Wall Township Public Schools	Board Approval Date: 8/19/2025

Course Title: Grade 4 - STEM

Course Description: This course integrates hands-on engineering challenges with foundational coding instruction using SAM Labs and Code.org. Aligned to the New Jersey Student Learning Standards, students will explore problem-solving, automation, and emerging technologies through real-world applications and collaborative projects. The course builds digital fluency and critical thinking while fostering creativity and innovation.

New Jersey Student Learning Standards

Disciplinary Concepts and Core Ideas:

Computing Systems: People interact with a wide variety of computing devices that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

Networks and the Internet: Computing devices typically do not operate in isolation. Networks connect computing devices to share information and resources and are an increasingly integral part of computing. Networks and communication systems provide greater connectivity in the computing world.

Data & Analysis: Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.

Algorithms & Programming: An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicInteraction of Technology and Humans Societies influence technological development. Societies are characterized by common elements such as shared values, differentiated roles, and cultural norms, as well as by entities such as community institutions, organizations, and businesses. Interaction of Technology and Humans concerns the ways society drives the improvement and creation of new technologies, and how technologies both serve and change society.

Engineering Design: People design for enjoyment and to solve problems, extend human capabilities, satisfy needs and wants, and improve the human condition. Engineering Design, a systematic approach to creating solutions to technological problems and

finding ways to meet people's needs and desires, allows for the effective and efficient development of products and systems.

Nature of Technology: Human population, patterns and movement focus on the size, composition, distribution, and movement of human populations and how they are fundamental and active features on Earth's surface. This includes understanding that the expansion and redistribution of the human population affects patterns of settlement, environmental changes, and resource use. Patterns and movements of population also relate to physical phenomena including climate variability, landforms, and locations of various natural hazards and their effects on population size, composition, and distribution.

Effects of Technology on the Natural World: Many of engineering and technology's impacts on society and the environment are widely regarded as desirable. However, other impacts are regarded as less desirable. Effects of Technology on the Natural World concerns the positive and negative ways that technologies affect the natural world.

Ethics & Culture: Ethics and Culture concerns the profound effects that technologies have on people, how those effects can widen or narrow disparities, and the responsibility that people have for the societal consequences of their technological decisions.

Course Sequence & Pacing

Unit Title	Lesson:
Unit 1: Exploring STEM Foundations & Digital Thinking	1-5
Unit 2: Building Smart Systems with Code & Sensors	6-9
Unit 3: Solving Real-World Problems Through Design	10-13
Unit 4: Innovation, AI & Presenting Solutions	14-18

Unit 1

Desired Results

Unit 1 Title: Exploring STEM Foundations & Digital Thinking

Unit Summary: This unit introduces students to the basics of STEM through hands-on exploration and early programming concepts. Students learn how to think algorithmically, troubleshoot code, and interact with basic hardware and digital tools to understand inputs and outputs.

Learning Standards

8.1.5.AP.1 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
8.1.5.AP.2 - Create programs that use clearly named variables to store and modify data.
8.1.5.CS.2 - Model how computer software and hardware work together as a system to accomplish tasks.
8.2.5.ED.1 - Explain the functions of a system and its subsystems.
8.2.5.ED.2 - Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3 - Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4 - Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ITH.1 - Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.NT.1 - Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.ETW.1 - Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
8.2.5.EC.1 – Analyze how technology contributes to or reduces inequities.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills

9.4.5.CT.1 - Identify and gather relevant data that will aid in the problem-solving process

Interdisciplinary Connections

NJSLS - ELA 2023

RI.IT.4.3. Describe the impact of individuals and events throughout the course of a text, explaining events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on evidence in the text.

SL.PE.4.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

NJSLS - SCIENCE 2020

3-5-ETS1-1 / ETS1-2 – Define a design problem and generate multiple solutions.

4-PS3-4 – Apply scientific ideas to design, test, and refine a device that converts energy.

