Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

SPARTAN MISSION:
Meeting the needs of all students with a proud tradition of academic excellence.

Curriculum Development Timeline

School: Ocean Township High School

Course: Makerspace I

Department: Applied Technology

Board Approval	Supervisor	Notes
July 2016	Michael Lambusta	Update Standards & Name Change
December 2017	Patrick O'Neill	Update Standards
August 2020	Patrick O'Neill	Alignment to Standards
August 2021	Patrick O'Neill	Review
August 2022	Derek Tranchina	Incorporate State Mandate

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Township of Ocean Pacing Guide	
Week	Marking Period 1-2
1	Robotics
2	Robotics
3	Robotics
4	Robotics
5	Robotics
6	Robotics
7	Robotics
8	CAD / 3D Modeling & Printing
9	CAD / 3D Modeling & Printing
10	CAD / 3D Modeling & Printing
Week	Marking Period 3-4
11	CAD / 3D Modeling & Printing
12	Programming / Game Coding
13	Programming / Game Coding
14	Programming / Game Coding
15	CID / Circuits
16	CID / Circuits
17	Final Project
18	Final Project
19	Final Project

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20	Final Project

Climate Change: CAD / 3D Modeling & Printing Unit

Core Instructional & Supplemental Materials including various levels of Texts
3d Printers 3d Printing Software Lego Mindstorms and Technic Parts, Mechanisms, and Linkages Lego Robotics Programming Software Makey Makey Circuit Boards Scratch Programming Language Scratch Programming Software Trimble Sketchup Software

Time Frame	Weeks 1-7
Topic	
Robotics	
Alignment to Standards	
8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences. 8.1.12.CS.2: Model interactions between application software, system software, and hardware. 8.1.12.CS.3: Compare the functions of application software, system software, and hardware. 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms. 8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables. 8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice. 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.	

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8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.

Learning Objectives and Activities

SWBAT answer the following questions

What are robots? What are robots used for? Who uses robots? Who creates and builds robots? How do robots make our lives better? Worse? What are the various ways robots can perform? How can robots be programmed to solve a particular problem? How important is the Engineering Design Process in developing an effective robot designed for a specific task?

SWBAT understand the following concepts

Robots are machines that produce an output of motion or force. Robots are programmed by humans to perform specific tasks or solve a particular problem. By building and programming robots to complete a variety of specific tasks, students are involved in self-guided discovery. Testing a robotic creation gives an opportunity to problem solve and immediately evaluate and improve its design. The Engineering Design Loop is important for identifying problems and designing robots that can solve them.

SWBAT “do”

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Students will be able to build a robot and program it to complete given tasks and problems.
Students will be able to identify programming commands then evaluate and compare various created programs and given logic.
Students will be able to calculate various needed vectors to be traveled and evaluate simple machine mechanisms to accomplish tasks.
Students will test and evaluate tradeoffs while designing a robot.

Assessments

Formative:

- Daily teacher observations and individualized student feedback.

Summative:

- Successfully navigating obstacle courses and meeting specific robotic project goals, ie: a robot that senses an opponent and pushes it out of bounds.

Benchmark:

- Pre-test and post-test encompassing all class units.

Alternative:

- Daily teacher observations and individualized student feedback.

Interdisciplinary Connections

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments,
taking measurements, or performing technical tasks, attending to special cases or exceptions
defined in the text. **Students use an instruction manual for assembly, and guided tutorials within coding software.**

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. **Students learn to use the Mindstorm programming software and become familiar with the purpose of different coding blocks and robotic sensors.**

RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). **Students design robots to maximize pushing force and friction needed to accomplish**

specific tasks, switching out parts for others that are better suited to meet their goals.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Technology Integration

- Students will use Lego Robotics (Current Platform is EV3) and Lego Robotics Programming Software (Current Platform is Lego Mindstorms) to collaborate and work towards solving authentic problems.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion.
    - 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

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Career Education
CRP1. Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management. CRP11. Use technology to enhance productivity.

Time Frame	Weeks 8-11
Topic	
CAD / 3D Modeling & Printing	
Alignment to Standards	
8.1.12.CS.3: Compare the functions of application software, system software, and hardware. 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue. 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. 8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs. 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users. 8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible. 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.	

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8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
8.2.12.ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
8.2.12.ED.6: Analyze the effects of changing resources.

8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.
8.2.12.NT.2: Redesign an existing product to improve form or function.

