Orange Public Schools

Office of Curriculum & Instruction
2019-2020 Mathematics Curriculum Guide

PLTW Launch
5th Grade

Curriculum Framework

September 9, 2019 – June 25, 2020

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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, and shared ideas can lead to improved designs.

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.
- U6 – Engineers write down everything they do to document their work, organize their thoughts, and show their steps in an engineering notebook.

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?

<table>
<tr>
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- 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.

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.

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- 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.

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<tr>
<td colspan="2">Acquisition</td>
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KNOWLEDGE: Students will…

- K1 – Explain what happens at each step of the design process. U1
- K2 – State questions that engineers may ask 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

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SKILLS: Students will…

- S1 – Follow a step by step approach to solving a problem. U1
- S2 – Identify specific constraints such as 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

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</table>

• 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		• 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 • 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

Evidence *(stage 2)*		
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning
Activity 1: Introduction to Robotics	• Essential questions • K-W-L chart of robots • Documentation of research on robots	• Presentation of research to class • Conclusion questions
Activity 2: Inputs and Outputs	• Essential questions • Observation documentation in Launch Log of input and outputs	• Completed Inputs and Outputs Worksheet • Conclusion questions
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
Project: 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 design solution • Conclusion questions
Problem: Environmental Design	• Essential questions • Documentation in the Launch Log of each of the design process steps	• Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype

Learning Plan *(stage 3)*	
Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1: 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 • 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 • 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: 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
Problem: Environmental Design • In this design problem, students are challenged to design, model, and test a mobile robot that can remove hazardous materials (represented by	K1, K2, K4, K5, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S14

	• Physical construction of the prototype • Communication of the design solution	• Results of the prototype testing • Communication of the design solution • Conclusion questions
Robotics and Automation Check for Understanding		Check for Understanding Summative Assessment

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 the project will serve as the basic robot design to be modified by the group.	
Robotics and Automation Check for Understanding	K4, K5, S11, S12

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

<table>
<tr><th colspan="3">Desired Results (stage 1)</th></tr>
<tr><td rowspan="4">Standards

Next Generation Science Standards
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, 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.</td><th colspan="2">Transfer</th></tr>
<tr><td colspan="2">Students will be able to independently use their learning to …
T1 – Evaluate a problem in a novel situation.
T2 – Apply a step by step design process to solve a problem.
T3 – Justify the use of autonomous robots to solve problems.</td></tr>
<tr><th colspan="2">Meaning</th></tr>
<tr><td>UNDERSTANDINGS:
Students will understand that …
U1 – Engineers use a step by step approach to looking at and solve 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.</td><td>ESSENTIAL QUESTIONS:
Students will keep considering …
Q1 – How can autonomous robots be used to help people?
Q2 – How can the engineering design process be applied in daily life?</td></tr>
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- 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.
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- 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.

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.

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- 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 – Robotic systems are programmed to complete specific tasks with or without human interaction.
- U9 – Automated guided vehicles (AGVs) such as automatic guided carts, mobile robots, and hybrid lift trucks assist humans in a variety of environments and do not require human interaction while the task is being performed.
- U9 – Sensors provide input to automated and robotic systems which can be used to adjust the behavior of outputs in a closed-loop control system.
- U10 – A variety of computer programming languages can be used to control an autonomous robot.
- U11 – Automation and driver control can be combined to solve a design problem.

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<tr>
<td colspan="2">Acquisition</td>
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KNOWLEDGE: Students will…

- K1 – Explain what happens at each step of the design process. U1
- K2 – State questions that engineers may ask when gathering information about a situation people want to change. U2
- K3 – Identify the differences between invention and innovation. U2

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SKILLS: Students will…

- S1 – Follow a step by step approach to solving a problem. U1
- S2 – Identify specific constraints such as materials, time, or cost that engineers and designers must take into account given a specific design problem. U2

