NEPTUNE TOWNSHIP SCHOOL DISTRICT

Elementary STEM
Curriculum
Preschool - Grade 2

NEPTUNE TOWNSHIP SCHOOL DISTRICT
Office of the Superintendent
60 Neptune Blvd.
Neptune, NJ 07753-4836

July 26, 2023 Document C1#1

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NEPTUNE TOWNSHIP SCHOOL DISTRICT

ELEMENTARY STEM CURRICULUM PRESCHOOL-GRADE 2

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NEPTUNE TOWNSHIP SCHOOL DISTRICT

Elementary STEM
Preschool - Grade 2

Acknowledgements

The Elementary STEM curriculum for Preschool through Grade 2 was developed through the dedicated efforts of Luke Tirrell, elementary STEM teacher; with guidance from the district's curriculum steering committee members, including Stacie Ferrara, Ed.D., former STEM Supervisor, and Sally A. Millaway, Ed.D., Director of Curriculum, Instruction and Assessment.

This curriculum was written in alignment with the 2020 New Jersey Student Learning Standards for Computer Science and Design Thinking. The units are also aligned to New Jersey Student Learning Standards in Math (2016), English Language Arts (2016) and Career Readiness, Life Literacies, and Key Skills (2020). These learning plans have a hands-on, inquiry based approach to STEM education. The student-centered activities provide meaningful and engaging opportunities to increase students' problem solving skills. It is our hope that this curriculum will serve as a valuable resource for the staff members who teach this course, and that they will provide feedback and make recommendations for improvement.

NEPTUNE TOWNSHIP SCHOOL DISTRICT

DISTRICT MISSION STATEMENT

The primary mission of the Neptune Township School District is to prepare all of our students for a life-long learning process and to become confident, competent, socially, and culturally- conscious citizens in a complex and diverse world. It is with high expectations that our schools foster:

• A strong foundation in academic and modern technologies.

• A positive, equitable, and varied approach to teaching and learning.

• An emphasis on critical thinking skills and problem-solving techniques.

• A respect for and an appreciation of our world, its resources, and its diverse people.

• A sense of responsibility, good citizenship, and accountability.

• An involvement by the parents and the community in the learning process.

Neptune Township School District

Educational Outcome Goals

The students in the Neptune Township schools will become life-long learners and will:

- Become fluent readers, writers, speakers, listeners, and viewers with comprehension and critical thinking skills.
- Acquire the mathematical skills, understandings, and attitudes that are needed to be successful in their careers and everyday life.
- Understand fundamental scientific principles, develop critical thinking skills, and demonstrate safe practices, skepticism, and open-mindedness when collecting, analyzing, and interpreting information.
- Become technologically literate.
- Demonstrate proficiency in all New Jersey Student Learning Standards (NJSLS).
- Develop the ability to understand their world and to have an appreciation for the heritage of America with a high degree of literacy in civics, history, economics and geography.
- Develop a respect for different cultures and demonstrate trustworthiness, responsibility, fairness, caring, and citizenship.
- Become culturally literate by being aware of the historical, societal, and multicultural aspects and implications of the arts.
- Demonstrate skills in decision-making, goal setting, and effective communication, with a focus on character development.
- Understand and practice the skills of family living, health, wellness and safety for their physical, mental, emotional, and social development.
- Develop consumer, family, and life skills necessary to be a functioning member of society.
- Develop the ability to be creative, inventive decision-makers with skills in communicating ideas, thoughts and feelings.
- Develop career awareness and essential technical and workplace readiness skills, which are significant to many aspects of life and work.

INTEGRATED SOCIAL AND EMOTIONAL LEARNING COMPETENCIES

The following social and emotional competencies are integrated in this curriculum document:

Self-Awareness	
x	Recognize one's own feelings and thoughts
x	Recognize the impact of one's feelings and thoughts on one's own behavior
x	Recognize one's personal traits, strengths and limitations
x	Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	
x	Understand and practice strategies for managing one's own emotions, thoughts and behaviors
x	Recognize the skills needed to establish and achieve personal and educational goals
x	Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	
x	Recognize and identify the thoughts, feelings, and perspectives of others
x	Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds
x	Demonstrate an understanding of the need for mutual respect when viewpoints differ
x	Demonstrate an awareness of the expectations for social interactions in a variety of setting
Responsible Decision Making	
x	Develop, implement and model effective problem solving and critical thinking skill
x	Identify the consequences associated with one's action in order to make constructive choices
x	Evaluate personal, ethical, safety and civic impact of decisions.
Relationship Skills	
x	Establish and maintain healthy relationships
x	Utilize positive communication and social skills to interact effectively with others
x	Identify ways to resist inappropriate social pressure
x	Demonstrate the ability to present and resolve interpersonal conflicts in constructive ways
x	Identify who, when, where, or how to seek help for oneself or others when needed

