Curriculum

Content Area: Computer Science and Design Thinking

Unit: Climate Change - Solar Energy | **Duration:** 6 Days

Grade Level: 4th Grade

Essential Questions

- What is Climate Change and what is causing it?
- What is solar energy and what are the pros and cons to solar energy?
- What are the differences between renewable and nonrenewable energy sources? What are some of the advantages/disadvantages of renewable and nonrenewable energy sources?
- How can we use the engineering design process (EDP) to design a technology that helps people harness solar energy?

Enduring Understandings

- The sun provides Earth with light or radiant energy and thermal energy, providing unlimited amounts of solar energy we can harness as a renewable energy source.
- Scientific facts agree that using renewable energy sources to generate electricity addresses some disadvantages of traditional energy sources.
- Scientists and Engineers use the EDP to find renewable energy solutions and develop prototypes for renewable energy.
- Renewable energy solutions provide a positive impact on the health and well being of humans, animals, and their overall environment.

Student Learning Targets (Objectives):

- Students will be able to explain how sunlight can produce electricity.
- Students will be able to differentiate between renewable and nonrenewable energy sources and identify advantages and disadvantages of both.
- Students will be able to use the engineering design process to design and build a prototype of a solar energy technology.
- Students will be able to use appropriate materials and time provided to present their solar energy technology prototype.

Focus Standards (Major Standards)

- **8.1.5.DA.4:** Organize and present climate change data visually to highlight relationships or support a claim. Many factors influence the accuracy of inferences and predictions.
- **8.1.5.DA.5:** Propose cause and effect relationships, predict outcomes, or communicate ideas using data.
- **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.ED.5:** Describe how specifications and limitations impact the engineering design process.
- **8.2.5.ED.6:** Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.

New Jersey Student Learning Standards: Interdisciplinary Connections

Math:

- **4.OA.A.** Use the four operations with whole numbers to solve problems.
- **4.OA.C.** Generate and analyze patterns.
- **4M.D.C.** Geometric measurement: understand concepts of angle and measure angles.

Science:

- **4-ESS3-1** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- **4-ESS3-2** Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans.
- **3-5-ETS1-1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

LA:

- **SL4.** Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- **SL5.** Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
- **SL6.** Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

New Jersey Student Learning Standards: College and Career Readiness

- **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 (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
- **9.4.5.CI.2:** Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
- **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 (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
- **9.4.5.CI.4:** Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
- **9.4.5.CT.4:** Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
- **9.4.5.IML.2:** Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).

New Jersey Student Learning Standards: Computer Science and Design Thinking

- **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.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.1:** Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
- **8.2.5.ETW.3:** Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.

Instructional Plan

Unit: Climate Change - Solar Energy

Lesson 1: What is Climate Change and what is causing it? - Research, Evaluate, Discuss
Lesson 2: Solar Energy as a Solution - What is Solar Energy? Understanding Solar Energy as a renewable source of energy.
Lesson 3: EDP - Solar Energy - Using the EDP to develop a solution

Evidence of Student Learning

Formative Assessments

- **Students are asked to identify the main steps of the EDP.**

Summative Assessments

- **Performance Task - Students complete and provide a final product for each one of the EDP steps, including a design of prototype and a physical model.**
- **Peer Feedback - Students provide meaningful feedback and assessment on their classmates work and projects.**

Suggested Options for Differentiation

Modifications (ELLs, Special Education, 504, Students at risk of failure, Gifted and Talented)

Special Education

- Follow studentIEP requirements.
- Preferential seating.
- Student choice in projects to allow for appropriate skill levels to be applied.
- Clarify and repeat expectations by providing digital copies, review of expectations at the start of class, highlighting expectations on student hardcopies, provide specific tasks as needed in group work to clarify goals.
- Support of student focus: verbal prompts, visual cues (lights out, etc)
- Positive reinforcement and praise
- Use of word processors and digital image software to replace writing and drawing by hand.
- Pacing and guidance in long term projects.
- Work chunked out based on tasks, individual check-ins.
- Extended projects are broken down into manageable tasks with frequent check-ins from the teacher.

504

- Follow student 504 requirements.
- Preferential seating.
- If the student cannot utilize computers or look at screens, research, planning, and computer-based learning experiences can be done on paper.