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• 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. • 5.G.A.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and *y*-coordinate). • 5.G.A.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	• K4 – Describe the characteristics of automation systems, including automatic guided vehicles. U8, U9 • K5 – Identify inputs and outputs within a robotic system. U10 • K6 – Identify software and hardware within a robotic system. U11	• 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 – Apply basic commands used to program a robotic system. U8, U9, U10, U11 • S11 – Design a control system to use sensor feedback to make decisions. U8, U9, U10, U11 • S12 – Apply knowledge of mechanisms, robotics, and programming to compete in a design challenge by designing, building, testing, and refining a mobile robot that meets a set of design

		constraints. U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11, U12

Evidence *(stage 2)*		
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning
Activity 1: Why Automation?	• Essential questions • Documentation of Research in Launch Log on autonomous robots • Popplet Lite app presentation	• Documentation of Research in Launch Log on autonomous robots • Popplet Lite app presentation • Conclusion questions
Activity 2: Introduction to Programming	• Essential questions • Documentation of programing steps in Launch Log • Execution of written instructions • Discussion of the activity learnings	• Documentation of programing steps in Launch Log • Discussion of the activity learnings • Conclusion questions
Activity 3: Input and Output Programming	• Essential questions • Competition of the four part learning resources • Correctly answering each of the prompts presented in the four part learning resources • Correct completion of the Input and Output Programming Design Sheet • Creation of each program presented in the four part learning resources	• Correct completion of the Input and Output Programming Design Sheet • Robot behaves as shown in each of the scenes of part 4 learning resource using programs created by students • Conclusion questions
Project: Programming Challenge	• Essential questions • Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype	• Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Results of the prototype testing

Learning Plan *(stage 3)*	
Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1: Why Automation? • In this activity students explore the need for automated robotic systems and cite specific applications currently in use. Students research and compare autonomous robots to identify characteristics that the robots share and characteristics that are unique to each robot.	K1, K2, K3, K4
Activity 2: Introduction to Programming • In this activity students will be introduced to programming and how this relates to robotics and automation.	K5, K6
Activity 3: Input and Output Programming • In this activity students will build a mobile robot with sensors and motors and create a variety of programs to change the default functionalities of the sensors. Students will also describe the programming necessary for the inputs and outputs to function in the default setting.	K5, K6, S10
Problem: Programming Challenge • In this project students modify a mobile robot with a variety of input and output devices and then create a computer program to direct the robot to follow a set of instructions.	S10, S11

	• Communication of the design solution	• Communication of the design solution • Competitive score in the challenge • Conclusion questions
Problem: Autonomous Vehicle Challenge	• 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
Robotics and Automation: Challenge Check for Understanding		Check for Understanding Summative Assessment

Problem: Autonomous Vehicle Challenge • In this design problem, students are challenged to use their knowledge of the VEX IQ platform and Modkit programming software to build a fully autonomous robot.	K1-5, S1-12
Robotics and Automation: Challenge Check for Understanding	K4, K5, S10, S11, S12

