacy (STEL) STEL-2M. Differentiate between inputs, processes, outputs, and feedback in technological systems. STEL-2N. Illustrate how systems thinking involves considering relationships between every part, as well as how the system interacts with the environment in which it is used STEL-8J**.** Use devices to control technological systems.
Essential Question(s):	● How do robots work? ● How do robots interact with the world around them? ● How do robots and programming work together? ● How can robots and programming be used to solve problems?
Enduring Understanding(s):	● Computational thinking is a systematic approach to planning, problem solving, and creating. ● Automation is the operation and control of equipment and processes through programmable

	systems to facilitate faster, easier, and more precise completion of tasks. ● Coding is a language that can be used to create instructions for computers to follow. ● Robotics programming can be used to solve real-world problems.
Learning Goal(s): *Students will know and will be able to use their learning to:* (Content/ Skills)	**Content:** (Students will know…) ● repeating actions can be represented using loops ● programming behaviors, including events, loops and conditionals. **Skills:** (Students will be able to…) ● analyze building directions and create a robot to complete a specific task. ● create, download and run a program using events, loops and conditionals. ● apply conditional programming to solve a design challenge. ● design and create a user interface.