- If the students' level of mobility is limited, making it difficult for the students to navigate the classroom, the student will be assigned a buddy to help with acquiring the necessary materials and supplies.
- If the students' fine or gross motor skills are impacted, s/he will receive assistance from the teacher for the specific artistic skills that require them.

Students at Risk for Failure

- Student choice in projects to allow for appropriate skill levels to be applied.
- Clarification and repetition of expectations, review of expectations at the start of class, highlighting expectations on student hardcopies, provide specific tasks as needed to clarify goals.
- Support of student focus: verbal prompts, visual cues (lights out, etc.).
- Positive reinforcement.
- Pacing and guidance in long term projects.
- Work chunked out based on tasks, individual check-ins.
- Extended projects are broken down into manageable tasks with frequent check-ins from the teacher.

Gifted and Talented:

- Provide access to additional materials to develop ideas and project details.
- Teach more advanced skills and give students new problems to solve or research

ELL:

- Use of Google Translate to assist students with instructions and lessons so they can follow along.
- Adjust goals to allow for language acquisition.
- Visual prompts and demonstrations.
- Teacher modeling of skills.
- Simplified written and verbal instructions.
- Include written instructions to supplement verbal.
- Preferential seating.

Suggested Materials

- Computer
- Design materials
- Build materials
- Tools

Suggested I Resources

- Laptop, Chromebook, or Computer
- Tablet

Curriculum

Content Area: Computer Science and Design Thinking

Unit: Basic Programmer/Computational Thinker | **Duration:** 6 Days

Grade Level: 4th Grade

Essential Questions

- How do we interact with hardware and software in our daily lives?
- What tasks are computers able to do better than humans?
- How can we give instructions to a computer and create a program?
- How can we use events as triggers in a programming project?

Enduring Understandings

- Computer programmers use critical thinking skills to solve problems, and make informed decisions using appropriate digital tools and resources.
- Computer programmers use a variety of technologies within a design process to solve problems in ways that leverage the power of technology methods.
- Computer programmers design, test, and debug algorithms that are readable, concise, and reusable.

Student Learning Targets (Objectives):

- Students will be able to apply general understanding of computer systems to make sense of human-made machines.
- Students will be able to develop efficient solutions to computational problems by breaking into subproblems and identifying parts that can be abstracted and modularized.
- Students will be able to troubleshoot to solve problems.

Focus Standards (Major Standards)

- **8.1.5.CS.1:** Model how computing devices connect to other components to form a system.
- **8.1.5.CS.2:** Model how computer software and hardware work together as a system to accomplish tasks.
- **8.1.5.CS.3:** Identify potential solutions for simple hardware and software problems using common troubleshooting strategies.
- **8.1.5.NI.2:** Describe physical and digital security measures for protecting sensitive personal information**.**
- **8.1.5.AP.2:** Create programs that use clearly named variables to store and modify data.
- **8.1.5.AP.3:** Create programs that include sequences, events, loops, and conditionals.
- **8.1.5.AP.6:** Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended.

New Jersey Student Learning Standards: Interdisciplinary Connections

Math:

- **4.OA.A.** Use the four operations with whole numbers to solve problems.
- **4.OA.C.** Generate and analyze patterns.

Science:

- **3-5-ETS1-1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

LA:

- **NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- **NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
- **W.5.6.** With some guidance and support from adults and peers, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting
- **SL4.** Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience**.**
- **SL5.** Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
- **SL6.** Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

New Jersey Student Learning Standards: College and Career Readiness

- **9.2.5.CAP.1:** Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
- **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 (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
- **9.4.5.CT.1:** Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
- **9.4.5.CT.3:** Describe how digital tools and technology may be used to solve problems.
- **9.4.5.CT.4:** Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
- **9.4.5.DC.5:** Identify the characteristics of a positive and negative online identity and the lasting implications of online activity.
- **9.4.5.DC.6:** Compare and contrast how digital tools have changed social interactions (e.g., 8.1.5.IC.1).
- **9.4.5.IML.3:** Represent the same data in multiple visual formats in order to tell a story about the data.

New Jersey Student Learning Standards: Computer Science and Design Thinking

- **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).

Instructional Plan

Unit: Basic Programmer/Computational Thinker
Lesson 1: How has computer science changed our society? Why is computer science important to our society?
Lesson 2: What is an algorithm? Why are Event Coding statements important? - Event statements to initiate computing
Lesson 3: Basic Programming Steps - Basic Algorithm
Lesson 4: Creating a Basic Program to have two Characters Interact - Basic Input statements

Evidence of Student Learning

Formative Assessments

- Code Prediction - students are provided a set of code, a program or an algorithm and asked to predict what is going to happen. Students can respond by drawing or writing out their prediction using general terms.
- Debugging - students are provided a completed project that has an intentional error or bug. Students are then asked to identify the bug and provide a solution.

Summative Assessments

- **Performance Task -** computer science offers a unique opportunity for a hands-on approach to create computer science artifacts such as animation, digital stories, games, applications, and websites. A formative assessment can also be a collection of artifacts creating a student portfolio.
- **Peer Feedback -** in the computer science classroom students can provide meaningful feedback and assessment on their classmates work and projects.

Suggested Options for Differentiation

Modifications (ELLs, Special Education, 504, Students at risk of failure, Gifted and Talented)

Special Education

- Follow student IEP requirements.
- Preferential seating.
- Student choice in projects to allow for appropriate skill levels to be applied.
- Clarify and repeat expectations by providing digital copies, review of expectations at the start of class, highlighting expectations on student hardcopies, provide specific tasks as needed in group work to clarify goals.
- Support of student focus: verbal prompts, visual cues (lights out, etc)
- Positive reinforcement and praise
- Use of word processors and digital image software to replace writing and drawing by hand.
- Pacing and guidance in long term projects.
- Work chunked out based on tasks, individual check-ins.
- Extended projects are broken down into manageable tasks with frequent check-ins from the teacher.

504

- Follow student 504 requirements.

- Preferential seating.
- If the student cannot utilize computers or look at screens, research, planning, and computer-based learning experiences can be done on paper.
- If the students' level of mobility is limited, making it difficult for the students to navigate the classroom, the student will be assigned a buddy to help with acquiring the necessary materials and supplies.
- If the students' fine or gross motor skills are impacted, s/he will receive assistance from the teacher for the specific artistic skills that require them.

Students at Risk for Failure

- Student choice in projects to allow for appropriate skill levels to be applied.
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- Extended projects are broken down into manageable tasks with frequent check-ins from the teacher.

Gifted and Talented:

- Provide access to additional materials to develop ideas and project details.
- Teach more advanced skills and give students new problems to solve or research

ELL:

- Use of Google Translate to assist students with instructions and lessons so they can follow along.
- Adjust goals to allow for language acquisition.
- Visual prompts and demonstrations.
- Teacher modeling of skills.
- Simplified written and verbal instructions.
- Include written instructions to supplement verbal.
- Preferential seating.

Suggested Materials

- Computer
- Online Programming Tools

Suggested I Resources

- Online Programming Tools
- Launch Input/Output: Computer Systems
- Laptop, Chromebook, or Computer
- Tablet

Curriculum

Content Area: Computer Science and Design Thinking

Unit: Teach Me Something - Our Solar System

Duration: 12 Days

Grade Level: 4th Grade

Essential Questions

- What are the main parts of our solar system?
- What are terrestrial vs jovian planets?
- How was the solar system formed?
- How is the Earth unique in the Solar system?

Enduring Understandings

- Our Solar System is part of the Milky Way Galaxy, which, in turn, is one of many galaxies in the known Universe.
- Our Solar System is a collection of gravitationally interacting bodies that include Earth and the Moon.
- The composition of planets vary considerably and are classified in two groups terrestrial and jovian.
- The motions and interactions of objects within the Solar System are consistent with the hypothesis that it emerged from a large disk of gas and dust.
- Humans use technology to explore space.

Student Learning Targets (Objectives):

- Students will be able to explain the theory behind the formation of our solar system.
- Students will be able to differentiate between terrestrial and jovian planets.
- Students will be able to identify the main parts of our solar system.
- Students will be able to use appropriate technology tools to research and present information on an object of their choice in the solar system.

Focus Standards (Major 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.3:** Organize and present collected data visually to communicate insights gained from different views of the data.
- **8.1.5.DA.4:** Organize and present climate change data visually to highlight relationships or support a claim. Many factors influence the accuracy of inferences and predictions.
- **8.1.5.DA.5:** Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

New Jersey Student Learning Standards: Interdisciplinary Connections

Math:

- **4.OA.A.** Use the four operations with whole numbers to solve problems.
- **4.OA.C.** Generate and analyze patterns.

