Wall Township Public Schools	Board Approval Date: 8/19/2025
Course Title: Grade 5 - 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: Engineering Systems & Design	1-4
Unit 2: Digital Literacy & Computational Thinking	5-8
Unit 3: Interactive Programming & Real-World Applications	9-13
Unit 4: Design Challenges, Innovation, AI & Showcase	14-18

Unit 1

Desired Results

Unit 1 Title: Engineering Systems & Design

Unit Summary: In this unit, students engage in hands-on exploration of engineering systems. Using SAM Labs and Mystery Science, they learn about circuits, energy flow, sensors, and forces as they design and build interactive prototypes while applying the engineering design process.

Learning Standards

8.2.5.ED.1 - Explain the functions of a system and its subsystems.
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.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.4 - Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
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.ETW.5 - Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.
8.2.5.NT.1 - Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.2 - Describe physical and digital security measures for protecting sensitive personal information.
8.2.5.NT.3 - Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4 - Identify how improvement in the understanding of materials science impacts technologies.

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
9.4.5.TL.1: Compare the common uses of at least two different digital tools and identify the advantages and disadvantages of using each.
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.

NJSLS - SCIENCE 2020

3-5-ETS1-1: Students define a simple design problem reflecting a need or a want.
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.
3-5-ETS1-1 - Students define a simple design problem reflecting a need or a want.

NJSLS - MATH 2023
MP.4 - Model with mathematics when measuring and building structures or circuits.

Learning Targets

Unit Essential Questions:

1. How do engineers design and improve technology?
2. How do we use technology to solve real-world problems?
3. How do engineers design and improve technology?
4. What roles do energy and motion play in engineering systems?
5. How can we use inputs and outputs to create smart solutions?

Unit Enduring Understandings:

1. Smart technologies are designed to make life easier, safer, or more efficient by solving problems through automation and innovation.
2. Engineers apply the design process to create and improve solutions to real-world problems.
3. Understanding energy, motion, and system components helps in designing effective technologies.

Vocabulary:

Engineer Design Process Prototype	Circuit Energy Current	Input Output Sensor	Motion Force Friction

Students will be able to:

- Use the engineering design process to develop a prototype.
- Build and test a simple circuit.
- Explain how energy flows in a system.
- Describe how forces affect the motion of an object.

Unit 1 Focus: *Introduce students to engineering designs and engaging foundations of STEM by using sensors, and actuators. Students will understand circuits and energy transfer in their designs. Students will investigate force, motion and design as they engineer a design challenge with vehicles.*

Resources Used:

SAM Labs: SAM Labs: (example: Boolean v. Numeric Inputs); SAM Studio (example: Create a Car and Going Green; Energy in Motion)

<u>Week 1</u>:

Lesson Title: Engineering Design Intro

Key Activities: SAM Labs Starter Lessons to introduce the platform and toolbars through teacher guided exploration;

<u>Week 2:</u>

Lesson Title: Inputs and Outputs Online;

Key Activities: Students will test each system in SAM Labs to view actual outputs and compare results to their initial predictions

Mystery Science: Ecosystems: Interactions, Energy, and Dynamics **Code.org:** Input/Output: Lesson 5	**<u>Week 3:</u>** **Lesson Title:** Energy & Electricity **Key Activities:** Cross curriculum connection with Mystery Science lessons Transfer of Energy; Students will invent their own ways of producing renewable energy via the designs of a solar panel/wind turbine. **<u>Week 4:</u>** **Lesson Title:** Forces & Motion **Key Activities:** Students will work collaboratively to gain an understanding of how the speed of an object relates to its energy and how the energy can be transferred; Students will investigate the speed of the energy of a 'car' through its impact with different objects.

Learning Activities:

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

- Analyze equity in access to clean technologies across communities

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.
- Collaborate in teams to design inclusive engineering projects
- 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

- Build working circuits to explore power use and conservation
- 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.
- Reinforces the idea that coding isn't just for games—it can solve real problems.