<table>
<tr><th colspan="3">Desired Results (stage 1)</th></tr>
<tr><td rowspan="4">Standards
Next Generation Science Standards
ETS1-1 Define a simple problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
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.
LS2.A: Interdependent Relationships in Ecosystems. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or their parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
ETS1.A: Defining and Delimiting Engineering Problems. Possible solutions to a problem are limited by available materials and resources (constraints).
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, and shared ideas can lead to improved designs.
Science and Engineering Practices – Asking Questions and Defining Problems – Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships.</td><th colspan="2">Transfer</th></tr>
<tr><td colspan="2">Students will be able to independently use their learning to …
T1 – Identify behaviors to maintain health and prevent the spread of infection.
T2 – Apply a step by step process to design and perform investigations to find answers to questions.
T3 – Utilize critical thinking skills to solve a problem.</td></tr>
<tr><th colspan="2">Meaning</th></tr>
<tr><td>UNDERSTANDINGS: Students will understand that …
U1 – Scientists ask and identify questions to gain knowledge or solve problems.
U2 – Scientists develop and use models to represent amounts, relationships, relative scales, and/or patterns in the natural and designed world(s).
U3 –Scientists plan and conduct investigations collaboratively to produce data that serves as evidence used to answer questions.
U4 – Scientists make predictions based on prior experiences.
U5 – Scientists make observations and/or collect data to construct evidence-based conclusions for natural phenomena.
U6 – Scientists keep and organize all of their work in a scientific notebook.
U7 – Scientists work collaboratively and communicate their findings with others.</td><td>ESSENTIAL QUESTIONS: Students will keep considering …
Q1 – How can germs be spread from person to person?
Q2 – How does the body defend itself from infectious disease?
Q3 – How can medical professionals use patient symptoms to diagnose illness?
Q4 – How can scientists determine how a germ spreads through a group of people?</td></tr>
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<tr>
<td rowspan="3">• Science and Engineering Practices – Developing and Using Models – Builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
• Science and Engineering Practices – Planning and Carrying Out Investigations – Builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
• Science and Engineering Practices – Analyzing and Interpreting Data – Builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
• 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.
• Science and Engineering Practices – Obtaining, Evaluating, and Communicating Information – Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.
• Crosscutting Concept – Patterns –
o Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and design products.
o Patterns of change can be used to make predictions.
o Patterns can be used as evidence to support an explanation.
• Crosscutting Concept – Cause and Effect – Case and effect relationships are routinely identified, tested, and used to explain change.
• Crosscutting Concept – Scale, Proportion, and Quantity – Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long periods of time.</td>
<td>• U8 – The design process is a step by step method used to guide people in developing solutions to problems.
• U9 – Infectious agents, such as bacteria and viruses, can cause illness and can spread from person to person.
• U10 – The body protects and defends itself from infection.
• U11 – Understanding how infectious disease spreads in a population helps medical professionals with prevention efforts.</td>
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<tr>
<td colspan="2">Acquisition</td>
</tr>
<tr>
<td>KNOWLEDGE: Students will…
• K1 – Recognize that germs can make a person sick and that bacteria and viruses are germs. U9, U10
• K2 – Describe the various ways germs can be passed from person to person. U9, U10
• K3 – Recognize that bacteria and viruses are microscopic in size and that they cannot be seen with the naked eye. U9
• K4 – Identify the ways that the body protects and defends itself against infection. U9, U10
• K5 – Identify behaviors that promote good health. U9, U10, U11</td>
<td>SKILLS: Students will…
• S1 – Use scientific tools to examine cells or organisms that are microscopic. U9
• S2 – Perform an investigation in order to draw conclusions. U1, U2, U3, U4, U5, U6, U7, U9, U11
• S3 – Maintain a notebook to document work. U1, U2, U3, U4, U5, U6, U7, U8
• S4 – Share findings and conclusions with others. U7, U8
• S5 – Organize and analyze medical data to determine a likely source of an infection. U2, U6, U7, U8, U9, U11
• S6 – Demonstrate the spread of infection using a graphical organizer and justify connections between infected individuals.U2, U6, U7, U8, U9, U11
• S7 – Follow a step by step method to solve a problem. U8, U9, U10, U11</td>
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Standards units are used to measure and describe physical quantities such as weight, time, temperature, and volume. • 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. *Common Core ELA* • RI.5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text. • RI.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text. • RI.5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area. • 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. • RI.5.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4-5 text complexity band independently and proficiently. • RF.5.4 Read with sufficient accuracy and fluency to support comprehension. • W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. • W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1-3 above.)		

- W.5.6 With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.
- W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.
- L.5.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- L.5.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.
- L.5.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

Common Core Math

- 5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
- 5.NBT.A.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- 5.NBT.A.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
- 5.NBT.A.3 Read, write, and compare decimals to thousandths.