Learning Objectives and Activities

SWBAT answer the following questions

What does CAD stand for? What is an orthographic drawing? What is 3D Modeling and what purpose does it serve? What are the three main views of a three dimensional object? What is 3D printing? What are some materials used in the 3D Printing manufacturing process? What fields, professions, and processes use 3D modeling? How important is the Engineering Design Process in developing a useful 3D model for creating a tangible 3D printed prototype?

SWBAT understand the following concepts

CAD is Computer Aided Design. Orthographic drawings represent objects in two dimensional space, while 3D models represent objects in three dimensional space. The Engineering Design Process and 3D modeling enable an opportunity to design, problem solve, and visualize an object before its construction as a prototype. 3D printing allows students to create a solid tangible product from a 3D design. Students become familiar with PLA, a 3D printing material that is organically sourced and environmentally friendly as well as additive manufacturing methods..*

SWBAT “do”

Students will be able to model a three dimensional object with an exact size using computer software.
Students will recognize X, Y, Z axes and be able to navigate effectively through 3D space.
Students will be able to analyze how different fields may use three-dimensional models given examples.

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Students will be able to identify sides, shape, and size of a three dimensional model then evaluate/compare a 3D printed object created from that design

* NJ Climate Change Education

Assessments

Formative:

- Daily teacher observations and individualized student feedback.

Summative:

- Successfully designing a variety of 3D models to meet specific project guidelines.

Benchmark:

Alternative:

- Daily teacher observations and individualized student feedback.

Interdisciplinary Connections

G-CO.12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing
perpendicular lines, including the perpendicular bisector of a line segment; and constructing a
line parallel to a given line through a point not on the line. **Students create orthographic drawings to precise measurements using compass & rulers; later in the unit, students use Sketchup modeling software to create lines and shapes that are precisely positioned to form objects.**

G-GMD.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. **Students create two-dimensional shapes within Sketchup, then use the push/pull and move tools to transform them into 3D objects.**

G-MG.1. Use geometric shapes, their measures, and their properties to describe objects (e.g.,

modeling a tree trunk or a human torso as a cylinder). **Students design complex objects (like a house or a staircase) out of multiple simple shapes**

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Technology Integration

- Students will use CAD Software (Current Platform is Sketchup) and 3d Printers to collaborate and work towards solving authentic problems.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion.
    - 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

Career Education

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CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.

Time Frame	Weeks 12-14

Topic

Programming / Game Coding

Alignment to Standards

8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
8.1.12.CS.2: Model interactions between application software, system software, and hardware.
8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables.
8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.

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8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

Learning Objectives and Activities

SWBAT answer the following questions

What is an algorithm? What is computer programming, and what are some things it can be used for? What are some languages used for programming computers? What are the benefits of block programming when compared to written programming languages? What is the purpose and benefit of programming loops? What are some fields or professions that use computer programming? How can the Engineering Design Process be employed to develop an entertaining video game that fulfills a designated task?

SWBAT understand the following concepts

An algorithm is a process or set of rules to be followed in order to solve a problem. Computer programs are essentially algorithms. Block coding simplifies the process of programming by using an easy to manipulate graphical user interface (GUI). Loops simplify programs by repeating designated functions, either indefinitely or until certain conditions are met. By employing the Engineering Design Process, a programmer can make more effective use of time spent in designing a video game.

SWBAT “do”

Students will design entertaining video games and animations by employing algorithms and the Design Process.
Students will be able to efficiently create computer programs using block programming computer software.
Students will be able to identify programming commands then evaluate, compare, and troubleshoot various created programs with given logic.
Students will further develop problem solving skills by continually critiquing and modifying their work to meet specific design goals.
Students will learn appropriate programming terminology and concepts (ie: sprite, costume, events, variables, forever loops, if/then/else, repeat until, and more)

Assessments

Formative:

- Daily teacher observations and individualized student feedback.

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Summative:

- Successfully programming computer video games that meet specific project guidelines.

Benchmark:

-

Alternative:

- Daily teacher observations and individualized student feedback.

Interdisciplinary Connections

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments,
taking measurements, or performing technical tasks, attending to special cases or exceptions
defined in the text. **Students follow guided tutorials that demonstrate multiple steps towards coding a project.**

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. **Students become familiar with coding terms like sprites, costumes, loops, events, and variables.**

RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
Students choose between a FOREVER loop or a REPEAT UNTIL loop when deciding what works best for a given project goal.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

Technology Integration

- Students will use Visual Programming Software (Current Platform is Scratch) and Programming Language (Current is Scratch) to collaborate and work towards solving authentic problems.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion.
    - 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

Career Education

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management. CRP11. Use technology to enhance productivity.