Learning Targets			
Unit Essential Questions: 1. What makes a solution "effective" when solving a STEM problem? 2. How can algorithms help us solve everyday problems? 3. Why is it important to communicate and collaborate when working with technology?		**Unit Enduring Understandings:** 1. Effective solutions are clear, testable, and based on logical steps; trial and error is part of the design process. 2. Algorithms are step-by-step instructions that help people and computers complete tasks efficiently and accurately. 3. STEM work requires teamwork, clear communication, and shared problem-solving to refine ideas and improve outcomes.	
Vocabulary:			
STEM Engineer Design Problem-solving	Prototype Algorithm Sequence Debug	Input Output Loop Conditional	Teamwork Feedback Reflection
Students will be able to: ● Identify the components of STEM and describe how they work together to solve real-world problems. ● Create simple algorithms to complete structured tasks using digital tools or visual coding platforms. ● Debug a sequence of code to improve its function and explain the changes made. ● Collaborate with peers to plan and carry out a hands-on design activity that requires logical reasoning. ● Demonstrate how inputs and outputs function within a basic technological system. ● Reflect on the learning process and explain how digital thinking can support creative problem-solving.			
Unit 1 Focus: *Introduce students to STEM as a way of thinking and solving problems. Students learn how computers process instructions, develop simple algorithms, and explore inputs and outputs through early engineering tasks.*	**Week 1:** **Lesson Title:** Introduction to STEM and Digital Tools **Key Activities**: Device setup, STEM interest inventory, STEM careers **Week 2:** **Lesson Title:** Algorithm Basics with Code.org **Key Activities**: Code.org Course D (1-3), Unplugged activities **Week 3:** **Lesson Title:** Debugging and Problem Solving **Key Activities**: Code.org Course D (4-5), Debugging games		

Resources used: **Code.org:** Course D – Lessons 1–5 **SAM Labs (SAM Studio):** Start Simple, Energy Flow Challenge	**Week 4:** **Lesson Title:** Introduction to Inputs and Outputs **Key Activities**: SAM Labs - Simple Lighting, Input/Output games **Week 5:** **Lesson Title:** Energy Transfer with Basic Systems **Key Activities**: SAM Labs - Energy Flow Challenge, basic circuit building

Learning Activities:

Amistad Law Alignment (N.J.S.A. 18A 52:16A-88)

Focus: Contributions of African Americans to the development of STEM, innovation, and American history.

- Connection: Highlight African American pioneers in STEM such as Katherine Johnson (NASA mathematician), George Washington Carver (agricultural scientist), or Mark Dean (co-inventor of the personal computer).
- Classroom Tie-In: Integrate short biographical STEM spotlights or coding warm-ups honoring diverse innovators during algorithm lessons.

Climate Change Alignment

Focus: Introduce the Purpose of STEM as a Tool for Problem Solving

- Connection: Frame STEM not just as “techy stuff” but as a way to help people and the planet.
- Instructional Tie-In: Ask students to brainstorm environmental problems they care about (e.g., too much plastic, energy waste, endangered animals).

Diversity & Inclusion Alignment (N.J.S.A. 18A:35-4.36a)

- Highlight diverse contributions in STEM
  Include daily or weekly spotlights honoring STEM pioneers from various backgrounds (e.g., African American, Indigenous, women, scientists with disabilities), sharing diverse perspectives and demonstrating that innovation comes from all communities.
- Promote inclusive collaboration
  Emphasize team roles, respectful communication, and diverse thinking in hands-on tasks. Encourage students to notice and respect diverse approaches during group planning and problem-solving.

Assessment Evidence

Formative Assessments:

- Exit tickets asking students to define terms like “algorithm” or “prototype”
- Observation checklists during group work or coding tasks

- Think-pair-share prompts (e.g., “What do you do if your code doesn’t work?”)
- Quick reflection journals or coding notebooks
- “Unplugged” card-sorting activities matching inputs/outputs or coding terms

Summative Assessments:

- Create and explain a basic algorithm for a classroom task (e.g., how to line up)
- Design challenge: build a simple system using inputs/outputs and explain how it works
- Short written quiz with vocabulary and coding logic questions
- Final group project: Plan, design, and present a basic STEM solution with visuals

Common Benchmark Assessments:

