Innovators in STEM
Grade 5
Unit 2 Plan

acher(s)	
rm	

Unit Overview

Unit Title	Engineering with Coding and Robotics
Unit Length	30 days; 15 periods; 42-minute periods
Performance Task	***Engineering with Coding and Robotics*** Students design attachments to a robot and code it to automate a task, such as feeding a pet on a schedule or deploying and retracting a sunshade to protect a garden. Students will utilize three different difficulty levels of coding (badge, block, and code) to create a cohesive program that utilizes loops, conditionals, and variables to command the robot. Students will work collaboratively to simulate a design team, ensuring they are properly ideating, testing, and debugging. ***Learning Process:*** *Engineering Design Process*
Essential Questions	How can coding and robotics help us do things more efficiently or effectively or enable us to do things we wouldn't have been able to do without them?
Enduring Understandings	We can build our knowledge of coding and robotics in order to automate tasks, make things safer, be more productive, and accomplish things we couldn't previously imagine possible.
Pacing Guide	Link to unit pacing guide.

Goals

STEM Program Goals *By the end of the 5th grade…*		**Unit Goal** *By the end of this unit…*
Communication	Students will be able to **ask, listen, and**	Students will be able to share their

	respond to questions, allowing for the **equitable flow of ideas**.	ideas and ask for the ideas of others to determine a task that can be automated using coding and robotics.
Collaboration	Students will be able to **utilize group roles** to manage time, resources, and tasks.	Students will be able to define roles in a team and act on the roles to create a cohesive coding program.
Creativity	Students will be able to **brainstorm answers or solutions** to questions or problems and **create something** that **serves a particular purpose**.	Students will be able to determine how to automate a task that considers multiple perspectives, needs, and approaches.
Critical Thinking	Students will be able to **break down the parts** of a problem, question, or task and determine **which information is relevant** to determining a solution and **explain how the evidence supports** their approach.	Students will be able to determine how to design an attachment that is coded to automate a task by breaking down the problem, considering different solutions, and debugging their designs.

Connections

Discipline	Connected Standards
Science (2020 NJSLS)	**Earth and Human Activity 5.ESS3.1** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, and address climate change issues.
Computer Science and Design Thinking (2020 NJSLS)	**Computing Systems 8.1.5.CS.3** Identify potential solutions for simple hardware and software problems using common troubleshooting strategies.
	Impacts of Computing 8.1.5.IC.1 Identify computing technologies that have impacted how individuals live and work and describe the factors that influenced the changes.
	Algorithms & Programming 8.1.5.AP.3 Create programs that include sequences, events, loops, and conditionals.
	Algorithms & Programming 8.1.5.AP.6 Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended.
English Language Arts	**Reading Anchor R10** Read and comprehend complex literary and informational texts independently and

(2020 NJSLSA)	proficiently with scaffolding as needed.
	Writing Anchor W6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
	Speaking and Listening Anchor SL5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
	Language Anchor L6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
Technology	**ISTE Innovative Designer 1.4.c** Students develop, test and refine prototypes as part of a cyclical design process.
	ISTE Computational Thinker 1.5.d Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.
	ISTE Global Collaborator 1.7.c Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.
UN Sustainable Development Goals	**Goal 8: Decent Work and Economic Growth** Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
	Goal 9: Industry, innovation, and infrastructure Promote inclusive and sustainable industrialization.
	Goal 12: Responsible Consumption and Production Ensure sustainable consumption and production patterns.
	Goal 14: Life below water Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
	Goal 15: Life on land Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Learning Process and Check Points

Assessment Type	Learning Phase	Student Product	Description	Goal Assessed
Formative	Investigate	Task Identification	Investigate a manual task that would benefit from automation.	Communication
Formative	Brainstorm	Performance Task Brainstorm	Brainstorm ways the task can be automated using the robot as a base.	Communication
Formative	Plan	Design Plan	Plan how the task will be automated with code. Plan the design for the attachment to the robot.	Collaboration
Formative	Build	Automated Attachment	Build the attachment and code the robot to interact with the attachment to complete a task.	Creativity
Formative	Test and Iterate	Design Log of Iterations	Test the efficacy of the attachment and code to complete the automated task	Critical Thinking
Summative	Share	Performance Task	Share your automation with other engineers.	Communication Collaboration Creativity Critical Thinking
Summative	Reflect	Unit reflection journal.	Reflect on your Engineering Design Process learning experience.	Communication Collaboration Creativity Critical Thinking

Unit Resources

Type	Purpose/Description	Access the Resource
Coding Robot	Robot to provide a base and connect to the coding software	*Recommendation:* Photon Coding Robot
Coding Software	Coding software to automate the task	*Recommendation:* Photon Coding Application

Physical Building Materials	Materials for the attachment	Gather craft and recyclable materials for building.
Optional: **Mechanized Parts**	Motorized parts for the attachment	*Recommendation:* Hummingbird Robotics Kit
UN Sustainable Development Goals	Students draw connections between their designs and real-world problems/goals	https://sdgs.un.org/goals
Optional: **Student Design Log**	Students record their learning and reflection as part of the design process	Create a digital or physical resource for students.