Unit Plan Title	Unit 1: Design Thinking
Suggested Time Frame	10-12 weeks (September, October, November)

Overview / Rationale

The design thinking unit introduces and progresses students through the design thinking framework, an innovative approach to problem-solving. This approach utilizes a methodology which requires the practitioner to truly understand the needs and preferences of potential end users of the products they endeavor to create. This empathy is critical to foster in elementary grade level students, and it is the centerpiece of student activities in design thinking. Students will be able to design, explain, and build solutions to problems discussed in collaboration with their peers in STEM class.

Stage 1 – Desired Results

Established Goals:

New Jersey Preschool Teaching and Learning Standards (2014)
Standard 5.1: Children develop inquiry skills.
Standard 5.2: Children observe and investigate matter and energy.
Standard 5.3: Children observe and investigate living things.
Standard 5.4: Children observe and investigate the Earth.
Standard 5.5: Children gain experience in using technology.

New Jersey Student Learning Standards for Design Thinking (2020)
Kindergarten
8.2.2.ETW.1 Classify products as resulting from nature or produced as a result of technology.
8.2.2.ITH.1 Identify products that are designed to meet human wants or needs.
8.2.2.ITH.2 Explain the purpose of a product and its value.

Grade 1
8.2.2.NT.1 Model and explain how a product works after taking it apart, identifying the relationship of each part, and putting it back together.
8.2.2.NT.2 Brainstorm how to build a product, improve a designed product, fix a product that has stopped working, or solve a simple problem.
8.2.2.ETW.2 Identify the natural resources needed to create a product.

Grade 2
8.2.2.ETW.3 Describe or model the system used for recycling technology.
8.2.2.ETW.4 Explain how the disposal of or reusing a product affects the local and global environment.
8.2.2.ITH.3 Identify how technology impacts or improves life.
8.2.2.ITH.4 Identify how various tools reduce work and improve daily tasks.

8.2.2.ITH.5 Design a solution to a problem affecting the community in a collaborative team and explain the intended impact of the solution.

Essential Questions:

- What is STEM?
- How does the design thinking process help STEM practitioners understand end users?
- Why does design thinking emphasize speed in the prototyping phase?
- How does embracing failure help students?
- How can testing results be checked to ensure product success?
- What are resources available to help solve problems?

Enduring Understandings:

Students will understand that...

- The purpose of STEM is to create products that solve problems in the real world.
- STEM practitioners must always consider the potential end users' needs and wants, in order to create products that people will actually use.
- The design thinking process is a framework that incorporates empathy to facilitate that consideration.
- The design thinking process promotes rapid prototyping as a means to get to a team's best idea most efficiently.
- Testing results should be compared to empathy data to ensure product success.
- Failure in STEM is a regular feature of the process; it is understood to be a helpful tool for learning, not the sign of ineptitude many have internalized it to be.

Knowledge:

Students will know…

- The design thinking process is a useful framework in STEM.
- The steps in the Design Thinking process are: empathize, define, ideate, prototype, and test.
- How to interview others to learn the most useful information towards identifying and solving a problem.
- How to clearly define a problem in order to be able to later measure a potential solution to that problem.
- Basic materials can be very useful in prototyping solution ideas.
- Companies use empathy to understand the interests and habits of potential end users when creating products.

Skills:

Students will be able to…

- Identify the steps of the design thinking process and the major elements of each step.
- Empathize with others by utilizing the interview process to determine needs, preferences, and habits.
- Define a problem someone else is experiencing which can be solved through design.
- Ideate in a group to generate possible solutions to the problem based on the information generated through empathy.