- Grade-wide digital logic and vocabulary quiz using Google Forms or another platform
- Coding comprehension assessment (identify bugs, fix a broken sequence)
- Standardized rubric to score a small-scale design task aligned to NJSLS-TECH and CLKS

Alternative Assessments:

- Create a screencast or voice recording explaining how an algorithm works
- Build a physical model or poster that shows a working input/output system
- Oral explanation or peer teaching of a coding concept
- Comic strip or storyboard showing the process of debugging a mistake

Core Instructional & Supplemental Materials

Sam Labs	Code.org	Typing Club	Mystery Science

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one
- Additional time - Review of directions
- Student restates information
- Space for movement or breaks

- Extra visual and verbal cues and prompts
- Preferential seating
- Follow a routine/schedule
- Rest breaks
- Verbal and visual cues regarding directions and staying on task
- Checklists
- Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts
- Personal Glossary
- Extended Time
- Simplified/Verbal Instructions
- Frequent Breaks
- Visual learning- including graphic organizers
- Teacher modeling

Students at Risk of Failure

- Home/School Connection
- Alternative Assessments
- Learning Contracts
- Leveled Rubrics and Tiered Activities
- Work Alone Choice
- Group Work Choice

Students with 504 Plans

- Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
- 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way.
- Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

- Homogeneous Grouping
- Small Group In-Depth Instruction
- Alternative Assessments, Supplemental Reading, Engaging projects, Differentiated Online Practice
- Pre-Assess to provide Differentiated Instruction to Accelerate Learning

Unit 2

Desired Results

Unit 2 Title: Building Smart Systems with Code & Sensors

Unit Summary: This unit deepens students' understanding of programming by introducing control structures like loops, events, and conditionals. Through interactive projects, students apply these concepts to design and test simple smart systems using sensors and real-world problem scenarios.

Learning Standards

8.2.5.ITH.3 - Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.
8.2.5.NT.2 - Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.1.5.AP.3 - Create programs that include sequences, events, loops, and conditionals.
8.1.5.CS.2 - Design a system that combines hardware and software components to process data.
8.1.5.CS.3 - Justify design decisions and explain potential system trade-offs.
8.2.5.ED.4 - Explain factors that influence the development and function of products and systems.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills 9.4.5.CT.2 - Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem.

9.4.5.IML.1 - Evaluate digital sources for accuracy, perspective, credibility and relevance

Interdisciplinary Connections

NJSLS - SCIENCE 2020

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.

4-PS4-3 - Generate and compare multiple solutions that use patterns to transfer information.

4-PS3-4 – Apply scientific ideas to design, test, and refine a device that converts energy.

NJSLS - MATH 2023

4.OA.A.3 – Solve multistep word problems with whole numbers using the four operations, interpreting remainders and assessing reasonableness

4.OA.B.4 – Find factor pairs and determine multiples/composite numbers (1–100).

Learning Targets			
Unit Essential Questions: 1. How do sensors help machines interact with the world? 2. What role do loops, conditionals, and events play in coding smart systems? 3. How does testing and debugging improve our designs? 4. How do we use technology to solve real-world problems?		**Unit Enduring Understandings:** 1. Sensors detect changes in the environment and allow machines to respond with programmed actions. 2. Control structures like loops and conditionals help systems make decisions, repeat actions, and respond to specific events efficiently. 3. Iterative testing and debugging help identify errors and refine a system so it works more reliably and effectively. 4. Smart technologies are designed to make life easier, safer, or more efficient by solving problems through automation and innovation.	
Vocabulary:			
Sensor Input Output Event	Loop Conditional System Circuit	Code Sequence Debug Automate	Trigger Response Program
Students will be able to: ● Identify and describe the function of sensors in a digital system. ● Explain how inputs and outputs work together to create a response in a coded system. ● Use loops and conditionals to create efficient and responsive code. ● Design and build a basic smart system that responds to sensor input. ● Debug a simple program to improve its accuracy and reliability. ● Collaborate with peers to plan and execute a coding challenge that solves a real-world problem. ● Reflect on the impact of automation in daily life and how smart systems improve efficiency. ● Communicate design decisions and coding logic clearly using appropriate technical vocabulary.			
Unit 2 Focus: *Build upon early logic and coding skills by introducing sensors, loops, and events. Students design responsive systems using*	**<u>Week 6:</u>** **Lesson Title:** Introduction to Loops and Events **Key Activities**: Code.org Course D – Lessons 6–8, Loop practice with movement-based coding games, Create a program that reacts to a specific input (e.g., mouse click, key press)		