Science:

- **4-ESS1-1** Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

LA:

- **W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- **W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
- **W.5.6.** With some guidance and support from adults and peers, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting
- **SL4.** Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- **SL5.** Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
- **SL6.** Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

New Jersey Student Learning Standards: College and Career Readiness

- **9.2.5.CAP.1:** Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
- **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 (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
- **9.4.5.CI.4:** Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
- **9.4.5.CT.1:** Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
- **9.4.5.IML.1:** Evaluate digital sources for accuracy, perspective, credibility and relevance (e.g., Social Studies Practice - Gathering and Evaluating Sources).
- **9.4.5.IML.2:** Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
- **9.4.5.IML.6:** Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7, 6.1.5.HistoryCC.7, 7.1.NM. IPRET.5).
- **9.4.5.IML.7:** Evaluate the degree to which information meets a need including social emotional learning, academic, and social (e.g., 2.2.5. PF.5).

New Jersey Student Learning Standards: Computer Science and Design Thinking

- **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.

Instructional Plan

Unit: **Teach Me Something - Our Solar System**

Lesson 1: Our Solar System - Formation and Main Parts - What is the main scientific theory on the formation of our solar system.
Lesson 2: Terrestrial and Jovian Planets - What is the main difference and classifications of the planets in our Solar System.
Lesson 3: Teach Me Something: Research and Prepare a Presentation On Your Favorite Celestial Object in our Solar System

Evidence of Student Learning

Formative Assessments

- **Students are asked to identify the main parts of the Solar system and theory of formation.**

Summative Assessments

- **Performance Task - Student research and presentation to class on their chosen solar system object.**
- **Peer Feedback - Students can provide meaningful feedback and assessment on their classmates' work and projects.**

Suggested Options for Differentiation

Modifications (ELLs, Special Education, 504, Students at risk of failure, Gifted and Talented)

Special Education

- Follow studentIEP requirements.
- Preferential seating.
- Student choice in projects to allow for appropriate skill levels to be applied.
- Clarify and repeat expectations by providing digital copies, review of expectations at the start of class, highlighting expectations on student hardcopies, provide specific tasks as needed in group work to clarify goals.
- Support of student focus: verbal prompts, visual cues (lights out, etc)
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504

- Follow student 504 requirements.
- Preferential seating.
- If the student cannot utilize computers or look at screens, research, planning, and computer-based learning experiences can be done on paper.
- If the students' level of mobility is limited, making it difficult for the students to navigate the classroom, the student will be assigned a buddy to help with acquiring the necessary materials and supplies.
- If the students' fine or gross motor skills are impacted, s/he will receive assistance from the teacher for the specific artistic skills that require them.

Students at Risk for Failure

- Student choice in projects to allow for appropriate skill levels to be applied.

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Gifted and Talented:

- Provide access to additional materials to develop ideas and project details.
- Teach more advanced skills and give students new problems to solve or research

ELL:

- Use of Google Translate to assist students with instructions and lessons so they can follow along.
- Adjust goals to allow for language acquisition.
- Visual prompts and demonstrations.
- Teacher modeling of skills.
- Simplified written and verbal instructions.
- Include written instructions to supplement verbal.
- Preferential seating.

Suggested Materials

- Computer
- Research resources

Suggested I Resources

- Laptop, Chromebook, or Computer Tablet

Curriculum

Content Area: Computer Science and Design Thinking

Unit: Prototype Design - Space Exploration | **Duration:** 6 Days

Grade Level: 4th Grade

Essential Questions

- How has our knowledge of our solar system changed over time?
- How have humans applied technological skills to explore space?
- What am I designing for (target purpose) and how do I ensure my design meets the requirements and needs of the target mission?
- How can I use the engineering design process (EDP), materials and time provided, as well as our prior knowledge and new knowledge to solve the problem at hand (space exploration technology design)?
- How do I clearly communicate the attributes of my/our design to others to aid in the manufacturing/production process?

Enduring Understandings

- Scientists and Engineers use the EDP to develop prototypes for renewable energy.
- Space exploration solutions provide opportunities for humans to learn about outer space, earth and solar system formation.