Assessment Evidence

Formative Assessments:

- SAM Labs interactive checkpoints and guided activities
- Student design journals and annotated circuit diagrams
- Partner feedback sessions on build iterations
- 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:

- Completed prototype builds with presentations
- Energy and force demonstration videos or infographics
- Project reflection rubric

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
- Differentiated Online Practice
- Alternative Assessments
- Pre-Assess to provide Differentiated Instruction to Accelerate Learning
- Supplemental Reading
- Engaging projects

Unit 2

Desired Results

Unit 2 Title: Digital Literacy & Computational Thinking

Unit Summary: This unit introduces students to essential digital citizenship skills and the foundations of computational thinking. Through guided Code.org lessons, students explore safe and responsible technology use while beginning to understand algorithms, sequencing, and debugging as core concepts in coding.

Learning Standards

8.1.5.DA.1 - Collect, organize, and display data in order to highlight relationships or support a claim.
8.1.5.NI.1 - Develop models that successfully transmit and receive information using both wired and wireless methods.
8.1.5.IC.1 - Identify computing technologies that have impacted how individuals live and work and describe the factors that influence the changes.
8.1.5.DA.2 - Compare the amount of storage space required for different types of data.
8.1.5.DA.5 - Propose cause and effect relationships, predict outcomes, or communicate ideas using data.
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.AP.4 - Break down problems into smaller, manageable sub-problems to facilitate program development.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills
9.4.5.CI.1: Use appropriate communication skills to brainstorm ideas and create solutions.
9.4.5.IML.3: Evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.

Interdisciplinary Connections

NJSL - ELA 2023
RI.5.7: Students interpret digital media and integrate information from diverse sources when analyzing online content.
SEL Competency: Responsible Decision-Making: Demonstrated through choices made during digital safety and citizenship discussions.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• What does it mean to be a responsible digital citizen?	• Responsible digital behavior helps students stay safe and ethical in a connected world.

• How do algorithms help solve problems? • Why is debugging important in computing? • How can algorithms help us solve everyday problems?	• Algorithms are step-by-step instructions that help people and computers complete tasks efficiently and accurately. • Algorithms and debugging are foundational skills for solving computational problems. • Solving complex problems requires creativity, collaboration, and iteration. • Clear communication is essential to share ideas, defend choices, and inspire others.

Vocabulary:

Digital Citizen Problem-Solving Conditional	Algorithm Sequence Debug Loop	Privacy Cyberbullying Password	Teamwork Feedback Reflection

Students will be able to:

- Demonstrate responsible use of digital resources.
- Create and debug simple block-based programs.
- Explain how algorithms are used to solve problems.
- Recognize and respond to unsafe digital behavior.
- 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.
- Reflect on the learning process and explain how digital thinking can support creative problem-solving.

Unit 2 Focus: *Students explore the importance of digital citizenship and internet safety as they navigate through online activities and group discussions about privacy and digital ethics. Using block programming, students will learn coding foundations; debugging and problem solving* **Resources used:** **Code.org:** Course D **CommonSense.org:** Be A Super Digital Citizen	**Week 5:** **Lesson Title:** Digital Citizenship & Internet Safety **Key Activities:** Exploration of Code.org and CommonSense.org will guide students with mini-lessons and differentiated instruction self-guidance through the lessons to be able to differentiate the basics of being safe online. **Week 6:** **Lesson Title:** Online Responsibility & Etiquette **Key Activities:** Using CommonSense.org students will explore topics like privacy and safety and the impact of their digital footprint. **Week 7:** **Lesson Title:** Algorithms & Sequencing: **Key Activities**: Students will get to practice reading and editing code to fix puzzles with simple algorithms, loops and nested loops. **Week 8:** **Lesson Title:** Debugging & Problem Solving **Key Activities:** Students will differentiate their instruction as they program through the levels in code.org.

