

Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

Curriculum Development Timeline

- School: Township of Ocean Intermediate School
- Course: Design and Modeling, Grade 6
- **Department:** Applied Technology

Board Approval	Supervisor	Notes
August 2019	Patrick O'Neill	Name Change/Revisions
August 2021	Patrick O'Neill	Alignment to Standards
August 2022	Derek Tranchina	Incorporate State Mandate





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

	Township of Ocean Pacing Guide
Wee k	Marking Period 1 & 3
1	Maker Mentality: Identify and Solve Problems
2	Maker Mentality: Identify and Solve Problems
3	Maker Mentality: Identify and Solve Problems
4	Maker Mentality: Identify and Solve Problems
5	Maker Mentality: Identify and Solve Problems
6	Introduction to Robotics
7	Introduction to Robotics
8	Introduction to Robotics
9	Introduction to Robotics
10	Introduction to Robotics
Wee k	Marking Period 2 & 4
11	Introduction to Robotics
12	Introduction to Robotics
13	STEAM project (team or independent) on a self-selected topic related to the essential question
14	STEAM project (team or independent) on a self-selected topic related to the essential question
15	STEAM project (team or independent) on a self-selected topic related to the essential question
16	STEAM project (team or independent) on a self-selected topic related to the







Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

	essential question	
17	STEAM project (team or independent) on a self-selected topic related to the essential question	
18	STEAM project (team or independent) on a self-selected topic related to the essential question	
19	STEAM project (team or independent) on a self-selected topic related to the essential question	
20	STEAM project (team or independent) on a self-selected topic related to the essential question	

Climate Change: STEAM Project Unit





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

Core Instructional & Supplemental Materials including various levels of Texts

- Google Classroom postings
- Endeavor STEM careers module login on everfi.com
- Class set of headsets
- LEGO EV3 kits
- Laptop cart with LEGO EV3 Mindstorms, LEGO WeDo, and SketchUp Pro 2017 software
- Class set of mice
- Makey Makey kits
- Merge Cubes
- 3D printers
- Snap Circuit kits
- 9V batteries, hobby motors, wires, wire cutter/strippers

STEM supplies:

hot glue guns, glue sticks, cardboard, utility knives, cutting mats, safety, goggles, wooden dowels, hand saws, screwdrivers, power drills, screws, clamps, wood glue, plastic cups, pipe cleaners, paper plates, scissors, glue, masking tape, shoeboxes, construction paper, popsicle sticks

Time Frame 5 Weeks	
	Торіс
	Maker Mentality: Identify and Solve Problems
	Alignment to Standards
 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.ED.1: Use research to 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.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and 	





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

maintenance of a chosen product.

- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
- 8.2.12.NT.2: Redesign an existing product to improve form or function.

Learning Objectives and Activities

SWBAT answer the following questions:

- Why is it important for an engineer to be aware of the criteria and constraints when designing a product?
- What forces are involved in the game of volleyball?
- Using the design process, how can we design a machine that plays volleyball to meet the criteria and constraints?
- How can we safely use tools to construct our design?
- What strategies and processes can I use to become a more effective problem solver?

SWBAT understand the following concepts:

- Computational thinking practices are critical for all students to learn and form the cornerstone of the language of innovation, and will drive all future STEM discoveries and careers.
- All machines utilize potential and kinetic energy to make them go.
- The lever, wheel and axle, pulley, inclined plane, wedge and screw help us to do work with less energy.
- Everyday machines use one or more of these simple machines to make a compound machine.
- Models can help us make sense of the natural world as we observe phenomena.

SWBAT to "do":

- Different types of forces in systems stations.
- Volleyball Machine redesign: Students will design and test possible modifications to the design to help the group choose the best model to try further modifications on to optimize the design.
- Simple Machine stations to gather information.
- Brainstorming toys that utilize simple machines or demonstrate forces.
- Planning a design for a new toy for Kindergarteners to observe forces.
- Building and testing, Evaluate solution to optimize and then present their solution through a commercial.





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

Assessments

Formative:

- · Class and group discussions while working on projects
- Student self-reflection/journaling during the design process
- Peer feedback (P-Q-P) while working on projects

Summative:

- Criteria on each project Design Brief met
- Independent and group project rubrics

Benchmark:

- Pre-assessment performance based vs final project
- Pre-assessment vs summative content information test

Alternative:

- Self-reflection
- Contest entries
- Peer Review

Interdisciplinary Connections

NGSS

MS-ETS1-2: Students will evaluate competing design solutions using a systematic process to

determine how well they meet the criteria and constraints of a problem during the volleyball

machine redesign.

<u>ELA</u>

RST.6-8.9. Students will compare and contrast the information gained from experiments,

simulations, video, or multimedia sources with that gained from reading a text in the simple

machine station to gather information.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to

interact and collaborate with others when students present through a commercial. WHST.6-8.7. Students will conduct short research projects to answer a question (including a





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

self-generated question), drawing on several sources and generating additional related, focused

questions that allow for multiple avenues of exploration while learning about different types of

forces in systems.

Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills and abilities.
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement and transition.
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.3: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task.
- 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.

Technology Integration

8.1 Educational Technology- All students will use digital tools to access, manage, evaluate,

and synthesize information in order to solve problems individually and collaboratively and to

create and communicate knowledge.

- See Alignment to Standards Section Above.
- Students will use internet based game sites such as Quizizz, Kahoot and Quizlet live to reflect on their learning progress.
- Students will use PLTW.org to further investigate lesson concepts and demonstrate understanding of standards.
- Additional resources and extension activities will be posted on Google Classroom in order to encourage students to reflect on their learning and expand on their knowledge.

Career Education





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

Time Frame	6 Weeks	
	Торіс	
	Introduction to Robotics	
	Alignment to Standards	
 Alignment to Standards 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users. 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms. 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. 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills and abilities. 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task. 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task. 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task. 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task. 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task. 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task. 9.4.12.CL.2: Identify transferable skills in career choices and design alternative career plans based on those skills. 9.4.12.CL.2: Identify career pathways that highlight personal talents, skills and abilities. 		
Learning Objectives and Activities		





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

SWBAT answer the following questions:

- Can I build a robot to do things that I can control?
- How does energy move in a system?
- How does electrical energy work?
- How can we use computer modeling to create a 3d object?
- How can students make one of their ideas using the LEGO® set, and can use other materials if needed to build their ideas, encouraging them to break problems down into smaller parts?
- Why do we use an iterative process to solve problems?
- Why do we use models to help our thinking become visible?

SWBAT understand the following concepts:

- Problem solving involves a community of learners, not an individual working alone.
- Productive talk is instrumental in a group's growth of ideas.
- Solving problems is a messy endeavor and takes multiple revisions.
- Modeling is a key part of making sense of your solution and can be used in the presentation of your ideas.
- Computational thinking practices are critical for all students to learn and form the cornerstone of the language of innovation, and will drive all future STEM discoveries and careers.
- Students will consider problems analytically and use data to inform decisions through real and approachable educational robotics system of the EV3.
- Robotic technologies are a part of our modern industrial society and future careers will rely on understanding how to use them.

SWBAT to "do":

- Investigating Building Circuits: Snap Circuit kits, scribblebot (group) and bristlebot (individual)
- Tinkercad software to make printable object that is 50 x 50 x 50 mm or less to familiarize with the "rules" to successfully print a 3D object.
- Students will observe different forms of energy and how it moves in a system (electrical circuit). Using this knowledge of circuits, students will design a part of their toy to include a part to be powered by electricity and a part that can be fabricated using a 3D printer (such as a functional handle or logo character).
- EV3 Goal
 - #1 Programming is Precise:

If you want a robot to do something, you need to communicate that idea with mathematical and logical precision, or it won't quite be what you





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology	COURSE: Design and Modeling, Grade 6
 intended. #2 Sensors, Programs and Data from sensors gives an program uses that data to n decisions. Data underlies t #3 Make Sense of Systems To understand the way som it in your head that captures system. This helps you ma "play out" similar or new sce happen. #4 Break Down Problems a To solve a difficult problem, Then, solve the smaller probig problem. #5 Computational Thinking These skills mathematical thinking with mental models robotics. They are the key 	Actions: robot information about its environment. A nake decisions, and the robot acts on those he core of the entire process. s: nething works, construct a mental "model" of s the important features and rules of the ke sense of it, and also gives you a tool to enarios in your head to predict what would and Build Up Solutions: try breaking it down into smaller problems. blems, building up towards a solution to the Applies Everywhere and logical clarity, using data, systems s, and problem-solvingare not just for to solving many problems in the world.
robotics. They are the key	to solving many problems in the world.
 <u>Formative:</u> Self-quizzes embedded in the EV3 Note-taking of key ideas about sof Summative: 	3 tutorials ftware/hardware usage
 Student Worksheet for each open- for basic documentation of the act presenting their work in front of the evaluations or for student self eval Robot to complete the Obstacle O Challenge 	ended, themed challenge scenario is helpful ivity. Students can also refer to it when e class or as a portfolio for performance luation. rchard Challenge or the Line Tracking
 Benchmark: Pre-assessment performance bas Pre-assessment vs summative contraction 	ed vs final project ntent information test
 <u>Alternative:</u> Group share/debriefing of progres 	s so far in the challenge at the end of each
Home of a	the Spartans!

#spartanlegacy





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

class

Interdisciplinary Connections

<u>ELA</u>

RST.6-8.3 Students will follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks when making sense of the

systems.

NJSLSA.W6. Students will use technology, including the Internet, to produce and publish

writing and to interact and collaborate with others learning about programming. Mathematics:

7.EE.3: Students will solve multi-step real-life and mathematical problems posed with positive

and negative rational numbers in any form (whole numbers, fractions, and decimals), using

tools strategically during goal #5 Computational thinking applies everywhere.

Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement and transition
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.3: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task.
- 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.

Technology Integration

8.1 Educational Technology- All students will use digital tools to access, manage, evaluate,

and synthesize information in order to solve problems individually and collaboratively and to

create and communicate knowledge.





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

- See Alignment to Standards Section Above.
- Students will use internet based game sites such as Quizizz, Kahoot and Quizlet live to reflect on their learning progress.
- Students will use PLTW.org to further investigate lesson concepts and demonstrate understanding of standards.
- Additional resources and extension activities will be posted on Google Classroom in order to encourage students to reflect on their learning and expand on their knowledge.

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.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

Time Frame 7 Weeks		
	Торіс	
STEAM project (team or independent) on a self-selected topic related to the essential question		
Alignment to Standards		
 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.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.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and 		





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

maintenance of a chosen product.

- 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs and risks, related to the use of the innovation.8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.

Learning Objectives and Activities

SWBAT answer the following questions:

- What problem would you wish had a solution?
- How can we use technology to engineer solutions to environmental problems/challenges? *

SWBAT understand the following concepts:

- Renewable resources are a more sustainable way to produce energy.
- Due to nonpoint source pollution, ocean animals are impacted by plastic pollution.
- World population is estimated to rise to 9 billion people by 2050 and food and clean water supplies are limited. Growing a school garden could help us become more sustainable.

SWBAT to "do":

Students will identify problems in our environment and brainstorm their causes. Based on one cause, students will research and design a model/way to address this issue. They will share their thoughts with other people to then evaluate and optimize a design. Once they have a solution, they will present their solutions through a presentation.

- Design Process
- Building and testing models
- Evaluating and optimizing a design
- Presenting solutions
- Problem Solving
 - Use a structured problem solving process to help address new problems
 - View challenges as solvable problems
 - Break down larger problems into smaller components





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

- Persistence
 - Expect and value mistakes as a natural and productive part of problem solving
 - Continue working towards solutions in spite of setbacks
 - \circ $\;$ Iterate and continue to improve partial solutions
- Creativity
 - Incorporate personal interests and ideas into activities and projects
 - Experiment with new ideas and consider multiple possible approaches
 - Extend or build upon the ideas and projects of others
- Collaboration
 - Work with others to develop solutions that incorporate all contributors
 - Mediate disagreements and help teammates agree on a common solution
 - Actively contribute to the success of group projects
- Communication
 - Structure work so that it can be easily understood by others
 - Consider the perspective and background of your audience when presenting your work
 - Provide and accept constructive feedback in order to improve your work
- * NJ Climate Change Education

Assessments

Formative:

- Daily calendar with listed goals checked off/moved to the next day
- Summary notes in group folder of the documented design process

Summative:

 Group commercials with their STEAM Tank pitch recorded at Ocean View Studios shared during group presentations where they share the steps they engaged in the design process

Benchmark:

• Entry to the STEAM Tank competition

Alternative:

• Group share without entry to the competition

Interdisciplinary Connections





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

<u>ELA</u>

RST.6-8.1. -Students will cite specific textual evidence to support analysis of science and

technical texts when presenting.

RST.6-8.3 -Students follow precisely a multistep procedure when carrying out experiments,

taking measurements, or performing technical tasks during building and testing models.

RST.6-8.9. Students will compare and contrast the information gained from experiments,

simulations, video, or multimedia sources with that gained from reading a text on the same

topic during the redesign process.

NJSLSA.W6. Students will use technology, including the Internet, to produce and publish

writing and to interact and collaborate with others when submitting solutions idea for STEAM

Tank contest.

WHST.6-8.7. Students will conduct short research projects to answer a question (including a

self-generated question), drawing on several sources and generating additional related, focused

questions that allow for multiple avenues of exploration during the STEAM Tank competition.

Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement and transition.
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.3: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task.
- 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.

Technology Integration





Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

8.1 Educational Technology- All students will use digital tools to access, manage, evaluate,

and synthesize information in order to solve problems individually and collaboratively and to

create and communicate knowledge.

- See Alignment to Standards Section Above.
- Students will use internet based game sites such as Quizizz, Kahoot and Quizlet live to reflect on their learning progress.
- Students will use PLTW.org to further investigate lesson concepts and demonstrate understanding of standards.
- Additional resources and extension activities will be posted on Google Classroom in order to encourage students to reflect on their learning and expand on their knowledge.

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.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

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

ELL:

- Use visuals airds
- Provide peer support
- Use of Google Translate
- Guided notes and/or scaffold outline for written assignments

Supports for Students With IEPs:

Allow extra time to complete assignments or tests







Assistant Superintendent Office of Teaching and Learning

SPARTAN MISSION:

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

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

- 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
- 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
- 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

