Curriculum Framework
PLTW Launch – 5th Grade – Robotics and Automation

Desired Results *(stage 1)*

Standards

Next Generation Science Standards

- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- ESS3.C: Human Impacts on Earth Systems - Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- ETS1.A Defining and Delimiting Engineering Problems – Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts.
- ETS1.B Developing Possible Solutions – Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the design process,

Transfer

Students will be able to independently use their learning to …

T1 – Evaluate a problem in a new and novel situation.
T2 – Apply a step by step design process to solve a problem.
T3 – Apply scientific ideas to address human needs and wants.

Meaning

UNDERSTANDINGS: Students will understand that …

- U1 – Engineers have a step by step approach for looking at and solving a problem called the design process.
- U2 – Engineers and designers create new products and technology to meet a need or want that meets specific criteria for success, including constraints on materials, time, and cost.
- U3 – Engineers generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- U4 – Engineers propose a solution to develop for a design problem after evaluating multiple possible designs.
- U5 – Prototypes can be evaluated and improved upon by a series of fair and controlled tests to identify a product's strengths and limitations.

ESSENTIAL QUESTIONS: Students will keep considering …

- Q1 – How can automation and robotics be used to protect the Earth's resources and environment?
- Q2 – How can the engineering design process be applied in daily life?

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and shared ideas can lead to improved designs. • Science and Engineering Practices – Using Mathematics and Computational Thinking – Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. • Science and Engineering Practices – Constructing Explanations and Designing Solutions – Builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Crosscutting Concept – Cause and Effect – Case and effect relationships are routinely identified, tested, and used to explain change. • Crosscutting Concept – Systems and System Models – A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • Crosscutting Concept – Systems and System Models – A system can be described in terms of its components and their interactions. • Crosscutting Concept – Structure and Function – Different materials have substructures, which can sometimes be observed. • Crosscutting Concept – Structure and Function – Substructures have shapes and parts that serve functions. • Crosscutting Concept – Influence of Science, Engineering, and Technology on Society and the Natural World - People's needs and wants change over time, as do their demands for new and improved technologies. • Crosscutting Concept – Influence of Science, Engineering, and Technology on Society and the Natural World - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.	• U6 – Engineers write down everything they do to document their work, organize their thoughts, and show their steps in an engineering notebook. • U7 – Engineers share their work with and get feedback from others at many points throughout the design process. • U8 – Automation and robotics can be used to complete a task that would cause a safety hazard for humans. • U9 – Automated systems control devices with minimal human intervention. • U10 – Robotic systems are programmed to complete specific tasks with or without human interaction. • U11 – Sensors provide input to automated and robotic systems which can be used to adjust the behavior of outputs. • U12 – The science and application of automation and robotics can be applied to protect the Earth's resources and environment. • U13 – Informational text supports the analysis, reflection, and research of the field of automation and robotics.	
	Acquisition	
	KNOWLEDGE: Students will… • K1 – Explain what happens at each step of the design process. U1 • K2 – State questions that engineers may ask	*SKILLS: Students will…* • S1 – Follow a step by step approach to solving a problem. U1 • S2 – Identify specific constraints such as

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Common Core ELA • RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. • RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. • RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. • W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. • W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. • W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. *Common Core Math* • MP.2 Reason abstractly and quantitatively. • MP.4 Model with mathematics. • MP.5 Use appropriate tools strategically. • 3-5.OA Operations and Algebraic Thinking	when gathering information about a situation people want to change. U2 • K3 – Identify the differences between invention and innovation. U2 • K4 – Identify applications of robot technology used to complete dangerous tasks. U8 • K5 – Identify inputs and outputs within a robotic system. U11	materials, time, or cost that engineers and designers must take into account given a specific design problem. U2 • S3 – Brainstorm and evaluate existing solutions to a design problem.U2, U3 • S4 – Generate multiple solutions to a design problem while taking into account criteria and constraints. U2, U3 • S5 – Use a decision matrix to compare multiple possible solutions to a design problem and select one to develop, taking into account how well each solution meets the criteria and constraints of the problem. U3, U4 • S6 – Plan fair tests in which variables are controlled to identify a product's strengths and limitations. U5 • S7 – Perform fair tests in which variables are controlled to identify a product's strengths and limitations. U5 • S8 – Organize and maintain an engineering notebook to document work. U6 • S9 – Share findings and conclusions with an audience. U7 • S10 – Use motors and sensors to solve robotic problems. U11 • S11 – Design a control system to use sensor feedback to make decisions. U11

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		• S12 – Demonstrate the functionalities of a vehicle designed to complete a task related to protecting the Earth's resources and environment. U8, U9, U10, U11, U12 • S13 – Draw evidence from informational texts to support analysis, reflection, and research on robotics. U13 • S14 – Select appropriate tools to strategically solve a robotics problem. U11

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Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1 Introduction to Robotics	• Essential questions • K-W-L chart of robots • Documentation of Research on robots • Popplet Lite or the Educreations app presentation	• Popplet Lite or the Educreations app presentation • Presentation of research to class • Conclusion questions	RA.1.1.A Introduction to Robotics • In this activity students learn about the history of robotics and research a variety of classes of robots including those developed to complete tasks that would be dangerous to humans.	K1, K2, K3, K4, S9, S13
Activity 2 Inputs and Outputs	• Essential questions • Observation documentation in Launch Log of input and outputs	• Completed Inputs and Outputs Worksheet • Conclusion questions	RA.1.2.A Inputs and Outputs • In this activity students explore a variety of input and output devices including a motor, bumper switch, touch LED, color sensor, and controller.	K5
Activity 3 Create a Toy	• Essential questions • Documentation in the Launch Log of each of the design process steps • Popplet presentation of the design solution	• Popplet presentation of the design solution • Conclusion questions	RA.1.3.A Create a Toy • In this activity students explore structural and motion components of a robotics system and investigate how the components work together to create a functional structure.	K3
Project 4 Build a Robot	• Essential questions • Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Communication of the design solution	• Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Results of the prototype testing • Communication of the	RA.1.4.P Build a Robot • In this project students build a remotely operated robot with a variety of input and output devices. Students will build a robot chassis according to a given plan. After they have built and tested the vehicle, they have the opportunity to modify the vehicle to complete the task of collecting blocks and moving them across the floor.	S10, S11

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		design solution • Conclusion questions		
Problem 5 Environmental Design Problem	• Essential questions • Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Communication of the design solution	• Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Results of the prototype testing • Communication of the design solution • Conclusion questions	RA.1.5.B Environmental Design Problem • In this design problem, students are challenged to design, model, and test a mobile robot that can remove hazardous materials (represented by blocks) from a disaster site. Students also design the layout of a disaster site using criteria and constraints presented in the problem. The robot chassis built in Project 4 will serve as the basic robot design to be modified by the group.	K1, K2, K4, K5, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S14
Robotics and Automation Check for Understanding		Check for Understanding Summative Assessment	Robotics and Automation Check for Understanding	K4, K5, S11, S12

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