- Prototype the group's consensus idea by utilizing the rapid prototype method to quickly determine viability.
- Test the prototype versus the empathy information and defined problem to gauge the efficacy and likelihood for success.
- Incorporate all other STEM classroom and school norms into their design thinking work.
- Report to others, both in the STEM classroom and beyond, on their work in design thinking.

Interdisciplinary Connections

New Jersey Student Learning Standards for Science (2020)
K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

New Jersey Student Learning Standards for Mathematics (2016)
1 Make sense of problems and persevere in solving them.
2 Reason abstractly and quantitatively.
3 Construct viable arguments and critique the reasoning of others.
4 Model with mathematics.
5 Use appropriate tools strategically.

New Jersey Student Learning Standards in English Language Arts (2016)
NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

New Jersey Student Learning Standards in Career Readiness,Life Literacies, and Key Skills (2020)
9.4.2.CI.1: Demonstrate openness to new ideas and perspectives.
9.4.2.CI.2: Demonstrate originality and inventiveness in work.
9.4.2.CT.1: Gather information about an issue, such as climate change, and collaboratively

brainstorm ways to solve the problem.
9.4.2.CT.2: Identify possible approaches and resources to execute a plan.

Student Resources
Technology: Chromebooks Desktop computers **Texts:** Books in STEM classroom and school library Neptune Township Public Library **Materials:** STEM classroom building materials and general supplies (ex. popsicle sticks, glue, scissors, paper, tape, string, cups, foil, Play-doh, paper bags, paper plates) Teacher created handouts
Teacher Resources
Technology: Chromebooks Desktop computers **Materials:** STEM classroom building materials and general supplies. **Texts:** books in STEM classroom, school library, and Neptune Township Public Library approved for use by administration **Slideshow:** Presentation from Dr. Stacie Ferrara, Design Thinking in the Classroom: https://docs.google.com/presentation/d/1NOeQgHWnbFjwrKt0IlJoyQpfFONfK52q2ox4Kg4_BP0/edit#slide=id.ge11a750ed6_0_0 **Websites:** Apps and Web sites approved for use by district administration: https://edprivacy.educationframework.com/Districts/main.aspx?districtid=30623 **Videos:** Overview of Design Thinking: https://www.youtube.com/watch?v=ldYzbV0NDp8&t=21s 30 Circle Challenge https://www.ideo.com/blog/build-your-creative-confidence-thirty-circles-exercise

Stage 2 – Assessment Evidence
Formative Assessments: Student Growth Assessment (SGO) content pre-assessments, teacher-created 1 or 5 Circle Challenge, or similar pre-assessment (creativity phase) STEM journal entries Student-created interview questions (empathy phase) Models created during prototype phase Class discussion Q&A Thumbs Up Thumbs Down Student survey ***Summative Assessments/Performance Tasks:*** Teacher-created post-assessments Student Growth Assessment (SGO) content post-assessments, teacher-created I Am a Maker (building challenge) Paper Playground Humpty Dumpty Design Challenge

Stage 3 – Learning Plan
Ready Set Design (mixed bag) I Am a Maker (building challenge) 30 Circle Challenge – then other shapes (creativity) Cup Towers Paper Playground Marshmallow Spaghetti Challenge (tape, string) Humpty Dumpty Design Challenge Empathy Interviews Ultimate Animal Design Station Team Building Challenges Introduce students to the STEM classroom and the materials that will be used throughout the year. Practice using materials correctly, cleaning them up correctly, moving with purpose throughout the classroom, working with elbow partners, etc. Remind students of "science eyes" activities from the PreK classroom. Allow students to use their science eyes to depict STEM materials in the classroom. Teacher will facilitate material stations and question students as they work and investigate.

Unit Plan Title	Unit 2: Computer Science
Suggested Time Frame	10-12 weeks (December, January, February)

Overview / Rationale
The study of computer science enables students to think critically and systematically about leveraging technology to solve local and global issues. Students will experience authentic learning tasks that enable them to develop computational thinking skills; acquire and incorporate varied perspectives; and communicate with diverse audiences about the use and effects of computing in a STEM context.