Time Frame	Weeks 15-16

Topic

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CID/Circuits

Alignment to Standards

8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
8.1.12.CS.2: Model interactions between application software, system software, and hardware.
8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.

Learning Objectives and Activities

SWBAT answer the following questions

What materials conduct electricity? What is a circuit? How does electrical current flow through a circuit? How do buttons and computer input devices work? What are some inventions that are made possible with electrical circuits?
SWBAT understand the following concepts
Water and many metals will conduct electricity. A circuit is a complete path around which electricity can flow. Computers, telephones, and most machines are made possible through the use of electrical circuits. A simple button controls an electrical current by opening or closing a circuit.
SWBAT "do"
Students will experiment with using organic materials as computer input devices.
Students will be able to understand how an electrical circuit functions.
Students will be able to design fully functional buttons and input devices with the use of circuits.
Students will create a tangible mechanism that utilizes an electrical circuit operating a computer video game they have designed.

Assessments

Formative:

- Daily teacher observations and individualized student feedback.

Summative:

- Successfully wiring a circuit board and designing a functional button that controls a computer program.

Benchmark:

-

Alternative:

- Daily teacher observations and individualized student feedback.

Interdisciplinary Connections

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments,
taking measurements, or performing technical tasks, attending to special cases or exceptions
defined in the text. **Students read user manual online to learn precise wiring steps to create a functional device.**

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. **Students identify the meaning of specific terms like circuit, ground, and resistance, and use alligator clips and specific types of wire to build a working device.**

RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy, resistance). **Students identify the difference between an open circuit and a closed circuit.**

Career Readiness, Life Literacies, and Key Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

Technology Integration

- Students will use CID's (Current is Makey Makey) and Circuit Building tools and materials to collaborate and work towards solving authentic problems.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion.
    - 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

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Career Education
CRP1. Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management. CRP11. Use technology to enhance productivity.

Time Frame	Weeks 17-20
Topic	
Final Project	
Alignment to Standards	
8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences. 8.1.12.CS.2: Model interactions between application software, system software, and hardware. 8.1.12.CS.3: Compare the functions of application software, system software, and hardware. 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms. 8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables. 8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice. 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue. 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. 8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.	

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8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
8.2.12.ED.6: Analyze the effects of changing resources.

8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.

Learning Objectives and Activities

SWBAT answer the following questions

What elements make a game more fun to play? When creating a game or interactive project, how can the Engineering Design Process be used to solve design problems? How can the skills learned by students throughout the course be combined to design a project that is interactive, and thus more engaging?

SWBAT understand the following concepts

The Engineering Design Process is a multi-step process that may require repeating steps in order to modify and improve the project's design and functionality. The design of a project may be approached in a variety of different ways using a variety of different building materials. Combining a variety of design features can enhance a project by making it more interactive and entertaining.

SWBAT "do"

Students will be able to combine the skills they've learned to design an interactive final project, such as a carnival game or a moving animatronic.
Students will be able to choose, shape, and finish a variety of building materials for their project (cardboard, styrofoam, wood, metal, 3D printed elements).

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Students will be able to solve design problems by employing the Engineering Design Process

Assessments

Formative:
- Daily teacher observations and individualized student feedback.

Summative:
- Successfully building a final project with moving parts and using key elements from earlier units.

Benchmark:
- .

Alternative:
- Daily teacher observations and individualized student feedback.

Interdisciplinary Connections

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments,
taking measurements, or performing technical tasks, attending to special cases or exceptions
defined in the text. **Students can refer to technical manuals and online tutorials for guidance when building their final projects.**

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. **Key terms and design elements from earlier units (robotics, 3D design, programming, circuitry) will be necessary for building the final project.**

RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). **Students trigger robotic movement by combining programming with circuitry, balancing relationships and choosing parts best suited to their goals.**

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

Technology Integration

- Students will collaborate and work towards developing and creating a developed solution to an authentic problem using the tools, materials, and knowledge from this class and integrating any cross content as they see fit.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion.
    - 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

Career Education

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.

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Modifications (ELL, Special Education, At-Risk Students, Gifted & Talented, & 504 Plans)

ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations

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- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns