Automation and Robotics

Standards	Goals
Lesson 1: Automating Mechanisms | 19 days **Activity 1.1: Welcome Interns!** **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.EE Differentiate between inputs, processes, outputs, and feedback in technological systems. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used.	• Build a simple gear train using VEX parts. • Explain the input movement and output movement of a mechanical system. • Explore careers in automation and robotics.
Activity 1.2: On the Move **Technology and Engineering** 3.5.6-8.F Analyze examples of technologies that have changed the way people think, interact, live, and communicate. 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.EE Differentiate between inputs, processes, outputs, and feedback in technological systems. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Build and program a motor to spin a gear train. • Identify the inputs and outputs through a system. • Assemble, wire, and program a system to complete a task.
Activity 1.3: Rescue Mission **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.CC Consider historical factors that have contributed to the development of technologies and human progress. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Build a four-wheel vehicle using VEX parts. • Practice the habit of troubleshooting when issues arise. • Apply programming best practices, such as using comments and testing code frequently. • Explore a variety of applications for autonomous robots and vehicles.

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Activity 1.4: Robot Shuffle **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.BB Demonstrate how knowledge gained from other content areas affects the development of technological products and systems. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Plan a program using appropriate strategies such as flowcharting. • Create appropriate event handlers to respond to runtime events, such as the push of a bumper switch. • Demonstrate successful collaboration within a team to meet development goals.
Activity 1.5: Looping Shuffle **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.BB Demonstrate how knowledge gained from other content areas affects the development of technological products and systems. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Create algorithms that use loops. • Generate ideas or build upon other ideas to innovate.
Activity 1.6: Time to Switch Gears **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.L Design methods to gather data about technological systems. 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.V Refine design solutions to address criteria and constraints.	• Calculate the gear ratio of a system. • Describe the relationship between gear size, speed, and torque in a gear train.

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Activity 1.7: It Is Universal **Technology and Engineering** 3.5.6-8.F Analyze examples of technologies that have changed the way people think, interact, live, and communicate. 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.W (ETS) 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. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Build a prototype using a universal joint. • Communicate a plan for creating a system using sketches and prototyping. • Test a design with the purpose of improving its function.
Activity 1.8: Bevel Up **Technology and Engineering** 3.5.6-8.F Analyze examples of technologies that have changed the way people think, interact, live, and communicate. 3.5.6-8.N (ETS) 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. 3.5.6-8.P (ETS) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.W (ETS) 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. 3.5.6-8.X Defend decisions related to a design problem. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Build a prototype using bevel gears. • Decompose a problem into smaller parts. • Explore the steps of a design process. • Explore careers in automation and robotics.

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Standards	Goals
Project 1.9: Design Challenge **Technology and Engineering** 3.5.6-8.M (ETS) 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. 3.5.6-8.N (ETS) 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. 3.5.6-8.P (ETS) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.S Illustrate the benefits and opportunities associated with different approaches to design. 3.5.6-8.U Evaluate and assess the strengths and weaknesses of various design solutions given established principles and elements of design. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.W (ETS) 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. 3.5.6-8.X Defend decisions related to a design problem. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Follow a design process to effectively develop a design solution. • Use a decision matrix to evaluate potential solutions. • Demonstrate successful collaboration within a team to meet design requirements. • Explore careers in automation and robotics.
Lesson 2: Sensors and Systems | 14 days **Activity 2.1: Makes Sense** **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Consider accessibility when designing and creating solutions. • Build a system that uses input from an optical sensor and output from an LED. • Create simple algorithms that involve conditionals and loops.
Activity 2.2: Color Coded **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.Q Apply a technology and engineering design thinking process.	• Decompose a problem into smaller parts. • Create a step-by-step process to complete a task. • Create simple algorithms that involve conditionals and loops.

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Standards	Goals
Activity 2.2: Color Coded cont. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	
Activity 2.3: Follow Me **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.N (ETS) 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. 3.5.6-8.P (ETS) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.U Evaluate and assess the strengths and weaknesses of various design solutions given established principles and elements of design. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.W (ETS) 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. 3.5.6-8.X Defend decisions related to a design problem. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Build and program a cam and follower system to move autonomously. • Create and follow a plan to solve a problem. • Decompose a problem into smaller parts.
Activity 2.4: End of the Line **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.N (ETS) 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. 3.5.6-8.P (ETS) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. 3.5.6-8.Q Apply a technology and engineering design thinking process.	• Build a chain drive system to move cubes. • Create and follow a plan to solve a problem. • Decompose a problem into smaller parts.

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Standards	Goals
Activity 2.4: End of the Line cont. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.U Evaluate and assess the strengths and weaknesses of various design solutions given established principles and elements of design. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.W (ETS) 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. 3.5.6-8.X Defend decisions related to a design problem. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	
Project 2.5: Helping Hand **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.M (ETS) 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. 3.5.6-8.N (ETS) 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. 3.5.6-8.P (ETS) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.U Evaluate and assess the strengths and weaknesses of various design solutions given established principles and elements of design. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.W (ETS) 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. 3.5.6-8.X Defend decisions related to a design problem. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Follow a design process to effectively develop a design solution. • Use a decision matrix to evaluate potential solutions. • Demonstrate successful collaboration within a team to meet design requirements. • Explore careers in automation and robotics.

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Standards	Goals
Lesson 3: Create and Automate | 12 days Activity 3.1: Show Your Skills **Technology and Engineering** 3.5.6-8.J Use tools, materials, and machines to safely diagnose, adjust, and repair systems. 3.5.6-8.K Use devices to control technological systems. 3.5.6-8.N (ETS) 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. 3.5.6-8.P (ETS) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem 3.5.6-8.Q Apply a technology and engineering design thinking process. 3.5.6-8.R Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants. 3.5.6-8.U Evaluate and assess the strengths and weaknesses of various design solutions given established principles and elements of design. 3.5.6-8.V Refine design solutions to address criteria and constraints. 3.5.6-8.W (ETS) 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. 3.5.6-8.X Defend decisions related to a design problem. 3.5.6-8.FF Demonstrate how systems thinking involves considering relationships between every part, as well as how the systems interact with the environment in which it is used. 3.5.6-8.JJ Apply informed problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.	• Follow a design process to effectively develop a design solution. • Use a decision matrix to evaluate potential solutions. • Demonstrate successful collaboration within a team to meet design requirements. • Explore internships and careers in automation and robotics.