Stage 1 – Desired Results

Established Goals:

New Jersey Preschool Teaching and Learning Standards (2014)
Standard 5.5: Children gain experience in using technology.
Standard 8.1: Navigate simple on screen menus.
Standard 8.2: Use electronic devices independently.
Standard 8.3: Begin to use electronic devices to communicate.
Standard 8.4: Use common technology vocabulary.
Standard 8.5: Begin to use electronic devices to gain information

New Jersey Student Learning Standards for Computer Science (2020)
Kindergarten
8.1.2.AP.1 Model daily processes by creating and following algorithms to complete tasks.
8.1.2.AP.3 Create programs with sequences and simple loops to accomplish tasks.
8.1.2.AP.4 Break down a task into a sequence of steps.
8.1.2.AP.5 Describe a program's sequence of events, goals, and expected outcomes.
8.1.2.DA.3 Identify and describe patterns in data visualizations.

First Grade
8.1.2.CS.1 Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
8.1.2.CS.2 Explain the functions of common software and hardware components of computing systems.
8.1.2.CS.3 Describe basic hardware and software problems using accurate terminology.
8.1.2.DA.4 Make predictions based on data using charts or graphs.
8.1.2.NI.2 Describe how the Internet enables individuals to connect with others worldwide.

Grade 2
8.1.2.AP.2 Model the way programs store and manipulate data by using numbers or other symbols to represent information.
8.1.2.AP.6 Debug errors in an algorithm or program that includes sequences and simple loops.

8.1.2.DA.1 Collect and present data, including climate change data, in various visual formats
8.1.2.DA.2 Store, copy, search, retrieve, modify, and delete data using a computing device.
8.1.2.IC.1 Compare how individuals live and work before and after the implementation of new computing technology.
8.1.2.NI.1 Model and describe how individuals use computers to connect to other individuals, places, information, and ideas through a network.
8.1.2.NI.3 Create a password that secures access to a device. Explain why it is important to create unique passwords that are not shared with others.
8.1.2.NI.4 Explain why access to devices need to be secured.

Essential Questions:

- How do I solve a problem?
- What do computers do?
- How do I use data?
- How do I research information with technology?
- What is coding and what can you use coding to create?
- How does computer science relate to everyday life?
- What relationship does coding have with the terms software and hardware?

Enduring Understandings:

Students will understand that...

- People use computing devices to perform a variety of tasks accurately and quickly.
- A computing system is composed of hardware and software. Hardware consists of physical components, while software provides instructions for the system.
- Clearly describing a problem is the first step toward finding a solution.
- Computer networks can be used to connect people to other people, places, information, and ideas.
- Everyday digital devices collect and display data over time.
- People follow and create processes as part of daily life; many of these processes can be expressed as algorithms that computers can follow.
- Computing technology has positively and negatively changed the way people live and work.

Knowledge:

Students will know…

- Standard input devices at an age-appropriate level.
- Basic operations involving a personal computer.
- Algorithms as a tool to solve problems.
- Functions of common software and hardware components.

Skills:

Students will be able to…

- Identify the input and output components of a personal computer.
- Safely and correctly perform basic operations involving a personal computer.
- Create and follow algorithms to complete tasks.
- Create programs with sequences and simple loops to accomplish tasks.
- Describe a program's sequence of events, goals, and expected outcomes.

- Identify and describe patterns.
- Explain the functions of common software and hardware components of computing.
- Describe basic hardware and software problems using accurate terminology.
- Debug errors in an algorithm.
- Describe how individuals use computers.

Interdisciplinary Connections

New Jersey Student Learning Standards for Mathematics (2016)
1 Make sense of problems and persevere in solving them.
2 Reason abstractly and quantitatively.
3 Construct viable arguments and critique the reasoning of others.
4 Model with mathematics.
5 Use appropriate tools strategically.

New Jersey Student Learning Standards in English Language Arts (2016)
NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

New Jersey Student Learning Standards in Career Readiness,Life Literacies, and Key Skills (2020)
9.4.2.DC.1: Explain differences between ownership and sharing of information.
9.4.2.DC.2: Explain the importance of respecting the digital content of others.
9.4.2.DC.3: Explain how to be safe online and follow safe practices when using the internet (e.g., 8.1.2.NI.3, 8.1.2.NI.4).
9.4.2.DC.4: Compare information that should be kept private to information that might be made public.
9.4.2.DC.5: Explain what a digital footprint is and how it is created.
9.4.2.DC.6: Identify respectful and responsible ways to communicate in digital environments.
9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource.
9.4.2.IML.2: Represent data in a visual format to tell a story about the data.