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: Germs, Germs Everywhere	• Essential questions • Discussion and identification of *patient zero* from disease transmission game • Discussion of modes of infectious disease transmission	• Explanation of how *patient zero* was identified • Documentation of modes of infectious disease transmission • Conclusion questions	Activity 1: Germs, Germs Everywhere • In this activity students will observe how germs can spread as they trace the path of a mysterious classroom infection. Students will play a version of the classic game Seven Up. Unbeknownst to them, one of the students in the game has been exposed to a glowing simulated germ. As the game progresses, this germ spreads. It will be up to the class to determine *patient zero*, the initial patient in this outbreak.	K1, K2, K5, S3, S4, S5, S6
Activity 2: Preventing the Spread	• Essential questions • Completion of example investigation • Discussion of comparison of the two sample investigations • Discussion and completion of each step of the scientific inquiry process, including experimental design • Discussions of experimental findings	• Identification of what was done better in Example Experiment 2 • Completion and documentation of each step of the scientific inquiry process in the Launch Log (or on the Experiment Data Sheet) • Conclusion questions	Activity 2: Preventing the Spread • In this activity students will work with a partner to design and perform an experiment to test the effectiveness of different hand washing methods. They will follow the scientific inquiry process to collect and analyze data and to draw conclusions • Students will be guided through two example experiments. Students will analyze the two alternatives to determine best practice with experimental design and use what they've learned to design and complete an investigation.	K5, S2, S3, S4
Activity 3: Infection Fighters	• Essential questions • Completion of Body's Defenses Against Infection presentation	• Drawing and descriptions on body outline of at least 6 substances, structures, or cells that work to protect against germ invaders • Conclusion questions	Activity 3: Infection Fighters • In this activity the teacher will explore the body's defenses and diagram how the body fights invasion from germs. Students will explore nonspecific defenses, defenses that are not targeted against a specific invader, such as the skin, cilia, and mucus in the nose and respiratory tract. These nonspecific defenses simply act as a barrier to keep foreign bodies from entering our system. Students will also begin to look at specific defenses, particularly the white blood cells, which target specific germs that enter the body.	K4, S3, S4
Project: Mystery at School	• Essential questions • Organization of diseases into	• Completed questions on Microorganisms Resource Sheet	Project: Mystery at School • In this project students will investigate germs in depth and explore the two types of germs that are responsible for a majority	K1, K3, S1, S3, S4, S5

	communicable vs. non-communicable • Documentation of key ideas on bacteria and viruses from informational text found on Microorganisms Resource Sheet • Documentation of viral and bacterial images in Launch Log	• Completion of Microorganisms Fill-In Sheet (Optional) • Completion of magnification math problems • Analysis of disease cards and patient symptoms • Identification of disease agent causing illness at the school • Conclusion questions
Problem: Disease Detectives	• Essential questions • Analysis of the Evidence Documents resource sheet and information from the Patient Information resource sheet to explore connections between infected students • Identification of patterns between infected students	• Documentation in the Launch Log of each of the design process steps • Discussion of each of the design process steps • Completion of a flowchart, web, or other graphic organizer to show all connections between infected students • Evaluation and justification of the logic used to identify patient zero and how the disease was spread between students • Conclusion questions
Infection: Detection Check for Understanding		• Check for Understanding Summative Assessment

of the communicable illnesses that infect humans - bacteria and viruses. They will explore different diseases and apply their knowledge to identify the mystery illness spreading around Mylo, Suzi, and Angelina's school. • Note that this activity is comprised of three parts. In Part 1, students sort diseases by whether or not they believe the disease can spread from person to person. They deduce characteristics that similarly grouped diseases have in common. In part 2, students examine bacteria and viruses, two microorganisms that can make us sick. In Part 3, students analyze medical information from patients in a simulated outbreak to determine which illness is sweeping through a fictional school.	
Problem: Disease Detectives • In this design challenge, students will determine the *patient zero* in a school outbreak of strep throat. • Students will deduce a path of transmission among the students in the class who are sick. Students will work through the design process to solve the problem.	K1, K2, K3, K5, S3, S4, S5, S6, S7
Infection: Detection Check for Understanding	K1, K2, K4, K5

Desired Results *(stage 1)*

Standards

Computer Science Teachers Association K-12 CS Standards

- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-13 Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
- 1B-AP-15 Test and debug (identify and fix) a program or algorithm to ensure it runs as intended.
- 1B-AP-16 Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development.
- 1B-IC-17 Describe choices made during program development using code comments, presentations, and demonstrations.