physical computing tools to demonstrate how smart technologies interact with their environment. Resources used: **Code.org:** Course D – Lessons 6-8 **SAM Labs (SAM Studio):** Lighting Challenge, Sound Interaction Project	**Week 7:** **Lesson Title:** Smart Light System Design **Key Activities**: SAM Labs: Lighting Challenge, Design a system that turns lights on/off based on a condition. **Week 8:** **Lesson Title:** Coding with Sound Sensors **Key Activities**: SAM Labs: Sound Interaction Project, Experiment with sensor values and thresholds **Week 9:** **Lesson Title:** Integrated Project: Smart Sensor Design **Key Activities**: Design a smart system (e.g., sound-triggered alarm, light-sensitive display)

Learning Activities:

Diversity & Inclusion Alignment (N.J.S.A. 18A:35-4.36a)

- Acknowledge economic diversity through design challenges: Pose scenarios that require designing affordable, low-resource sensor systems, highlighting that not all communities have equal access to technology and prompting empathy in student design.
- Explore biases in data and sensors: Introduce age-appropriate discussions about how social or cultural biases (e.g., race, gender norms) can affect sensor effectiveness (like skin tone detection or voice recognition) and why inclusive design matters.

Climate Change Alignment

Smart System Design with Environmental Purpose

- Lesson Tie-In: *Smart Thermostat Challenge*
- Integration: Have students design a thermostat that conserves energy in a school or home setting. Discuss how regulating temperature saves electricity and reduces greenhouse gas emissions.
- STEM Concept: Energy efficiency through automation
- Connection to Sustainability: Emphasizes the role of programmable systems in reducing energy waste.

Sensor-Based Conservation Projects

- Lesson Tie-In: *Smart Light or Sound System*
- Integration: Program lights or sound systems that only activate when needed (e.g., motion-activated lighting). Connect this to reducing unnecessary power use in buildings.
- Computational Thinking: Triggered events, conditionals
- Environmental Application: Teaches the practical use of Cleantech principles in everyday life.

Discussion Prompt: Can We Code for the Planet?

- Mini-Reflection or Class Talk - Ask: “How could sensors or smart systems help people protect natural resources like water, electricity, or clean air?”
- Encourage ideas like drip irrigation sensors, pollution monitors, or waste-sorting systems.

Assessment Evidence

Formative Assessments:

- Quick code check-ins – Students predict what a short block of code will do before testing it.
- Sensor exit tickets – Ask: "What is the input in our system today? What output did it trigger?"
- Partner observation – Teachers use a checklist to observe student collaboration and use of control structures (loops, conditionals).
- Sticky-note self-assessment – Students rate their confidence in concepts like loops or debugging.
- Think-alouds – Students explain their reasoning while building or testing smart systems.

Summative Assessments:

- Final Smart System Build – Students design, code, and demonstrate a functional system using at least one sensor, loop, and conditional.
- STEM journal reflection – Students explain how their system works and describe how it could help solve a real-world problem.
- Vocabulary quiz – Terms like input, output, loop, sensor, debug, and automate.
- Design plan submission – Include labeled diagrams and code logic with annotations.

Common Benchmark Assessments:

- Standardized coding task – All students complete a brief program challenge using provided blocks and identify inputs/outputs.
- Performance rubric – Used across classrooms to assess smart system projects (creativity, logic, sensor use, functionality).
- Tech vocabulary and logic quiz – Digital or paper-based assessment shared across the grade level.

Alternative Assessments:

- Video explanation – Students record themselves explaining how their system works step-by-step.
- Storyboard/comic strip – Illustrates how their smart system responds to sensor input in a real-world setting.
- Oral presentation – Students present their build to peers or a visiting class using visuals and simplified language.
- Tactile model – For students with language or processing needs, using physical objects to show input-output pathways.