9.4.2.IML.3: Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults.
9.4.2.IML.4: Compare and contrast the way information is shared in a variety of contexts.
9.4.2.TL.7: Describe the benefits of collaborating with others to complete digital tasks or develop digital artifacts.

Student Resources
Technology: Chromebooks/laptops Desktop computers Code.org Kodables.com **Texts:** Books in STEM classroom and school library
Teacher Resources
Technology: Chromebooks/laptops Desktop computers Code.org https://code.org/about **https://code.org/educate/curriculum/elementary-school** **https://code.org/student/elementary** Kodables.com K12 Computer Science Framework https://k12cs.org/ Lego WeDo 2.0 Kits Lego Mindstorms NXT or EV3 Student Chromebooks Lego WeDo App Mindstorms EV3 Manual: https://www.sos.wa.gov/_assets/library/libraries/projects/youthservices/legomindstormsev3programmingbasics.pdf Ozobots

Stage 2 – Assessment Evidence
Formative Assessments: STEM journal entries Q&A

Observation of student progress
Exit slips
Pre-assessment questions on computer science topics

Summative Assessments/Performance Tasks:
Teacher-created offline post-assessments (movement activities, table activities, e.g.)
Online lesson based assessment (from Code.org or Kodables, e.g.)

Stage 3 – Learning Plan
Students are shown how to use proper body position when using the computer. Code.org's Hour of Code apps are refreshed annually in the December Hour of Code week of online events, and students may access them year-round at school and/or at home, with or without an account. Code.org's suite of instructional activities require an account to track/record the progress of each student; they may also be accessed without an account, sans tracking. Kodable Basics: Level 1 Intro to Sequence Level 2 Intro to Conditions Level 3 Intro to Debugging Sequencing and Branching Level 1-2 Algorithms Sequencing and Branching Level 3/6 What are Conditions? Sequencing and Branching Level 8 Debugging Pattern and Repeats Level 1 Loops Pattern and Repeats Level 2/4 Loops Pattern and Repeats Level 7 Functions Pattern and Repeats Level 8/11 Functions Intro to Variables Level 1-2 Booleans Intro to Variables Level 4/6 Equality

Unit Plan Title	Unit 3: Engineering
Suggested Time Frame	10-12 Weeks (March, April, May)

Overview / Rationale
Students will explore engineering and science concepts that build upon the knowledge and experiences they have had, which enables them to connect to new concepts and skills and prepare them for the next stage of STEM exploration. Students will investigate and experiment with tools and materials and observe, analyze, and construct as they imagine and explore the world around them.

Stage 1 – Desired Results

Established Goals:

New Jersey Preschool Teaching and Learning Standards (2014)
Standard 5.1: Children develop inquiry skills.
Standard 5.2: Children observe and investigate matter and energy.
Standard 5.3: Children observe and investigate living things.
Standard 5.4: Children observe and investigate the Earth.
Standard 5.5: Children gain experience in using technology.

New Jersey Student Learning Standards for Design Thinking (2020)
Grades K-2
8.2.2.ED.1 Communicate the function of a product or device.
8.2.2.ED.2 Collaborate to solve a simple problem, or to illustrate how to build a product using the design process.
8.2.2.ED.3 Select and use appropriate tools and materials to build a product using the design process.

Grade 2
8.2.2.ED.4 Identify constraints and their role in the engineering design process.

Essential Questions:

- What do engineers do?
- How can I solve a problem?
- What materials can I use to solve problems?

Enduring Understandings:
Students will understand that...

- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- There are many ways to solve a problem, it is useful to compare and test designs.
- Technology is constantly changing to meet our needs.

- Resources and constraints are important factors when solving a problem.
- Failure in STEM is a regular feature of the process; it is understood to be a helpful tool for learning, not the sign of ineptitude many have internalized it to be.

Knowledge:
Students will know…

- STEM classroom materials are not toys; they are very important to our work.
- Working together allows for more ideas and better structures.
- Engineers influence our lives by creating sustainable structures.

Skills:
Students will be able to…

- Solve a problem using the engineering design process (EDP).
- Draw scientific depictions of the world around them.
- Engage in productive talk and brainstorming.
- Create increasingly complex structures as they progress through our program.