Vocabulary

Academic Vocabulary ***(Tier 2 Words)***		**Subject-Specific Vocabulary** ***(Tier 3 Words)***	
• Manual • Automated • Task • Attachment • Physical	• Safety • Efficiency • Capability • Sustainable • Solution	• Program • Algorithm • Code • Robot • Software	• Variable • Loop • Conditional • Engineer • Hardware

Differentiation

Type *The type of differentiation strategy.*	**Strategy** *The specific differentiation strategy.*	**Implementation** *When, how, or why the strategy is implemented.*
Modifications *Changes to the learning objective.*	Set individualized and relevant learning goals based on the performance task rubric.	For students who are working on developing their skills but below grade level expectations, use the performance task rubric to identify which criteria levels the students will meet. (ie. some students will have a goal of achieving level 4 whereas others might have a goal of achieving level 2.
	Students will utilize at least one coding level appropriate to their performance levels.	For students who require modification to the requirement to utilize three coding levels to determine a solution.
Scaffolds *Supports to aid access, learning, and mastery of*	Real life examples of automation.	Students research or explore educator curated samples of automation in real life. Supports students who benefit from concrete examples.

an objective. May result in a change in the time, input, output, or size of learning experiences.	Group roles - some roles might include: *programmer, architect, quality assurer, project manager*	Utilize intentional group roles to support student collaboration.
	Provide an engineering Design Process checklist.	Provide the steps of the Engineering Design Process to remind students of the process and move autonomously through it.
	Provide or co-create sample or exemplar code.	Sample coding programs to model how coding commands create automation.
	Have students utilize offline coding cards.	Students plan their coding programs offline using manipulative cards prior to or alongside coding with the software.
	Have students present to peers and exchange ideas and/or feedback.	Sharing ideas with peers can help generate ideas, provide modeling to students who may benefit from an example, as well as support student troubleshooting and iteration.
Enrichment *A way to provide students personalized, in depth learning.*	Student choice of topics and challenges the automation aims to solve.	Students can have as little as or as much choice in the topic of their solution. Some students benefit from a concrete list of structured choice whereas others may benefit from open ended choice and can work through the abstract.
Extension *A way of extending the learning of a unit, objective, or lesson.*	Students enter their solutions into the New Jersey STEAM Tank competition.	Students, with the support of an educator, can enter their design solutions into the STEAM Tank competition to share publicly and iterate their ideas with the support of mentors from the field.

Unit Preparation

Technology Set Up

1. **Complete the next section, "Unit Considerations," and reflect on student strengths, areas of anticipated challenges, and appreciate differentiation strategies.**
2. **Review the sample Pacing Guide and modify it to accommodate your learning schedule.**
3. Ensure coding robots are charged and updated.
4. Ensure coding software is downloaded, updated, and accounts created (or set up instructions on how to create accounts).
5. Gather building materials such as craft materials, recyclables, etc. One

	idea might be to have a “Building Materials” drive where other teachers, staff, parents, or people in the community donate craft materials and/or recyclable materials. 6. Determine where students will document and submit their learning. You may create a student Design Log and/or set up assignments in your Learning Management System (ie. Google Classroom, Microsoft Teams, etc.) for students to submit their work.
Unit Considerations *Teacher Reflection*	*Think about students' current skills and knowledge, what they may struggle with, where differentiation might be appropriate, and how this unit can be customized for your classroom. Write your reflections below:*

Pacing Guide

The learning phases and project checkpoints are outlined below. Complete, revise, and/or expand upon the pacing guide for your classroom.

Day/Class Period	Phase	Aim / Activity *What is the learning objective? What will students do?*	Assessment *How will you assess learning?*
Day 1	Investigate		
Day 2			
Day 3		Students will be able to investigate a manual task that would benefit from automation.	Students will identify a task to automate.
Day 4	Brainstorm		
Day 5		Students will be able to brainstorm ways the task can be automated using the robot as a base.	Students will identify approaches to automating the task with the robot.
Day 6	Plan		
Day 7			
Day 8		Students will plan how the task will be automated with code and plan the design for the attachment to the robot.	Students will build an offline coding program, a physical or digital drawing of the attachment, and a plan of the solution and how they will

			achieve it.
Day 9	Build		
Day 10		Students will be able to build the attachment and code the robot to interact with the attachment to complete a task.	Students will create a coding program and an attachment.
Day 11	Test and Iterate		
Day 12		Students will be able to test the efficacy of the attachment and code to complete the automated task.	Students will document a log of iterations to the design (code and/or attachment).
Day 13	Share		
Day 14		Students will be able to share their automation with other engineers (peers and/or in the field).	Students will present the automation.
Day 15	Reflect	Students will be able to reflect on the Engineering Design Process learning experience.	Students will journal reflections of their learning experience.