Common Core Math

- CCSS.Math.5.G.1
  Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
- CCSS.Math.5.G.2
  Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Next Generation Science Standards

Transfer

Students will be able to independently use their learning to…

T1 – Appreciate the power of technology-enabled modeling and simulation to help humans make sense of large phenomena, such as transmission of a pathogen through a host population.
T2 – Apply technology to create age-appropriate digital models of phenomena such as simplified interdependent systems.
T3 – Develop efficient solutions to computational problems by breaking them into subproblems and identifying parts that can be abstracted and modularized.

Meaning

UNDERSTANDINGS: Students will understand that…

- U1 – **Modeling** and **simulation** allows scientists to test a digital model of a physical system with different parameters to understand and predict how the system behaves in the real world.
- U2 – Computers are essential tools for modeling and simulation because they can rapidly calculate and display information about a system.
- U3 – Modularization, breaking problems into subproblems, and abstraction, ignoring details while focusing on common properties, are important steps to take when developing solutions with technology.
- U4 – Computing is a collaborative activity that fosters creativity and requires communication and teamwork.
- U5 – People use technology to create useful tools that help us understand the world better.
- U6 – Computer programs do not need to be right the first time. Testing and fixing things is normal when programming.

ESSENTIAL QUESTIONS: Students will keep considering…

- Q1 – How does technology help us to make sense of scientific phenomena?
- Q2 – Why is it helpful to be able to approximate a system with a computer model?

Acquisition

KNOWLEDGE: Students will…

- K1 – Identify the agents and parameters in a simple system. U1, U2

SKILLS: Students will…

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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, and shared ideas can lead to improved designs.
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.
Crosscutting Concept: Cause and Effect—Cause and effect relationships are routinely identified.
Crosscutting Concept: Cause and Effect—Cause and effect relationships are routinely identified, tested, and used to explain change.

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K2 – Explain that changing a parameter while running a simulation uncovers how the parameter affects the model system. U1, U2, U3, U5
K3 – Identify parts of a computational solution that can be abstracted and modularized in order to make the solution efficient and generalizable. U1, U2, U3, U4, U5, U6
K4 – Identify events that drive a program’s behavior such as external user interaction and internal variable counters. U1, U2, U3
K5 – Explain in simple terms how to clone an object to make a variable number of copies as determined at program runtime. U1, U2, U3, U5, U6

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S1 – Organize and collaborate with group members by assigning roles and taking turns. U3, U4, U6
S2 – Use parameters in a preprogrammed simulation to investigate the model system, its agents, and the effects of its parameters. U1, U2, U5
S3 – Decompose a problem and use a predefined set of commands to write an algorithm that will solve the problem. U3, U4, U5, U6
S4 – Use variables appropriately as part of a computational solution. U1, U2, U6
S5 – Construct a class of objects with inherited properties and methods to create a variable number of agents in a program. U1, U2, U3, U6
S6 – Implement a loop when appropriate to make a program repeat a section of code until an ending condition is reached. U2, U3, U6
S7 – Program actors to respond to both internal and external event triggers. U1, U2, U3, U4, U5, U6
S8 – Construct a computer program using age-appropriate tools to model a simple system and to simulate how it works. U1, U2, U3, U4, U5, U6
S9 – Demonstrate persistence in the cycle of testing, finding, and fixing problems in computer programs. U3, U4, U6

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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning
Activity 1 Simulation Game	• Teacher stops the first simulation after four exchanges to check that everyone understands what is happening. • Teacher leads discussion after first simulation to help students articulate what they learned from acting out the simulation. • Students record observations and data in Launch Log.	• Teacher leads discussion at the end of the last simulation. • Teacher reviews Launch Logs to see individual student observations and explanations.
Activity 2 Virtual Ecosystem	• Students work in pairs or small groups and converse about the activity while they are doing it. • Students write observations in Launch Log. • Students record data about parameters and outcomes for several trials. • Students draw conclusions about the interdependence of the agents in the system.	• Students answer conclusion questions in Launch Log. • Teacher checks Launch Logs for evidence of understanding, both in conclusion question answers and also in data and observation notes.
Activity 3 Building Computer Models	• Students follow prompts during the activity to help them build understanding.	• Students answer conclusion questions in Launch Log.