Interdisciplinary Connections

New Jersey Student Learning Standards for Science (2020)
K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

New Jersey Student Learning Standards for Mathematics (2016)
1 Make sense of problems and persevere in solving them.
2 Reason abstractly and quantitatively.
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4 Model with mathematics.
5 Use appropriate tools strategically.

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NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

New Jersey Student Learning Standards in Career Readiness,Life Literacies, and Key Skills (2020)
9.4.2.CI.1: Demonstrate openness to new ideas and perspectives.
9.4.2.CI.2: Demonstrate originality and inventiveness in work.
9.4.2.CT.1: Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem.
9.4.2.CT.2: Identify possible approaches and resources to execute a plan.

Student Resources
Technology: Chromebooks/laptops Desktop computers; STEM classroom building materials and general supplies **Texts:** Books in STEM classroom and school library
Teacher Resources
Technology: Chromebooks/laptops Desktop computers STEM classroom building materials and general supplies https://www.teachengineering.org/populartopics/designprocess

Stage 2 – Assessment Evidence
Formative Assessments: KWL chart Science journal with vocabulary words, brainstorming ideas, and problems and solutions. Observation of student work Student feedback Q&A Exit slips Student reflections

Summative Assessments/Performance Tasks:
Teacher-created post-assessments

Stage 3 – Learning Plan

Quick builds/challenges (1 period) classroom building materials (in centers, stations, table setups, etc.) utilized by students individually and in groups of varying size assignments

Windmill (The Boy Who Harnessed the Wind)
Design and build a bridge (Iggy Peck)
Helicopter/Airplane Challenge (Rosie Revere)
Design and build a pasta rover
Design and build a satellite
Egg Drop Challenge

Unit Plan Title	Unit 4: Sustainability/Gardening
Suggested Time Frame	2-4 weeks (throughout school year, June)

Overview / Rationale

Sustainability is a key, emerging component of being a STEM practitioner. Understanding the role of sustainability in STEM will help students feel connected to the work they do, as well as to the world their work can someday serve. Gardening, as an element of sustainability, can help students develop many skills which are essential in STEM: responsibility (through caring for plants); understanding (through cause and effect, as in plants dying without water, weeds growing, etc.); self-confidence (through achieving their goals and enjoying the food they have grown); love of nature (through learning about the outdoor environment in a safe and pleasant place); physical activity (through doing something fun and productive); cooperation (through shared activity and teamwork); creativity (through finding new and exciting ways to grow food); and nutrition (through learning about where fresh food comes from).

Stage 1 – Desired Results

Established Goals:

New Jersey Preschool Teaching and Learning Standards (2014)
Standard 5.1: Children develop inquiry skills.
Standard 5.2: Children observe and investigate matter and energy.
Standard 5.3: Children observe and investigate living things.
Standard 5.4: Children observe and investigate the Earth.
Standard 5.5: Children gain experience in using technology.

New Jersey Student Learning Standards for Science (2020)
Grades K-2
K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.

Grade Kindergarten
K-ESS2-2 Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
K-ESS3-3 Communicate solutions that will reduce the impact of climate change and humans on the land, water, air, and/or other living things in the local environment.

Grade 1
1-LS1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

1-LS3-1 Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
1-ESS1-2 Make observations at different times of year to relate the amount of daylight to the time of year.

Grade 2
2-LS2-1 Plan and conduct an investigation to determine if plants need sunlight and water to grow.
2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.

Essential Questions:

- What is sustainability?
- Why is it important to use sustainable means in STEM?
- What do living things need to survive, stay healthy, and grow?
- What is a garden, and what types of gardens exist?
- What plants do we eat?
- What fruits and vegetables can we grow in the garden?

Enduring Understandings:
Students will understand that...

- Sustainability is a helpful philosophy in STEM.
- Sustainability requires considerable thought towards every component of a build.
- If sustainability is widely practiced moving forward, it can have a major impact on the earth's climate and the experience of all its inhabitants.
- Plants are living things
- Every part of a plant has an important function.
- Plants grow from seeds and need water, nutrients and light to live.
- Plants are all around us.
- There are many different types of plants.
- Plants are important for many reasons.

Knowledge:
Students will know…

- Proper seed spacing for planting in the garden.
- Plants need water just like people and animals need water.
- The difference between edible and non-edible and understand how these concepts connect to a garden
- Properties of a garden.
- Parts of plants and their functions
- Properties of soil and why soil is important to plants.