Core Instructional & Supplemental Materials

Sam Labs	Code.org	Typing Club	Mystery Science

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one
- Additional time - Review of directions
- Student restates information
- Space for movement or breaks
- Extra visual and verbal cues and prompts, Verbal and visual cues regarding directions and staying on task
- Preferential seating
- Follow a routine/schedule, Rest breaks
- Checklists, Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts, Teacher modeling
- Personal Glossary
- Extended Time
- Simplified/Verbal Instructions
- Visual learning- including graphic organizers

Students at Risk of Failure

- Home/School Connection
- Alternative Assessments, Learning Contracts, Leveled Rubrics and Tiered Activities
- Work Alone Choice, Group Work Choice

Students with 504 Plans

- Teachers are responsible for implementing designated services and strategies identified on a student’s 504 Plan.
- 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way.
- Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

- Homogeneous Grouping, Small Group In-Depth Instruction
- Alternative Assessments, Differentiated Online Practice
- Pre-Assess to provide Differentiated Instruction to Accelerate Learning
- Supplemental Reading, Engaging projects

Unit 3

Desired Results

Unit 3 Title: Solving Real-World Problems Through Design

Unit Summary: This unit challenges students to apply coding and engineering skills to tackle practical problems. They use logic, functions, and automation to create solutions that demonstrate how technology can improve everyday life.

Learning Standards

8.1.5.AP.4 - Break down problems into smaller, manageable sub-problems to facilitate program development.
8.1.5.AP.3 - Create programs that include sequences, events, loops, and conditionals.
8.1.2.AP.5 - Describe a program's sequence of events, goals, and expected outcomes.
8.1.5.CS.3 - Identify potential solutions for simple hardware and software problems using common troubleshooting strategies
8.2.5.ED.5 - Describe how specifications and limitations impact the engineering design process.
8.2.5.ITH.2 - Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process.

9.4.5.CT.2 - Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem.
9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Interdisciplinary Connections

NJSLS - SCIENCE 2020

4-PS3-4 - Apply scientific ideas to design, test, and refine a device that converts energy from one form to another

4-ESS3-1 – Earth and human activity: Use design solutions to reduce environmental impact.

NJSLS - SOCIAL STUDIES 2020

6.1.5.CivicsPD.2 – Engage in discussions to consider multiple perspectives and promote decision-making.

6.3.5.CivicsPR.4 – Communicate with others to inform or influence change.

NJSLS - MATH 2023

4.NBT.A.1–A.3 – Understanding place value, reading/writing large numbers, and rounding multi-digit numbers.

4.NBT.B.4 – Fluent standard-algorithm addition and subtraction for multi-digit whole numbers

Learning Targets

Unit Essential Questions:

1. How can we use technology to design solutions to everyday problems?
2. Why is planning important before building a solution?
3. How do functions and automation make systems smarter?
4. What can we learn from failed attempts?

Unit Enduring Understandings:

1. Technology allows us to design, test, and improve solutions that address real-life challenges in creative and practical ways.
2. Careful planning helps us identify needs, choose materials wisely, and organize steps for building effective and efficient solutions.
3. Functions allow for reusable code, and automation helps systems perform tasks consistently without human input.
4. Failures are valuable opportunities to learn, improve designs, and develop resilience as problem-solvers.

Vocabulary:

Design Problem Solution Criteria	Constraints Prototype Model Function	Code Function (in coding) Automation Sequence	Debug Efficiency Iterate

Students will be able to:

- Identify a real-world problem and define the criteria and constraints for a possible solution.
- Plan and build a working prototype that uses basic coding and design principles.
- Use functions in code to simplify and organize repeated actions in a program.
- Debug and revise a system to improve its performance and efficiency.
- Collaborate with peers to test and refine a technology-based solution.
- Explain how automation can be used to solve problems in everyday life.
- Reflect on the design process and how it helped improve the final product.
- Present a solution using clear visuals, technical vocabulary, and step-by-step explanations.