Learning Plan *(stage 3)*	
Activities (A), Projects (P), and Problems (B)	Knowledge and Skills
5_4_1A Simulation Game • Students act out a simulation that mimics an ecosystem but on a very simple scale. • Students act out the simulation several times. • Students record data from each simulation. • Students make observations about cause-effect and the dynamic interdependence of the agents in the system.	K1, K2, S1, S2
5_4_2A Virtual Ecosystem • Students use simulation software to see how powerful it is to be able to run many simulations on a model, and to see how one can gain understanding of system dynamics by running simulations with different parameters. • Students develop a strong understanding of models and simulations: models are approximations; simulations can be run many times with large numbers. Computers give us the capability to investigate things we can't see and/or can't calculate quickly enough to make sense of the system.	K1, K2, S2
5_4_3A Building Computer Models • Students design a game where the main actor chases a target and tries to avoid being hit by flying objects.	K3, K4, S4, S6, S7, S9

	• Teacher leads discussion with class for first example data set. • Students discuss with each other to clarify learning and build understanding. • Students record data and observations in Launch Log.	• Teacher checks Launch Logs for evidence of understanding, both in conclusion question answers and also in data and observation notes.	• This introduces many of the programming skills and modeling and simulation concepts that are required for the project and the problem.	
Project 4 Playing with Parameters	• Students modify the code for the model and debug as necessary until the simulation works as expected. The cycle of testing and fixing is formative assessment. • Students record observations and predictions in Launch Log, with prompting from Project instructions. • Students run simulations and compare outcomes to predictions. Teacher and other students point out inconsistencies to help students correct understandings about the particular model/sim and about modeling and sim in general.	• Teacher reads student Launch Logs to confirm student understanding. • Teacher leads class discussion at the end of the project. • Students answer conclusion questions to reaffirm what they've learned during the project.	5_4_4P Playing with Parameters • Students program user-configurable parameters and incorporate the values of the given parameters into the simulation. • Students discover what it means to program a computer to simulate a model. Students deepen understanding of the approximations that go into the model-building process. Students gain increased appreciation for the power of technology to churn through many iterations.	K2, K5, S3, S5, S8, S9

Problem 5 Simulating Infectious Diseases	• Students write code to model the infectious disease. During the cycle of testing and fixing, students formatively assess their own learning. • Students use the design process guide in Launch Log. Self-assessment rubrics help teacher and students correct misconceptions and guide students to understanding, both of the CS content and the science content.	• Student computer program successfully models the infectious disease and the simulation approximates the actual dynamics of the system. • Students record understandings in the Launch Log. • Teacher reads Launch Log. • Students answer conclusion questions. • Teacher reviews student conclusion question answers.	5_4_5B_Simulating Infectious Diseases • Students develop a model of an infectious disease and then build an original computer program to simulate it. • Students build a simple model in Tynker based on that disease's characteristics. With guidance, students develop an algorithm for running simulations on the model and then program the simulation. Students use their original program to run simulations and record data. Students document findings based on the data.	K1, K2, K3, K4, K5, S1, S2, S3, S4, S5, S6, S7, S8, S9
Modeling and Simulation Check for Understanding		Check for Understanding Summative Assessment	Modeling and Simulation Check for Understanding	K1, K2, K3, K4, S4, S5, S6, S7, S8, S9