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).
  - Role-playing online safety scenarios and identifying safe vs unsafe choices (Amistad Law: explore historical examples of digital equity)
- 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).
- Investigation into energy use of digital systems

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

- Discussions on representation and bias in media/technology
- 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 “digital citizenship” or “algorithm”
- Code.org lesson checks and reflection prompts
- Digital citizenship role-plays and class discussions
- Observation checklists during group work or coding tasks
- Think-pair-share prompts (e.g., “What do you do if your witness cyberbullying?”)
- 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)
- Completed Code.org projects (e.g., My Digital Footprint activity)
- Digital safety infographic presentation
- Cumulative coding challenge demonstrating loops, conditionals, and sequencing

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
- Create digital citizenship guidelines on Google platforms
- 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:

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- Preferential seating
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- Rest breaks
- Verbal and visual cues regarding directions and staying on task
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- Immediate feedback

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- 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

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

Unit 3

Desired Results

Unit 3 Title: Interactive Programming & Real-World Applications

Unit Summary: In this unit, students expand their understanding of coding and science through real-world applications. They use programming for storytelling, create robotic solutions, investigate scientific phenomena, and analyze data—all while collaborating to solve authentic problems with technology.

Learning Standards

8.1.5.AP.4 - Break down problems into smaller, manageable sub-problems to facilitate program development.
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.
8.1.5.CS.1 - Model how computing devices connect to other components to form a system.
8.1.5.DA.3 - Organize and present collected data visually to communicate insights gained from different views of the data.
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.
8.2.5.NT.1 - Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.3 - Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4 - Identify how improvement in the understanding of materials science impacts technologies.
8.2.5.ETW.3 - Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.

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.
9.4.5.GCA.1: Analyze how culture shapes individual and community perspectives and points of view.

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

ELA W.5.6: Use digital tools to produce and publish work collaboratively.
Science 5-PS1-4: Conduct investigations and analyze outcomes (e.g., chemical reactions).

Learning Targets

Unit Essential Questions:

- How can we use technology to design solutions to everyday problems?
- Why is planning important before building a solution?
- How can we use technology to tell stories or share ideas?
- In what ways can programming and robotics solve real-world problems?
- How can data help us make informed decisions?

Unit Enduring Understandings:

- Technology allows us to design, test, and improve solutions that address real-life challenges in creative and practical ways.
- Careful planning helps us identify needs, choose materials wisely, and organize steps for building effective and efficient solutions.
- Failures are valuable opportunities to learn, improve designs, and develop resilience as problem-solvers.
- Programming empowers students to create interactive and meaningful solutions.
- Data and scientific inquiry are essential tools in solving problems and making decisions.
- Data and scientific inquiry are essential tools in solving problems and making decisions.

Vocabulary:

Program Storyboard Animation	Variable Sensor Data	Graph Chemical reaction Collaboration	Sustainability

Students will be able to:

- Design and animate a story using code.
- Create and test a robotic solution.
- Collect and interpret sensor data.
- Work collaboratively to solve STEM-related problems.

Unit 3 Focus:

<u>Week 9:</u>
Lesson Title: Storytelling with Code

Students will animate a story using characters, scenes, and conditionals; Design a robotic solution to complete a simple task; Collect data using sensors, create graphs and interpret results; Conduct experiments, analyze observations and cause-effect; Explore renewable energy and sustainable design ideas **Resources used:** **Code.org** Coding Book Covers; Hour of AI: Data Collection **SAM Labs** Mixing Substances; Mars Rover; Guardians of the Earth; Blocky Explores Artificial Intelligence	**Key Activities:** In Code.org, students will code interactive book covers using sprites and text to convey characters, setting and story line. **Week 10:** **Lesson Title:** Robotics & Automation **Key Activities:** Students will gain understanding of how vehicles are modified to suit their purpose, exploring the design of the Mars rover as a case study. Students will integrate and exhibit learning by creating a model 'Mars rover', identifying two possible solutions for its steering mechanism. They will compare and contrast the capabilities of each design in order to determine which one allows the 'rover' to better fulfill its main objective. **Week 11:** **Lesson Title:** Data Collection & Graphing: **Key Activities:** Students will practice making their own predictions and learn about data categorization and sorting. In Sam Labs, students will explore machine learning and the reliability of Artificial Intelligence in these career and industry themed activities. **Week 12:** **Lesson Title:** Chemical Reactions Inquiry: **Key Activities:** During this lesson, students will gain understanding that matter is made up of particles which are too small to be seen by the human eye and that combining two substances can sometimes form a new substance. They will integrate and exhibit learning by creating a system to represent the combination of two separate substances to create a new substance. **Week 13:** **Lesson Title:** Environmental Tech & Sustainability **Key Activities:** During this lesson, students will gain an understanding of the ocean's role in sustaining life on Earth. Students will explore the current threat to oceans due to plastic pollution. Students will discuss how human ingenuity, robust