Unit 3 Focus: *Apply coding structures like conditionals and functions to solve authentic, real-world problems. Students work collaboratively through the*	**<u>Week 10:</u>** **Lesson Title:** Intro to Conditionals in Code **Key Activities**: Code.org Course D – Lessons 9–11, Unplugged conditional games (e.g., “If this happens, then jump…”), Build a basic program that reacts differently based on input

design process to plan, test, and revise solutions to everyday challenges using smart technology. **Resources used:** **SAM Labs:** Smart Thermostat Challenge, Automated Plant Watering **Code.org:** Course D – Lessons 9–14	**Week 11:** **Lesson Title:** Smart Thermostat Challenge **Key Activities**: Students code a system that turns heat or cooling on/off based on temperature **Week 12:** **Lesson Title:** Functions and Automation in Code **Key Activities**: Code.org Course D (12-14), Practice writing and calling custom functions, Compare two systems (one with functions, one without) and analyze efficiency **Week 13:** **Lesson Title:** Automated Plant Watering System **Key Activities**: SAM Labs: Automated Plant Watering Project, Integrate functions, loops, and conditionals

Learning Activities:

Diversity & Inclusion Alignment (N.J.S.A. 18A:35-4.36a)

- Design with community in mind - Encourage students to identify problems in diverse communities (e.g., accessibility needs for peers with disabilities) and design inclusive solutions, reinforcing empathy and equity.
- Support multiple entry points - Offer varied project options and scaffolded tasks so learners of differing strengths (including ELLs or students with disabilities) can access and succeed in STEM challenges.

Climate Change Alignment

Energy-Conscious Engineering

- Project Tie-In: Smart Thermostat Challenge
- Students program a thermostat to manage temperature efficiently based on environmental data.
- Climate Connection: Teaches how reducing heating/cooling energy reduces carbon emissions.
- Discussion Prompt: “How can smart homes help reduce our impact on the planet?”

Assessment Evidence

Formative Assessments:

- Design journal entries – Students sketch and explain their design ideas as they evolve.
- Code walk-throughs – Students verbally explain their code to a partner or teacher.
- Mid-build check-ins – Students complete a checklist or “red-yellow-green” reflection on their progress.
- Gallery walk with peer feedback – Students share prototypes in progress and receive peer questions or suggestions.
- Debugging tasks – Provide a broken function or logic sequence for students to fix and explain

Summative Assessments:

- Final design project – Students create a functioning system that solves a real-world problem, includes a written or verbal explanation, and incorporates functions or automation.
- Presentation – Students present their design and process to peers or a panel, using visuals and technical vocabulary.
- Design process reflection – Students write about the steps they took, changes they made, and what they learned.
- Rubric-scored prototype – Evaluate criteria like innovation, coding accuracy, function use, teamwork, and problem-solving.

Common Benchmark Assessments:

- Coding logic mini-assessment – Evaluate student ability to write or read functions and identify their role in a program.
- Performance-based task – All students complete the same design challenge with rubric-based scoring.
- Engineering design plan template – Completed by all students, showing their problem, prototype plan, materials, and solution logic.

Alternative Assessments:

- Video explanation – Students record themselves describing their system and how it solves the problem.
- Storyboard – Students draw the steps their system follows and annotate with technical terms.
- Oral interview – One-on-one conversation where students explain their design and thought process.
- Tactile model demonstration – For students with language needs, a hands-on explanation using props and guided questions.

Core Instructional & Supplemental Materials

Sam Labs	Code.org	Typing Club	Mystery Science

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one
- Additional time - Review of directions
- Student restates information
- Space for movement or breaks
- Extra visual and verbal cues and prompts, Verbal and visual cues regarding directions and staying on task

- Preferential seating
- Follow a routine/schedule, Rest breaks
- Checklists, Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts, Teacher modeling
- Personal Glossary
- Extended Time
- Simplified/Verbal Instructions
- Visual learning- including graphic organizers

Students at Risk of Failure

- Home/School Connection
- Alternative Assessments
- Learning Contracts
- Leveled Rubrics and Tiered Activities
- Work Alone Choice, Group Work Choice

Students with 504 Plans

- Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
- 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way.
- Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

- Homogeneous Grouping
- Small Group In-Depth Instruction
- Differentiated Online Practice
- Alternative Assessments
- Pre-Assess to provide Differentiated Instruction to Accelerate Learning
- Supplemental Reading
- Engaging projects

Unit 4

Desired Results

Unit 4 Title: Innovation, AI & Presenting Solutions

Unit Summary: This unit introduces students to emerging technologies like artificial intelligence and ethical tech use. The unit culminates in a student showcase where learners present their final projects, reflecting on their STEM journey and sharing their creative solutions with others.