Modifications	
Special Education/504:	**English Language Learners:**
• Adhere to all modifications and health concerns stated in each IEP. • Give students a MENU of options, allowing them to choose assignments from different levels based on difficulty. • Accommodate Instructional Strategies: use of post-its, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time • Allow extra time to complete assignments or tests • Allow students to demonstrate understanding of a problem by drawing a functional model of the answer and then explaining the reasoning orally and/or writing. • Provide breaks between tasks, use positive reinforcement, use proximity • Work in a small group • Use large print books, Braille, or digital texts • Strategies for Students with 504 Plans	• Simplify written and verbal instructions • Use manipulatives to promote conceptual understanding and enhance vocabulary usage • Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing • Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words • Provide graphic representations, gestures, drawings, equations, and pictures during all segments of instruction • Utilize program translations tools such as Snap and Read (if available) • Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information • Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve real life problems. • Reword questions in simpler language • Provide class notes ahead of time to allow students to preview material and increase comprehension • Provide extended time
Gifted and Talented:	**Students at Risk for Failure:**
• Organize and offer flexible small group learning opportunities / activities. • Utilize elevated contextual complexity • Inquiry based or open ended assignments, performance tasks and projects • Allow more time to study concepts with greater depth • Provide options, alternatives and choices to differentiate and broaden the curriculum. • Promote the synthesis of concepts and making real world connections • Provide students with enrichment practice that are imbedded in the curriculum	• Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum • Modify Instructional Strategies; extended time, reading aloud text, graphic organizers, flexible grouping, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Utilize Scaffolded Questioning, Field Trips, Google Expeditions, Peer Support, Modified Assignments, Chunking of Information, Peer Buddies • Assure constant parental/ guardian contact throughout the year with successes/ challenges • Provide academic contracts to students and guardians • Create an interactive notebook with samples, key vocabulary words, student goals/ objectives.

o allowing students to design problems to be addressed by the class o allowing students to modify the lesson by introducing a related phenomena o allow for interest-based extension activities • Utilize an enhanced set of introductory activities (e.g. phenomena, organizers, concept maps etc) • Provide whole group enrichment explorations. • Teach cognitive and methodological skills • Allow for the use of stations • Organize integrated problem-solving simulations.	• Always plan to address students at risk in the designing of learning tasks, instructions, and directions. • Try to anticipate where the needs will be and then address them prior to lessons. • Teacher should allow for preferential seating • Include Visual Cues/Modeling • Allow for technology Integration, especially Assistive Technology

21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. These skills enable students to make informed decisions that prepare them to engage as active citizens in a dynamic global society and to successfully meet the challenges and opportunities of the 21st century workplace.

As such, they should be taught and reinforced in all career exploration and preparation programs, with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9**. Model integrity, ethical leadership and effective management.
- **CRP10**. Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Students are provided with an equitable opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are also encouraged to reason through experiences and exposure to phenomena that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, and educational websites.

Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.

https://www.state.nj.us/education/cccs/2014/tech/

8.1 Educational Technology:	8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:
All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations. B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology. C. **Communication and Collaboration:** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information. F. **Critical thinking, problem solving, and decision making:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live. B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society. C. **Design:** The design process is a systematic approach to solving problems. D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems. E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Interdisciplinary Connections:
Science:
• 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. • LS2.A Interdependent Relationships in Ecosystems: Some organisms, such as fungi and bacteria, break down dead organisms (both plants or their parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. • 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, and shared ideas can lead to improved designs.

Interdisciplinary Connections:

English Language Arts:

- RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
- RI.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- RI.5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
- 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. RI.5.10 By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4-5 text complexity band independently and proficiently.
- RF.5.4 Read with sufficient accuracy and fluency to support comprehension.
- W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- W.5.6 With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.
- 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.
- SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- L.5.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- L.5.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.
- L.5.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

Interdisciplinary Connections:

Mathematics:

- 5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
- 5.NBT.A.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- 5.NBT.A.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
- 5.NBT.A.3 Read, write, and compare decimals to thousandths.
- 5.G.A.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
- 5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.
- MP.5 Use appropriate tools strategically.