Skills:
Students will be able to…

- Choose what to grow, how to grow it, and when to plant a fall and/or spring garden.
- Make observations of the properties of common objects in the garden.
- Identify plants in the garden
- Closely observe soil and practice tallying and reporting results of soil experiments.
- Construct a "bird's-eye-view" picture of a garden bed.
- Work together to make group decisions in planning a classroom garden.
- Plan, plant, and grow a garden based on a piece of children's literature.

Interdisciplinary Connections

New Jersey Student Learning Standards for Mathematics (2016)
1 Make sense of problems and persevere in solving them.
2 Reason abstractly and quantitatively.
3 Construct viable arguments and critique the reasoning of others.
4 Model with mathematics.
5 Use appropriate tools strategically.

New Jersey Student Learning Standards in English Language Arts (2016)
NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

New Jersey Student Learning Standards in Career Readiness,Life Literacies, and Key Skills (2020)
9.4.2.CI.1: Demonstrate openness to new ideas and perspectives.
9.4.2.CI.2: Demonstrate originality and inventiveness in work.
9.4.2.CT.1: Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem.
9.4.2.CT.2: Identify possible approaches and resources to execute a plan.

Student Resources
Technology: Chromebooks/laptops **Texts:** Gardening books in STEM classroom and school library
Teacher Resources
Technology: Chromebooks/laptops STEM classroom building materials and general supplies **Texts:** books in STEM classroom, school library, and Neptune Township Public Library approved for use by administration **Materials:** soil, seeds, watering can, shovels, gloves https://growing-minds.org/garden-lesson-plans/ https://www.wholekidsfoundation.org/assets/documents/school-garden-lesson-plans.pdf https://dpi.wi.gov/sites/default/files/imce/team-nutrition/pdf/lets-plant-classroom-garden-lessons.pdf https://www.berkeleyschools.net/wp-content/uploads/2015/08/Garden-Based-Learning-Curriculum-Final-Package.pdf?5759fb

Stage 2 – Assessment Evidence
Formative Assessments: Class discussion Q&A on gardening topics Background knowledge of gardening Planning gardening design ***Summative Assessments/Performance Task(s):*** Written reflection on gardening activities

Stage 3 – Learning Plan
Utilize landscape features by school site: Gables: garden beds, Bioswale/Rain garden Green Grove: garden beds, orchard

Midtown**:** garden beds, rooftop garden, native plant meadow
Shark River Hills: garden beds, Sassafras Wood
Summerfield: garden beds, native plant garden beds, SummerWood, bioswale/rain garden

PreK-Kindergarten: Sensory gardening
Introduction to gardens
Observing plants
Signs of seasons
Preparing the garden

Grade 1: Birds
Introduction to gardens
Planting seeds- tulips
Observing goldfinch & seeds
Signs of seasons
Predicting and tracking tulips
Preparing the garden
Planting and observing

Grade 2: Butterflies
Introduction to garden
Planting- Chrysalis. Milkweed seeds
Signs of seasons
Predicting and tracking Monarch Migration
Preparing the garden
Planting and observing

Accommodations and Modifications:
Below please find a list of suggestions for accommodations and modifications to meet the diverse needs of our students. Teachers should consider this a resource and understand that they are not limited to the recommendations included below.

An **accommodation** *changes* HOW *a student learns*; the change needed does not alter the grade-level standard. A **modification** *changes* WHAT *a student learns*; the change alters the grade-level expectation.

Special Education and 504 Plans
All modifications and accommodations must be specific to each individual child's IEP (Individualized Educational Plan) or 504 Plan.

- Pre-teach or preview vocabulary
- Repeat or reword directions
- Have students repeat directions
- Use of small group instruction
- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments
- Repetition and time for additional practice
- Model skills/techniques to be mastered
- Extended time to complete task/assignment/work
- Provide a copy of class notes
- Strategic seating (with a purpose - eg. less distraction)
- Flexible seating
- Repetition and additional practice
- Use of manipulatives
- Use of assistive technology (as appropriate)
- Assign a peer buddy
- Emphasize key words or critical information by highlighting
- Use of graphic organizers
- Scaffold with prompts for sentence starters
- Check for understanding with more frequency
- Provide oral reminders and check student work during independent practice
- Provide home/school communication
- Teacher checks student STEM journals
- Provide student with clear expectations in writing and grading criteria for assignments (rubrics)

English Language Learners:
All modifications and accommodations should be specific to each individual child's LEP level as determined by the WIDA screening or ACCESS, utilizing the WIDA Can Do Descriptors.