Learning Standards

8.1.5.IC.1 - Identify computing technologies that have impacted how individuals live and work and describe the factors that influenced the changes.
8.1.5.IC.2 - Identify possible ways to improve the accessibility and usability of computing technologies to address the diverse needs and wants of users.
8.1.5.DA.1 - Collect, organize, and display data in order to highlight relationships or support a claim.
8.2.5.ED.6 - Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.
8.2.5.ITH.4 - Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.ETW.2 - Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3 - Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ED.6 - Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills

9.4.5.CT.1 - Identify and gather relevant data that will aid in the problem-solving process.

9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.

9.4.5.IML.2: Create a visual representation to organize information about a problem or issue..

9.4.5.IML.3: Represent the same data in multiple visual formats in order to tell a story about the data .

9.4.5.TL.5: Collaborate digitally to produce an artifact

Interdisciplinary Connections

NJSLS - SCIENCE 2020

4-LS1-1 - Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

NJSLS - ELA 2023

SL.PI.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

SL.UM.4.5. Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.
W.IW.4.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

NJSLS - MATH 2023

4.DL.A.1 – Create data-based questions, generate ideas based on the questions, and then refine the questions.

4.DL.A.2 – Develop strategies to collect various types of data and organize data digitally.

4.DL.A.3 – Understand that subsets of data can be selected and analyzed for a particular purpose.

4.DL.A.4 – Analyze visualizations of a single data set, share explanations, and draw conclusions that the data supports.

Learning Targets

Unit Essential Questions:

1. How can we use data to improve our designs?
2. What is artificial intelligence, and how is it changing the way we live and work?
3. How do we communicate our ideas clearly and effectively?
4. Why is it important to consider the impact of technology on people and society?

Unit Enduring Understandings:

1. Collecting, organizing, and analyzing data helps us make informed decisions and refine our solutions for better performance.
2. Artificial intelligence allows machines to mimic human thinking and decision-making, and it is transforming industries, communication, and problem-solving.
3. Strong presentations include organized ideas, visual supports, and clear explanations that help others understand and value our work.
4. Technology has ethical, social, and environmental effects, and we have a responsibility to design and use it in ways that are fair, safe, and helpful.

Vocabulary:

Innovation Artificial Intelligence (AI) Ethics	Data Input Output	Digital Tool Prototype Feedback	Presentation Audience Visualization	Algorithm Reflection Impact

Students will be able to:

- Explain what artificial intelligence is and how it is used in real-world applications.
- Identify ethical considerations when designing or using technology.
- Analyze data and use it to improve a prototype or digital system.
- Create a clear and engaging visual presentation to explain a STEM project.

- Use digital tools to collaborate and produce a final project artifact.
- Reflect on the design and problem-solving process from idea to presentation.
- Communicate ideas effectively to an audience using appropriate vocabulary and visuals.
- Evaluate how technology can impact individuals, communities, and the environment.

Unit 4 Focus: *Explore artificial intelligence and ethics in technology, emphasizing responsible innovation. Students prepare and deliver final projects that showcase their understanding of STEM systems and their potential to solve real-world problems.* **Resources used:** **SAM Labs:** Project enhancements and final integration **Code.org:** AI & Ethics module, data and presentation tools	**Week 14:** **Lesson Title:** Introduction to AI and Responsible Innovation **Key Activities**: Code.org AI & Ethics Module (Intro Lesson), Discuss real-world AI examples (voice assistants, recommendation systems) **Weeks 15 - 16:** **Lesson Title:** Exploring AI and Clean Technology **Key Activities**: Student research: AI tools in conservation or energy efficiency, Brainstorm connections to climate goals (e.g., water-saving, energy-aware systems) **Weeks 17-18:** **Lesson Title:** Showcase Planning and Design **Key Activities**: Use planning template to outline project explanation, Create visual aids (slide deck, poster, model), Peer feedback sessions