	community effort, robotics, and automation can overcome this huge environmental problem. Students will integrate and exhibit learning by building a river cleaning barge with trash receptacles and coding a system to represent emptying the trash when the receptacles are full.

Learning Activities:

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

- Create animated stories highlighting underrepresented voices

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: Explore environmental data through sensors and graphing tools

- 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

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- Follow a routine/schedule, Rest breaks

- Checklists, Immediate feedback

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Unit 4

Desired Results

Unit 4 Title: Design Challenges, Innovation, AI & Showcase

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

8.2.5.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.2 - Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.1.5.AP.3 - Create programs that include sequences, events, loops, and conditionals.

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.CI.2: Investigate a persistent local or global issue and collaborate with others to design solutions.
9.4.5.TL.2: Sort and filter data in a spreadsheet to analyze findings.

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.
ELA SL.5.4: Report on a topic or text with supporting details; organize and present findings.
Visual & Performing Arts 1.4.5.Cr1a: Apply creative processes in presenting technology-driven solutions.

Learning Targets

Unit Essential Questions:

- What is artificial intelligence, and how is it changing the way we live and work?
- How do we communicate our ideas clearly and effectively?
- Why is it important to consider the impact of technology on people and society?
- How do we apply the design process to real-world challenges?
- What makes a solution effective and innovative?
- How can we clearly communicate our ideas and solutions?

Unit Enduring Understandings:

- Collecting, organizing, and analyzing data helps us make informed decisions and refine our solutions for better performance.
- Artificial intelligence allows machines to mimic human thinking and decision-making, and it is transforming industries, communication, and problem-solving.
- 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.
- Solving complex problems requires creativity, collaboration, and iteration.
- Clear communication is essential to share ideas, defend choices, and inspire others.

Vocabulary:

Innovation Artificial Intelligence (AI) Presentation	Constraints Iteration Feedback	Showcase Smart System	Audience Visualization	Ethics Criteria

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.
- 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.
- Apply the design process to solve open-ended problems.
- Build and improve a solution through testing and feedback.
- Present and explain their project to an audience.
- Reflect on their learning and their peers' solutions.

Unit 4 Focus:
Students will collaboratively work on creative tech-based problem-solving projects. They will plan, build, test and revise a bridge using real-world constraints. Create a traffic light or sensor system for a model city. Students will examine several examples of maps and discuss what features make up the map. Prepare final projects, build presentation, practice delivery and present to class; Peer feedback and self reflections will constitute a class discussion.

Resources used:
SAM Labs: Bridges Around the World
Mystery Science: How do you build a bridge to last 100 years?
Code.org

<u>Week 14:</u>
Lesson Title: Innovation & Collaboration:
Key Activities: Using SamLab platforms, create a traffic light /street lights with sensors denoting change in day light and the light's response. (Example: turns on when it gets dark or light changes color after a specific time)

<u>Week 15:</u>
Lesson Title: Design Challenge 1: Bridge Building:
Key Activities: Explore Mystery Science mini-lesson and Sam Labs Bridges.

<u>Week 16:</u>
Lesson Title: Design Challenge 2: Smart City:
Key Activities: Using Code.org students will follow a self-paced guide in designing an Interactive Map

<u>Week 17:</u>
Lesson Title: Showcase Prep: All Platforms
Key Activities: Students will problem-solve and finalize their showcase portfolio from Code.org lessons and SamLab explorations.

<u>Week 18:</u>
Lesson Title: Final Presentations: All Platforms
Key Activities: Time to shine and showcase this year's innovations.

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.
    - Integrate sustainability goals into final projects

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.
    - Design inclusive bridge or smart city models that reflect cultural influences and accessibility

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

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