Student Learning Targets (Objectives):

- Students will be able to use the engineering design process to design and build a prototype of a space exploration technology.
- Students will be able to use appropriate materials and time provided to present their space exploration technology prototype.

Focus Standards (Major Standards)

- **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.ED.5:** Describe how specifications and limitations impact the engineering design process.
- **8.2.5.ED.6:** Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.

New Jersey Student Learning Standards: Interdisciplinary Connections

Math:

- **4.OA.A.** Use the four operations with whole numbers to solve problems.
- **4.OA.C.** Generate and analyze patterns.
- **4M.D.C.** Geometric measurement: understand concepts of angle and measure angles.

Science:

- **3-5-ETS1-1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

LA:

- **W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- **W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
- **W.5.6.** With some guidance and support from adults and peers, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting
- **SL4.** Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- **SL5.** Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
- **SL6.** Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

New Jersey Student Learning Standards: College and Career Readiness

- **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 (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
- **9.4.5.CI.4:** Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
- **9.4.5.CT.4:** Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
- **9.4.5.IML.2:** Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).

New Jersey Student Learning Standards: Computer Science and Design Thinking

- **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.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.1:** Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
- **8.2.5.ETW.3:** Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.

Instructional Plan

Unit: Prototype Design - Space Exploration
Lesson 1: Engineering Design Process - Ask and Imagine Prototype - Space Exploration Solution
Lesson 2: Engineering Design Process - Plan and Design Prototype - Space Exploration Solution
Lesson 3: Engineering Design Process - Create and Improve Prototype - Space Exploration Solution

Lesson 2: Engineering Design Process - Communicate Findings and Project - Space Exploration Solution

Evidence of Student Learning

Formative Assessments

- Students are asked to identify the main steps of the Engineering Design Process(EDP)

Summative Assessments

- Performance Task - Students complete and provide a final product for each one of the EDP steps, including a design of prototype and a physical model.
- Peer Feedback - Students provide meaningful feedback and assessment on their classmates work and projects.

Suggested Options for Differentiation

Modifications (ELLs, Special Education, 504, Students at risk of failure, Gifted and Talented)

Special Education

- Follow student IEP requirements.
- Preferential seating.
- Student choice in projects to allow for appropriate skill levels to be applied.
- Clarify and repeat expectations by providing digital copies, review of expectations at the start of class, highlighting expectations on student hardcopies, provide specific tasks as needed in group work to clarify goals.
- Support of student focus: verbal prompts, visual cues (lights out, etc)
- Positive reinforcement and praise
- Use of word processors and digital image software to replace writing and drawing by hand.
- Pacing and guidance in long term projects.
- Work chunked out based on tasks, individual check-ins.
- Extended projects are broken down into manageable tasks with frequent check-ins from the teacher.

504

- Follow student 504 requirements.
- Preferential seating.
- If the student cannot utilize computers or look at screens, research, planning, and computer-based learning experiences can be done on paper.
- If the students' level of mobility is limited, making it difficult for the students to navigate the classroom, the student will be assigned a buddy to help with acquiring the necessary materials and supplies.
- If the students' fine or gross motor skills are impacted, s/he will receive assistance from the teacher for the specific artistic skills that require them.

Students at Risk for Failure

- Student choice in projects to allow for appropriate skill levels to be applied.
- Clarification and repetition of expectations, review of expectations at the start of class, highlighting expectations on student hardcopies, provide specific tasks as needed to clarify goals.
- Support of student focus: verbal prompts, visual cues (lights out, etc.).
- Positive reinforcement.
- Pacing and guidance in long term projects.

- Work chunked out based on tasks, individual check-ins.
- Extended projects are broken down into manageable tasks with frequent check-ins from the teacher.

Gifted and Talented:

- Provide access to additional materials to develop ideas and project details.
- Teach more advanced skills and give students new problems to solve or research

ELL:

- Use of Google Translate to assist students with instructions and lessons so they can follow along.
- Adjust goals to allow for language acquisition.
- Visual prompts and demonstrations.
- Teacher modeling of skills.
- Simplified written and verbal instructions.
- Include written instructions to supplement verbal.
- Preferential seating.

Suggested Materials

- Computer
- Design materials
- Build materials
- Tools

Suggested I Resources

- Laptop, Chromebook, or Computer
- Tablet