Learning Activities:

Diversity & Inclusion Alignment (N.J.S.A. 18A:35-4.36a)

- Lesson: *Showcase Presentations*
    - Connection: Ensure a diverse presentation environment by prompting students to highlight how their project can serve different communities equitably. During the showcase, foster an inclusive atmosphere by using unbiased language, encouraging peer respect, and celebrating diverse perspectives.

Climate Change Alignment

- Lesson: AI Application Exploration & Showcase Presentations

- Connection: Introduce AI-driven tools that support environmental sustainability such as smart energy grids and wildlife monitoring using sensors. Encourage students to explain how their own projects could help manage resources like water and energy while supporting clean technology and computational sustainability goals.

Amistad Law Alignment (N.J.S.A. 18A 52:16A-88)

- Lesson: *AI Application Exploration*
  - Connection: Showcase contributions from influential African Americans in technology and AI—like Joy Buolamwini (Algorithmic Justice League) and Timnit Gebru (AI ethics researcher). This honors their voices and recognizes their efforts to create fair and accessible technologies.

Holocaust Law Alignment (N.J.S.A. 18A:35 - 28)

- Lesson: Innovation & AI Ethics Discussion
  - Connection: Facilitate a discussion about how AI and technology have been misused in historical contexts such as surveillance, propaganda, or discriminatory practices during the Holocaust. Highlight the ethical responsibility modern innovators have to prevent technology from facilitating bias or oppression.

Assessment Evidence

Formative Assessments:

- Ethics scenario journal – Students respond to short prompts about the responsible use of AI.
- Peer feedback on presentation drafts – Students give structured comments on clarity and visuals.
- Exit tickets – Students reflect on how AI can help or harm society.
- Presentation practice rounds – Informal rehearsal with self-assessment checklists.
- Vocabulary checks – Quick quizzes or games reviewing terms like algorithm, bias, innovation, and impact.

Summative Assessments:

- Final STEM project presentation – Students present their prototype or innovation with visuals and explanations.
- Digital artifact submission – Includes code, diagrams, data, and student reflection.
- Written reflection – Students explain the purpose of their project, challenges they faced, and how they solved them.
- AI ethics response – Students analyze a scenario and explain the responsible course of action.

Common Benchmark Assessments:

- Presentation rubric – Standardized tool for scoring organization, clarity, vocabulary use, and content.
- Project design log – All students submit a log of their design process and AI application.
- Tech fluency check – Grade-level mini-assessment on responsible tech use, coding logic, and project communication.

Alternative Assessments:

- Video presentation – Students record themselves explaining their innovation.
- Poster board or infographic – Students represent their work visually with minimal text.

- One-on-one oral interview – Teacher checks understanding through guided conversation.
- Annotated slide deck – Students turn in their presentation with notes explaining their thinking.

Core Instructional & Supplemental Materials			
Sam Labs	Code.org	Typing Club	Mystery Science

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one
- Additional time - Review of directions
- Student restates information
- Space for movement or breaks
- Extra visual and verbal cues and prompts, Verbal and visual cues regarding directions and staying on task
- Preferential seating
- Follow a routine/schedule, Rest breaks
- Checklists, Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts, Teacher modeling
- Personal Glossary
- Extended Time
- Simplified/Verbal Instructions
- Visual learning- including graphic organizers

Students at Risk of Failure

- Home/School Connection
- Alternative Assessments
- Learning Contracts

- Leveled Rubrics and Tiered Activities
- Work Alone Choice, Group Work Choice

Students with 504 Plans

- Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
- 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way.
- Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

- Homogeneous Grouping
- Small Group In-Depth Instruction
- Differentiated Online Practice
- Alternative Assessments
- Pre-Assess to provide Differentiated Instruction to Accelerate Learning
- Supplemental Reading
- Engaging projects