- Pre-teach or preview vocabulary
- Repeat or reword directions
- Have students repeat directions

- Use of small group instruction
- Scaffold language based on their Can Do Descriptors
- Alter materials and requirements according to Can Do Descriptors
- Adjust number of paragraphs or length of writing according to their Can Do Descriptor
- TPR (Total Physical Response-Sheltered Instruction strategy) Demonstrate concepts through multi sensory forms such as with body language, intonation
- Pair visual prompts with verbal presentations
- Repetition and additional practice
- Model skills and techniques to be mastered
- Native Language translation (teacher, peer, assistive technology, bilingual dictionary)
- Emphasize key words or critical information by highlighting
- Use of graphic organizers
- Scaffold with prompts for sentence starters
- Check for understanding with more frequency
- Make vocabulary words available in a student created vocabulary notebook, vocabulary bank, Word Wall, or vocabulary ring (STEM journal)
- Extended time
- Select text complexity and tiered vocabulary according to Can Do Descriptors
- Projects completed individually or with partners
- Use online dictionary that includes images for words: http://visual.merriamwebster.com/.
- Use online translator to assist students with pronunciation: http://www.reverso.net/text_translation.aspx?lang=EN.

Students at Risk of Failure:

- Use of self-assessment rubrics for check-in
- Pair visual prompts with verbal presentations
- Ask students to restate information and/or directions
- Opportunity for repetition and additional practice
- Model skills/techniques to be mastered
- Extended time
- Provide copy of class notes
- Strategic seating with a purpose
- Provide students opportunity to make corrections and/or explain their answers
- Support organizational skills
- Check STEM journal
- Encourage student to proofread work
- Assign a peer buddy
- Vocabulary Sorts-students engage with the vocabulary word by sorting into groups of similar/different rather than memorizing definitions
- Provide “Realia” (real life objects to relate to the five senses) and ask questions relating to the senses
- Role Play-students create or participate in role playing situations or Reader’s Theater

- Moving Circle-an inside and outside circle partner and discuss, circles moves to new partner (Refer to Kagan Differentiated Strategies https://sirblois.files.wordpress.com/2016/09/cooperative-learning-activities.pdf)
- Gallery Walk-Objects, books, or student work is displayed. Students examine artifacts and rotate.
- Chunking-chunk reading, tests, questions, homework, etc to focus on particular elements.
- Note-taking -can be done through words, pictures, phrases, and sentences depending on level
- KWL (Know, Want to Know, Learned)/KWHL(Know, What to Know, How Will I Learn, learned)/KWLS (Know, Want to Know, Learned, Still Want to Know) /KWLQ (Know, What to Know, Learned, Questions I Still Have) Charts
- Corners Cooperative Learning Strategy: http://cooperativelearningstrategies.pbworks.com/w/page/28234420/Corners.
- Circle Map strategy- place the main topic in a small circle and add student ideas in a bigger circle around the topic. Students may use their native language with peers to brainstorm.
- Flexible grouping -as a whole class, a small group, or with a partner, temporary groups are created: http://www.teachhub.com/flexible-grouping-differentiated-instruction-strategy.
- Jigsaw Activities -cooperative learning in a group, each group member is responsible for becoming an "expert" on one section of the assigned material and then "teaching" it to the other members of the team: http://www.adlit.org/strategies/22371/.

High Achieving:

Extension Activities

- Allow for student choice from a menu of differentiated outcomes; choices grouped by complexity of thinking skills; variety of options enable students to work in the mode that most interests them
- Allow opportunities for peer leadership through pairings or small groups
- Allow students to pursue independent projects based on their individual interests
- Provide enrichment activities that include more complex material
- Allow opportunities for peer collaboration and team-teaching
- Set individual goals
- Conduct research and provide presentation of appropriate topics
- Provide students opportunity to design surveys to generate and analyze data to be used in discussion
- Allow students to move through the assignment at their own pace (as appropriate)

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An Affirmative Action Equal Opportunity Employer

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